Integrated Solid Waste Management System for the Cayman Islands: Environmental Impact Assessment

Draft Environmental Statement

ReGen and Cayman Islands Government

18 August 2023

→ The Power of Commitment

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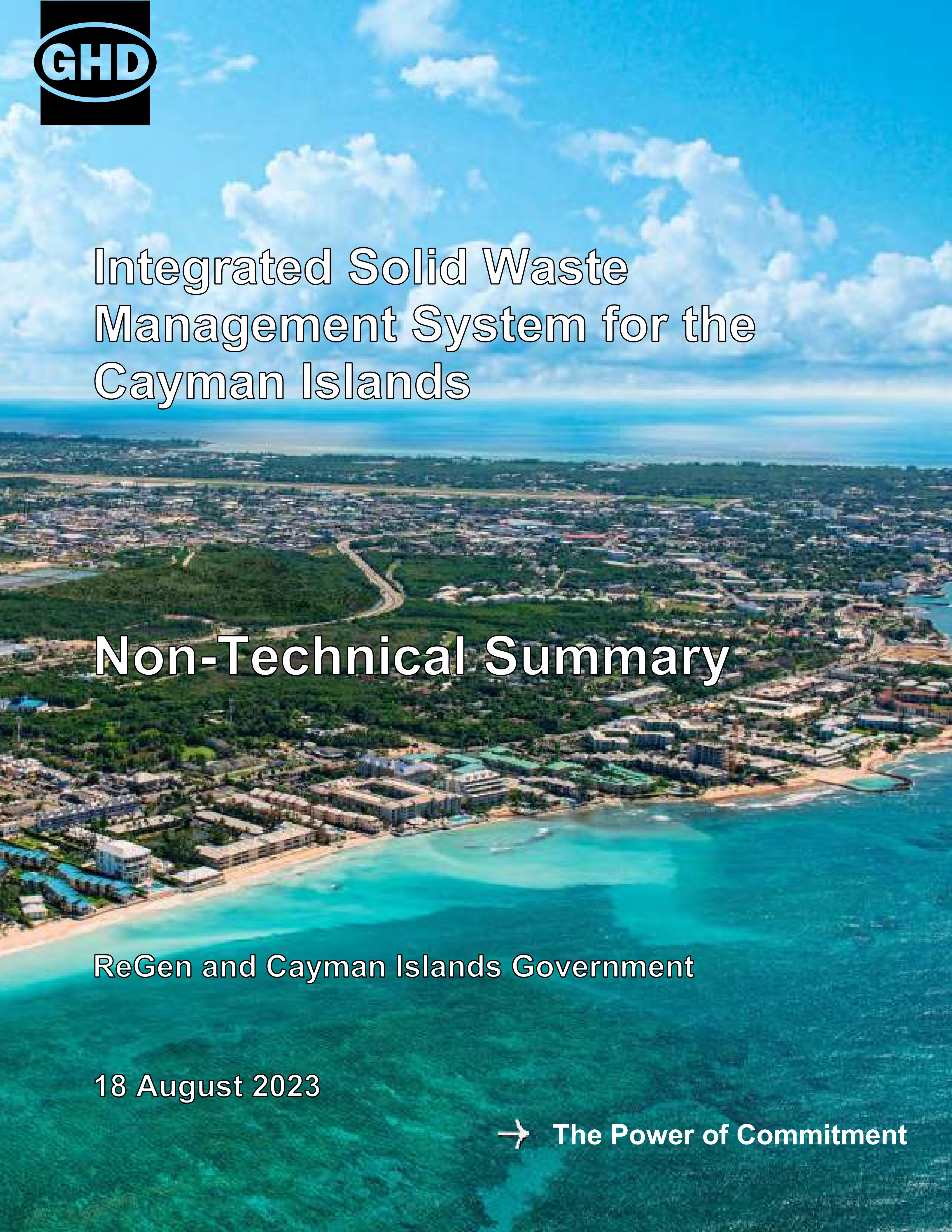

Integrated Solid Waste Management System for the Cayman Islands

Non-Technical Summary

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1. What is the Integrated Solid Waste Management System for the Cayman Islands?

The Integrated Solid Waste Management System (ISWMS) for the Cayman Islands is a proposed development made up of multiple facilities and infrastructure to address several modern challenges around waste management, including:

– A rapid reduction in waste disposal capacity at the current George Town Landfill, which has grown to be the primary solid waste management site for Grand Cayman and is supported by aging and often non-functional plant, equipment and infrastructure.
– Growing pressures on waste management, treatment and disposal services, caused by increased waste volumes from a growing population and expanded development in the Cayman Islands.
– The need to develop new "energy from waste" recovery facilities.
– The continued use of non-engineered landfills in George Town, Cayman Brac and Little Cayman, which is inconsistent with sustainable best practices.

The proposed management system will:

– Replace the existing George Town Landfill and associated aging waste infrastructure with modern facilities that reflect best practices around waste management, treatment, and disposal.
– Include the construction of an Energy Recovery Facility and supporting waste processing, treatment, and disposal facilities.
– Allow the existing landfills in George Town, Cayman Brac and Little Cayman to be closed and remediated.

1.1 Who is making the application?

The proponent making the application for the ISWMS is the Dart Consortium, in collaboration with ReGen (a collaborative organization representing the new energy recovery and recycling facilities that form the ISWMS), the Cayman Islands Government and its respective consultants. A special purpose vehicle (or subsidiary) is planned to be established, with Waste Solutions Cayman Ltd. as the legal entity.

As part of the application, an Environmental Statement has been prepared, which summarizes the findings of the Environmental Impact Assessment, which has been undertaken by experts in a wide range of disciplines. This statement helps decision makers understand and make informed decisions regarding environmental implications.

This document forms the Non-Technical Summary of the Environmental Statement for the ISWMS for the Cayman Islands Project.

1.2 Why is an Integrated Solid Waste Management System proposed?

The ISWMS has been proposed following the development of the Cayman Islands Government's National Solid Waste Management Policy and National Solid Waste Management Strategy, which guides decision-making for solid waste management over the next 50 years. The Strategy outlines the key elements of the waste management hierarchy in decreasing order of importance:

1. Reduce (or 'Prevent')
2. Reuse
3. Recycle
4. Recover
5. Dispose

The business case for the ISWMS is based on strategic, economic, commercial, management and financial considerations. The ISWMS project is an economically viable and environmentally sustainable solution to the issues and challenges described.

In summary, the effort to develop the ISWMS is driven by a recognition that the existing solid waste management regime is not sustainable, poses a potential threat to the environment, and does not make best use of potential resources that could benefit the Cayman Islands. The continued use of aging, non-engineered and increasingly full landfills on each of the islands does not align with modern and sustainable waste management best practices and does not meet the solid waste disposal and processing needs of the National Solid Waste Management Strategy.

2. What is an Environmental Impact Assessment?

An Environmental Impact Assessment identifies how people and environmental resources could be affected by a proposed project, and puts forward measures that will avoid, offset, or minimize any negative effects. It acts as a mechanism to safeguard the environment and people from development actions which may cause harm or danger. There are five main stages of a typical Environmental Impact Assessment process.

Because of the ISWMS's proposed strategic, economic, commercial, management and financial benefits, and because it was developed following the Cayman Islands Government's National Solid Waste Management Policy and National Solid Waste Management Strategy, the Dart Consortium proceeded to the process's Scoping step.

1. **Screening –** Determine whether a project falls within applicable regulation, if it is likely to have a significant effect on the environment, and if it requires an assessment.
2. **Scoping –** Determine the extent of issues considered in the assessment.
3. **Preparing an Environmental Statement –** Where an assessment is needed, the project's applicant must prepare and submit an Environmental Statement to the local planning authority. The Statement must include the information required to assess the likely significant environmental effects of the development.
4. **Making a planning application and consultation –** The Environmental Statement is publicized online and through public notice. The consultation's stakeholders and public are given an opportunity to share their views on the proposed development and Environmental Statement.

5. **Decision making –** The Environmental Statement and any comments are taken into account by the authorizing entity when deciding whether or not to grant consent for the development. The public is informed of the decision and the supporting reasons.

2.1.1 Environmental Impact Assessment timeline for ISWMS project

3. What is being proposed?

To divert waste away from landfills and better reuse and recycle the items that waste producers currently throw away, the ISWMS Project proposes to close the George Town Landfill site and build state-of-the-art infrastructure immediately south-west of the existing landfill. When finished, this infrastructure will improve recycling and turn materials that aren't recycled into electricity to power homes and businesses.

3.1 Proposed facilities

The ISWMS is made up of several facilities proposed to be located immediately southwest of the existing George Town Landfill Site, as well as 'satellite' waste infrastructure to be developed on the two Sister Islands of Cayman Brac and Little Cayman. While some facilities require an Environmental Impact Assessment, some smaller elements of the project do not, on their own, require the same assessment. However, the Environmental Impact Assessment considers the cumulative effects of all aspects of the ISWMS, as they operate in combination with each other. The Environmental Impact Assessment excludes an assessment of the proposed facilities in Cayman Brac and Little Cayman. Transport of material from the Sister Islands to the Port is described and reviewed in the Environmental Impact Assessment.

Adjacent to the George Town Landfill site (Grand Cayman)

– An Energy Recovery Facility
– Non-energy recovery waste management facilities, including:
  - Site weighbridges (excluded from the Environmental Impact Assessment), where vehicles are weighed for tracking.
  - A green waste processing facility to process yard waste and store the resulting compost and mulch products.
  - A construction and demolition waste processing facility that recycles, recovers and diverts waste materials.
  - A bottom ash processing facility to process bottom ash from the Energy Recovery Facility into a recovered aggregate.
  - An abandoned and end of life/scrap metal processing facility to recycle, recover and divert vehicles that have been abandoned or surpassed their useful life.

  - A medical waste facility to receive, store and process medical waste not suitable for treatment at the Energy Recovery Facility.
  - A materials recycling facility (excluded from the Environmental Impact Assessment) to divert and recover dry mixed recyclables in Grand Cayman and the Sister Islands.
  - A household waste recycling centre (excluded from the Environmental Impact Assessment), established as the public's central drop-off point for recyclable/non-recyclable household waste, including household hazardous waste.
  - A landfill gas facility to allow for the capture and destruction of landfill gas from the North Mound of the George Town Landfill.
  - A residual waste landfill to receive non-hazardous, non-recoverable and/or residual waste coming from ReGen's operations.
- Supporting facilities (excluded from the Environmental Impact Assessment), including:
  - An administrative building to accommodate staff and visitor groups and provide space for meetings, educational displays, an eating area, and associated washrooms.
  - A maintenance building to store plant equipment and carry out general maintenance of equipment associated with ISWMS operations.
  - A Caribbean Utilities Company substation to connect to the electricity grid.

At Cayman Brac

- Infrastructure for composting, recycling, end of life vehicle processing and waste transfer.

At Little Cayman

- Infrastructure for recycling, end of life vehicle processing and waste transfer.

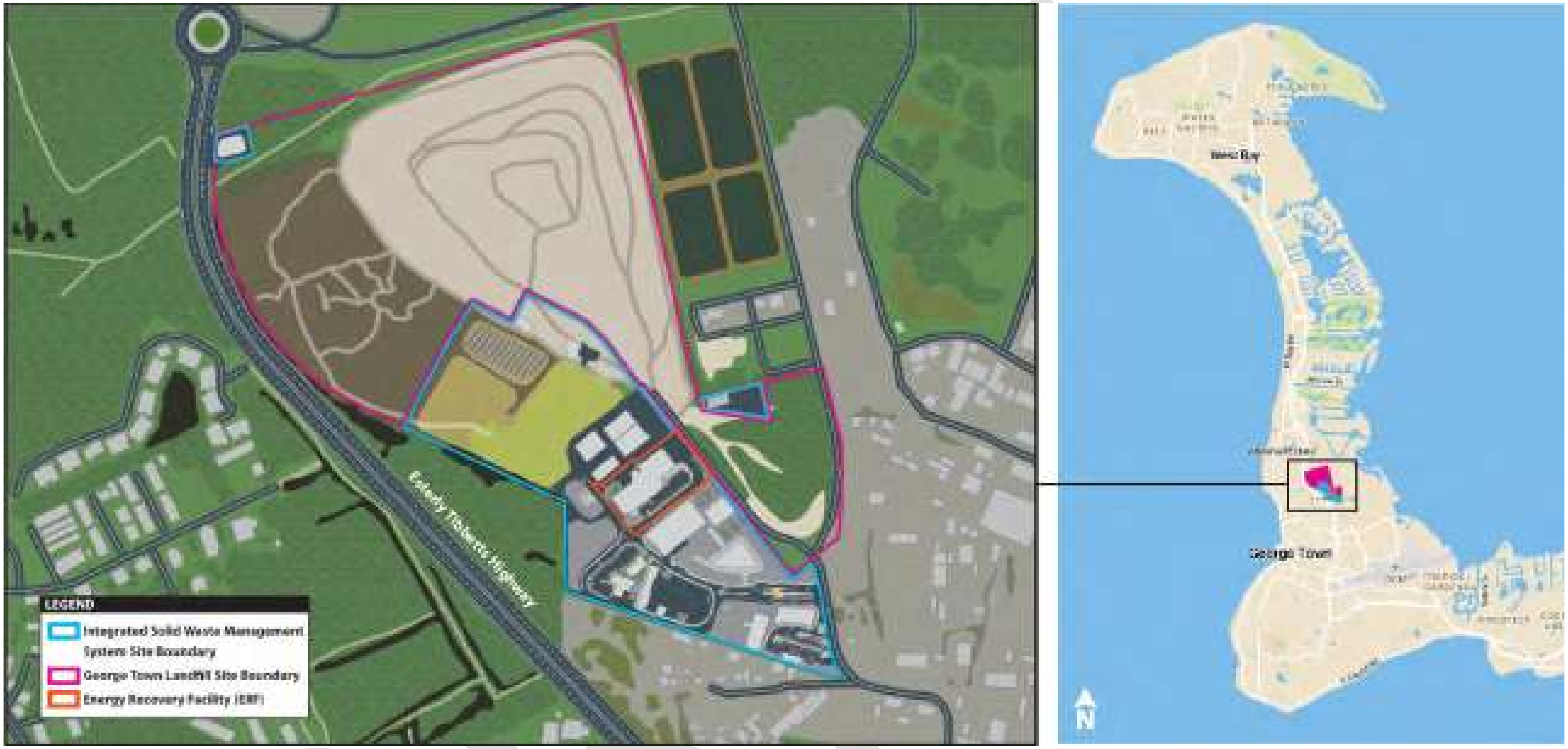

Figure 3.1 ISWMS Site Location

Figure 3.2 ISWMS Facilities

3.2 About the Energy Recovery Facility

The proposed Energy Recovery Facility is a modern controlled combustion (or mass burn) facility that will convert combustible, non-recyclable waste to chemically inactive ash (bottom ash, air pollution control residue and boiler ash). The volume of incoming waste will be reduced by about 90 percent through this process.

The Facility is anticipated to process up to 120,000 tons of municipal solid waste per year. The heat emitted from the combustion of waste will be captured to produce electricity for sale to the Caribbean Utilities Company.

Bottom ash will be managed via the proposed bottom ash recycling facility at the ISWMS Site. Air pollution control residue and boiler ash will be disposed of at the proposed Residual Waste Landfill.

Advanced air pollution control and continuous emissions monitoring systems will ensure that the Facility's emissions can meet current and future standards, and not pose an adverse effect to the environment.

The Facility has four primary processes.

1. **Combusting –** The Energy Recovery Facility will turn waste into electricity by combusting it at very high temperatures.
2. **Steam –** The heat is used to produce steam that drives a turbine to generate electricity, which is supplied to the grid.
3. **Recycle –** After the waste is completely burned, any leftover materials, such as steel or aluminum, will be recovered and recycled.
4. **Filter emissions –** State-of-the-art technology scrubs emissions to European Union Industrial Emissions Directive standards.

Figure 3.3 Energy Recovery Facility Process

Access, security and lighting

The ISWMS Site will be accessed along the same route as the current George Town Landfill operations: from the south, via Seymour Drive. A metal chain-link perimeter fence will be installed for Site security. Access to the ISWMS Site is provided via a 24-foot main gate on the south side of the property.

As 90 percent of the activity at the ISWMS Site occurs from dawn to dusk, lighting is restricted to the main access road to allow for waste deliveries and building eves. Closed-circuit television cameras will monitor the property, ensuring total coverage.

Working hours and employment

The ISWMS Site's working hours will vary between facilities based on the specific work demands and needs, as well as open hours necessary for the public and companies using the facilities. The Project is anticipated to create approximately 70 full-time positions during operation.

Landscaping

As part of the ISWMS Site's landscaping, native species will be planted to create an attractive setting and soften the appearance of the development. Landscaping will also enhance biodiversity across the Site. Materials will be chosen that complement the surrounding landscape, and reflective materials and bright colours will be avoided where possible. Small trees and bushes will be planted in some areas, especially toward the edge of the Site, helping to create connectivity between habitats. Tree planting around the entrance will help soften the perimeter fence and create a more interesting gateway.

3.3 Design and construction

All project designs will be in accordance with applicable codes and amendments referenced in *The Building Code (Amendments) Regulations (2016).* The design, construction, and testing of ISWMS facilities will generally follow harmonized European standards and meet all applicable legislation. Where standards are not available, appropriate national or international standards will be used in line with good industry practice.

Construction activities will involve:

– A Construction Environmental Management Plan, Site Waste Management Plan and a Health and Safety Plan
– Appropriate geotechnical investigations and surveys
– 'Flexible' designed buildings that are sustainably reused and reconfigured to meet future needs
– The use of locally available construction materials (such as construction and demolition waste)
– Site preparation, including clearance, Site levelling, compaction and demolition
– An approximate 2.5-year timeline to design, engineer, procure and construct the Energy Recovery Facility
– An approximate 1.5-year timeline to design, engineer, procure and construct the non-energy recovery facilities

The aim is for all ISWMS facilities to be ready for operation at the same time.

As part of the ISWMS Project, the George Town Landfill current waste mound will be remediated. The Landfill may take several years to stabilize, and monitoring programs will determine its final use.

3.4 Community sustainability

The Project will generate positive sustainability benefits to Cayman, such as:

Reduced emissions – The remediation of the George Town Landfill is anticipated to cut greenhouse gas emissions by more than 25,000 tons per year. That's like removing more than 5,000 cars from our roads every year. When the new waste management facilities are up and running, they will help create a cleaner and greener Cayman Islands, benefitting the whole community.

Reduced landfilling – Through the "reduce, reuse, recycle and recover" key elements of the waste management process, the proposed development has the capacity to divert up to 95 percent of the community's waste away from the landfill.

Improved recycling – New facilities for processing green waste, metal, household waste, and construction and demolition waste will allow more things to be recycled.

Sustainable power – Cayman's trash will be used to generate approximately nine megawatts of electricity. That's enough to power more than 2,000 homes and businesses in Grand Cayman.

Facility designs include a preference for equipment with high energy efficiency specifications and sustainable lifecycle costs. Main operations focus on electricity generation by the Energy Recovery Facility. The Energy Recovery Facility will also meet the classification for a recovery facility rather than a disposal facility. Water conservation measures will be adopted throughout the design of each ISWMS facility.

4. Summary of effects and mitigation

The Terms of Reference for the ISWMS concluded that these topics should be addressed in the Environmental Impact Assessment to determine significant impacts and mitigation efforts for the Project:

– Marine ecology
– Terrestrial ecology
– Hydrology and hydrogeology
– Land quality
– Landscape and visual elements
– Air quality and greenhouse gases emissions
– Noise and vibration
– Traffic and transport
– Socio-economics

4.1 Marine ecology

The consultant team has completed background information reviews to get a sense of the Project's marine environment, with a focus on marine and coastal habitats, wildlife, protected species, and significant natural areas. The Study Area includes the North Sound and wider coastal waters, extending from the mean high-water mark on Grand Cayman to 12 nautical miles (22.2 kilometres) out. These reviews included a desk study, habitat survey and habitat mapping, and protected species surveys to identify the marine ecology within and close to the ISWMS Site.

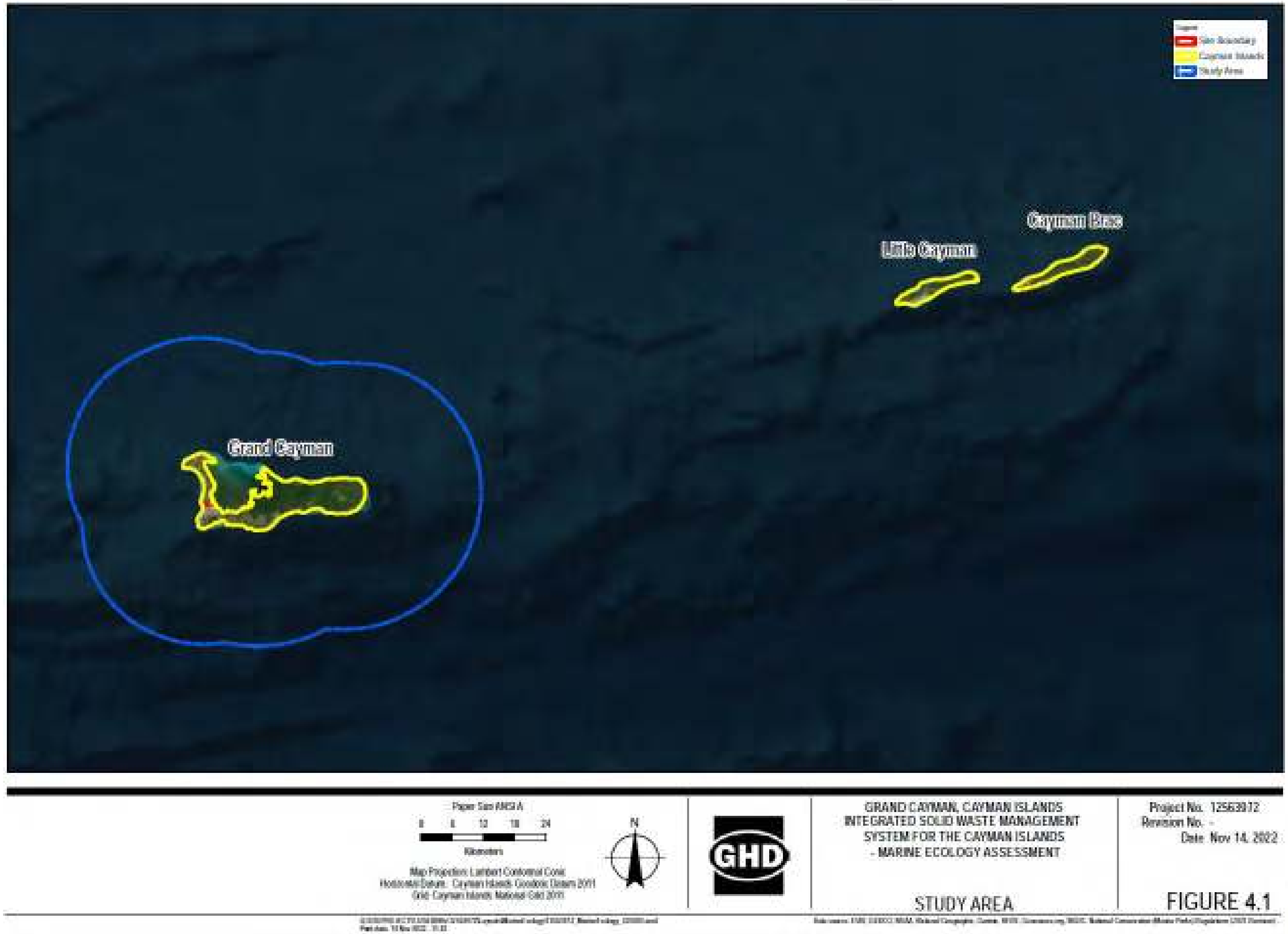

Figure 4.1 Marine Ecology Study Area

4.1.1 Baseline data and existing environment

To establish a comprehensive baseline condition of the Study Area's marine environment, the consultant team obtained records of protected species and species habitat mapping, as well as natural features within the Study Area. The team also carried out baseline studies of the oceanography and biology of the shallow marine environments of Grand Cayman.

The three Cayman Islands are flat, low-lying limestone islands with large offshore reef systems, mostly surrounded by reefs and mangroves that enclose sand- and seagrass-filled lagoons. With these habitats come diverse marine species, including several molluscs and crustaceans. Marine habitat mapping within a 1.2 mile (2 kilometre) radius of the Site displayed the following habitats:

- Shelf benthic classification
  - Aggregated patch reef
  - Beach rock
  - Colonized hardbottom
  - Rubble
  - Sand
  - Spur
  - Uncolonized hardbottom
- Lagoon benthic classification
  - Hardbottom
  - Seagrass beds
  - Silt
  - Vegetated sand

4.1.2 Impacts

The proposed development will result in:

- No anticipated direct discharge to the marine environment.

Based on an impact analysis, it was found that, because there is no anticipated direct discharge to the marine environment from the ISWMS Site, there are no anticipated impacts to the surrounding marine environment. However, as the Facility design is not yet finalized, there is a possibility (although unlikely) of direct marine discharge of cooling water to the North Sound if the anticipated discharge alternatives prove to be infeasible. An assessment of this possible outcome proved not significant with mitigation in place to ensure no impacts to natural communities impacting the North Sound. There are also no significant impacts anticipated while importing waste from the Sister Islands.

Habitat and wildlife interference or strikes may be possible, resulting from vessel movements between the islands during operation. Most components lie outside of marine natural areas, however there may be protected species present in select areas and when importing waste from the Sister Islands.

Monitoring will be in place during construction and operation for erosion and sediment control. By applying proposed mitigation measures, best management practices and restoration conditions, the potential residual effects on the marine environment within and around the ISWMS Site are considered not significant.

4.2 Terrestrial ecology

The consultant team's ecologists have completed background information reviews to get a sense of the Project's terrestrial environment, with a focus on terrestrial habitats, wildlife, protected species, and significant natural areas. The Study Area includes the ISWMS Site and the area within 1.2 miles (or 2 kilometres).

As part of the study, the consultation team collected and reviewed information from Cayman Islands Department of Environment, Google Earth, the UK Overseas Territories and Crown Dependencies, Cayman Islands National Trust and iNaturalist. The team also completed:

– A field reconnaissance assessment of existing conditions and sensitivities, including taking Site photos.
– Equipment installation within the site to determine the presence or absence of wildlife.

4.2.1 Baseline data and existing environment

The ISWMS Site lies within a landscape that is mostly heavily developed. Immediately north of the Site lies the George Town Landfill – the northwestern part of the proposed ISWMS Site is formed of part of the landfilled area. An inland mangrove and the Esterley Tibbetts Highway are to the west, and to the northeast is the Cayman Islands Wastewater Treatment Plant. Immediately south and east of the ISWMS Site is an industrial area made up of bare land, storage of plant equipment, and a series of low-rise industrial buildings.

The ISWMS Site consists of areas of filled land, mangrove, poorly vegetated land, and bare ground. The southwest part of the ISWMS Site is made up of a mangrove community. The remainder of the ISWMS Site is a combination of bare ground, landfilled ground, and a few small operations buildings with little or no vegetative cover. Vegetation clearing was completed in the southeast part of the Study Area.

The project team collected records of protected species, species habitat mapping, and information on additional natural features to establish a baseline condition of the Study Area's terrestrial environment. A terrestrial habitat assessment was conducted and natural vegetation communities within the ISWMS Site were identified. The team completed a photographic botanical inventory and refined vegetation mapping using a vegetation classification system.

Wildlife monitoring was conducted to collect data on bat houses and colonies, resident and migratory bird species, and incidental wildlife that may traverse the ISWMS Site.

Several species of wildlife were recorded on the ISWMS Site such as the green iguana (*Iguana iguana*), and red junglefowl (*Gallus gallus*). Results also found that the terrestrial habitat within the south-east portion of the ISWMS Site, while mapped previously as Primary Habitat, is no longer consistent with the definition of 'primary habitat'.

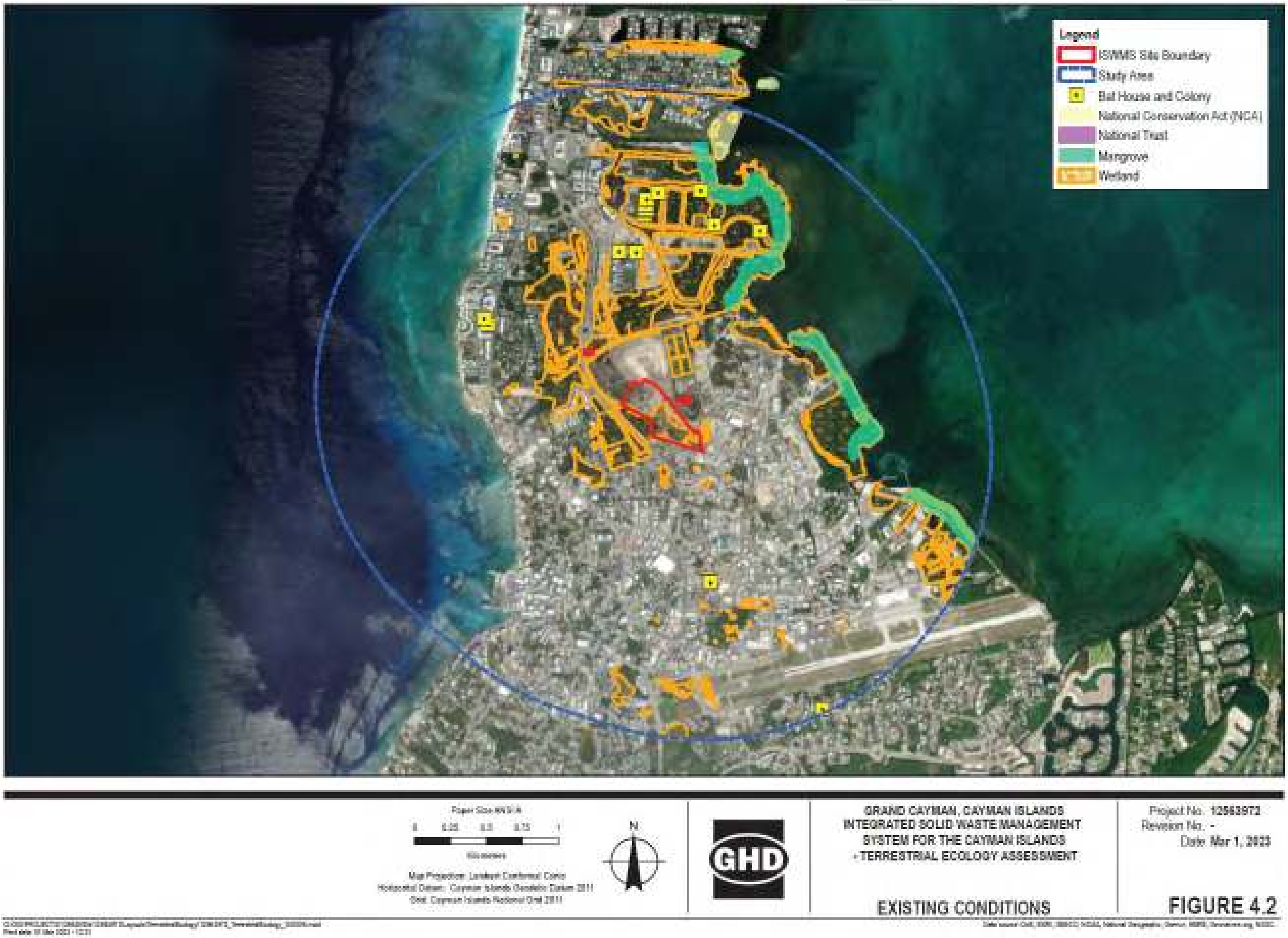

Figure 4.2 Terrestrial Ecology Existing Conditions

4.2.2 Impacts

The proposed development will result in the removal of 33 acres (or 13.35 hectares) of terrestrial habitat and 1.7 acres (0.7 hectares) of inland mangrove habitat. During construction, there may be potential loss of vegetation that could serve as habitat to species that have been found within and around the landfill site. However, since the Site is sparsely populated, it is not considered suitable for species to live in due to ongoing activities. Some fauna species may be eliminated due to construction during Site preparation. Some sedimentation and erosion may result as an indirect result of the removed vegetation.

Associated residual effects include vegetation loss, soil erosion, dust, noise and vibration, and spills. Monitoring will be in place during pre-construction, construction and operation for fauna, and erosion and sediment control.

There may be protected species in select areas throughout the ISWMS Site – mainly mangrove-dwelling wildlife species such as birds and bats. To address any impacts, recommended mitigation measures have been provided throughout construction and operation.

The potential residual effects on the terrestrial environment within and around the ISWMS Site are considered not significant due to the application of proposed mitigation measures and management best practices.

4.3 Hydrology and hydrogeology

Members of the consultant's technical team examined the potential impacts that the ISWMS would have on hydrology (surface water) and hydrogeology (groundwater) within a 1.2 mile (or 2 kilometre) Study Area of the ISWMS Site, specifically effects on:

– Water quantity (level and flow)
– Water quality
– Surface water flows
– Immediate and downstream morphology
– Sediment dynamics
– Flood risk

Technical researchers studied the effects the site might have on several elements, including:

– Water environment (including the Ironshore Formation aquifer, located beneath the proposed Site; the Bluff Group aquifer, which consists of the Pedro Castle Formation aquifer, the Cayman Formation and Brac Formation, also located beneath the proposed ISWMS Site; and the North Sound)
– Water use (including groundwater abstraction for the purposes of geothermal cooling and potable water)
– Humans, properties and infrastructure within areas prone to flooding

4.3.1 Baseline data and existing environment

Hydrology

– The northern channel is fringed with mangroves and is culverted below Esterley Tibbetts Highway to the west of the ISWMS Site. Its water level fluctuates with the tide and is potentially affected by leachate from George Town Landfill, which acts as a potential source contaminants.

Hydrogeology

– Groundwater beneath the ISWMS Site is shown to be tidally influenced indicating hydraulic connectivity between the groundwater and ocean, resulting in considerable mixing of saltwater from the ocean and freshwater, causing transition zone of brackish water.

- Grand Cayman potable (drinkable) water is supplied from desalinisation plants by reverse osmosis abstracted at depth (250 feet or 76 metres).
- The ISWMS Site is not considered to be close to any major freshwater lenses, which are located on the eastern side of the Island.
- A number of abstractions are located within 1.2 miles (or 2 kilometres) of the ISWMS Site for potable water supply, cooling water, and geothermal cooling purposes.

Water Quality

- Groundwater and surface water data in the vicinity of the ISWMS Site have been analyzed throughout the sampling period. Contaminant cleanup target level exceedances have been identified for certain analytes.

4.3.2 Impacts

The following measures included in the design of the ISWMS will mitigate most impacts related to hydrology and hydrogeology:

- Facility design standards for still water elevation, Base Flood Elevation, and Design Flood Elevation based on Hurricane Ivan and US FEMA guidance
- Appropriate storage and material handling
- Leachate management at the Residual Waste Landfill
- Stormwater Management Plan
- Groundwater abstraction and injection modeling simulations demonstrate no impacts on Caribbean Sea, North Sounds, the residential canals or nearby water users

Mitigation measures for potentially significant impacts associated with the construction, operation and decommissioning of the ISWMS are recommended, including:

- A detailed surface runoff management plan with proposed runoff collection and treatment options, and encouraging appropriate infiltration of runoff to groundwater, mimicking the natural infiltration process.
- A detailed wastewater and sewage plan that minimises the risk of leaks and spills within the system, with considerations on changes to the local climate and sea level due to climate change.
- A Waste Management Plan with waste management planning for emergency situations.
- An appropriate grade of concrete used in the design of the development that prevents sulphate attack and degradation of infrastructure under its surface in the event of groundwater contamination.
- A sensitivity to flooding incorporated in the ISWMS Site's design and Environmental Management Plan, such as finished floor levels, raised equipment above anticipated flood water levels, built surfaces that direct floodwater away from sensitive infrastructure and evacuation routes, and a hazard management plan used in response to government-issued warnings.

With these mitigation measures adopted, the significance of these potential impacts are considered to be minor, except for the residual risk of tidal flooding and extreme weather and climate change-induced flooding, which can cause lasting effects to Site infrastructure and risk life.

Due to the current unsustainable design and practices at the George Town Landfill and resulting impacts to groundwater quality, the construction of the ISWMS will likely result in net environmental benefits due to improved waste management practices and facilities.

4.4 Land quality

Members of the consultant's technical team examined the potential land quality impacts (such as land stability, wind-blown dusts and land contamination) that the ISWMS would have on human health, ISWMS infrastructure and surrounding land users (homes, businesses and schools). The study encompasses the footprint of the ISWMS and the surrounding land within approximately 250 yards (or 229 metres). This includes:

– The existing George Town Landfill.
– Parts of the land owned by the Cayman Water Authority to the east, with four former wastewater treatment lagoons (now used for sludge) and a current wastewater treatment plant.
– The mangrove to the south, along with a concrete batching plant and a concrete block and paving stone manufacturer.
– The Esterley Tibbetts Highway and parts of the Lakeside Development to the west.

4.4.1 Baseline conditions and existing environment

The ISWMS Site's elevation ranges between 7 and 20 feet (2 and 6 metres) above sea level and the surrounding land is mostly flat and low lying, except for the George Town Landfill. The landfill's north mound is around 100 feet (30 metres) above sea level and the south mound is around 40 feet (12 feet) above sea level.

Beneath the ISWMS Site lies four geological units, including man-made deposits (waste materials covered with topsoil and shot rock), organic peat, an Ironshore formation and a bluff formation of limestone and dolostone. Exposure to earthquakes is possible and a lack of strong quakes in Grand Cayman over the past 300 years could mean that seismic energy is currently accumulating in the fault line, resulting in a large magnitude earthquake in the future. No liquefiable soils are located at or around the ISWMS Site.

4.4.1.1 George Town Landfill

The proposed ISWMS footprint (except for the Landfill Gas Facility proposed to be overtop the old landfill) lies outside of the George Town Landfill's old landfill area, main landfill area and Hurricane Ivan fill area (a flat area in the north-west part of the site that was infilled with demolition and related wastes from disaster clean-up operations following Hurricane Ivan in 2004).

An arsenic containment cell is proposed to lie within the ISWMS footprint, located beneath the Residual Waste Landfill.

Figure 4.3 Boundary and Layout of the George Town Landfill

The Cayman Islands Government's Department of Environmental Health gathered leachate sampling data to the west of the main landfill from 2016 to 2020. Arsenic and chromium values analyzed in 2020 were substantially higher than corresponding data for ground and surface water samples.

Using gas probe data, the team found that due to the unlined nature of the George Town Landfill, underground movement of landfill gases and vapours does pose a potential risk to the ISWMS. But given the distance between the active area of the landfill and ISWMS facilities, as well as the existing and planned active gas management system within the landfill's north mound, along with the presence of the Residual Waste Landfill between the north mound and its facilities, it's likely any meaningful gas movement from the George Town Landfill to the ISWMS facilities is minimal.

Since the current landfill operates on outdated waste management principles and lacks most environmental mitigations commonly applied to modern facilities, local regulators have identified leachate emissions as one of the main sources of contamination to the North Sound. The National Solid Waste Management Strategy for the Cayman Islands anticipates that the landfill will be closed, but is expected to continue to operate while the new ISWMS is developed and implemented. Remediation and restoration work options are proposed, including landfill mining and capping.

4.4.1.2 Soil and gas baseline data

Contamination within the ISWMS footprint is most likely associated with historic waste handling and disposal activities at the landfill. Potential contaminants located at various areas of the Site (landfill, oil and hazardous waste storage area, equipment storage area, arsenic containment cell and an old scrap and tyre stockpile area) include materials such as metals, combustion products, asbestos, arsine gas, pesticides, paints and solvents, organic vapours and landfill/ground gases.

The entire ISWMS footprint, with the possible exception of the Caribbean Utilities Company Substation, is expected to be on land affected by landfill or waste disposal activities. Little soil analysis is available that is relevant to the actual footprint of the Site itself and not to the George Town Landfill. Within the northern third of the ISWMS Site, data does not suggest that substantial contamination will be encountered, and no data is available for all other ISWMS components in the south, so the project team could not make conclusions regarding present soil contamination.

Landfill gas, generated from the George Town Landfill, could laterally affect the ISWMS Site with no basal liner at the landfill, however it's not likely any meaningful above-ground movement will exist.

4.4.2 Impacts

Any of the following potentially significant impacts related to the ground conditions and geological setting of Grand Cayman can be reasonably mitigated for the ISWMS Site, including:

– The low bearing capacity of the existing waste surface layer (mitigated by transferring the development loads to the Ironshore or bluff formation bedrock).
– Sinkholes and foundational damage (mitigated by installing geotextiles – permeable fabrics that separate, filter, reinforce, protect and drain soil – and geogrids - geosynthetic, grid-based material used to reinforce soils – on the Ironshore formation).
– Ground instability (mitigated by avoiding cavity locations in the bedrock of the bluff formation).
– Earthquakes and seismic activity (mitigated by the design of the ISWMS facilities and foundation systems to withstand effects).

The following potentially significant effects were identified through the geoenvironmental assessment:

– Health effects on ISWMS Site staff, construction workers and visitors through exposure (and potential spread) of contaminated soils at the site surface and release of runoff, dusts, gases and vapours within the Old Scrap and Tyre Stockpile Area and underlying soils of Areas 2 and 3 during construction.
– Health effects on ISWMS Site staff, construction workers and visitors through disturbance of existing contamination within the Equipment Storage Area, particularly the Oil and Hazardous Waste Storage Area during construction.
– Health effects on surrounding land users from failure of the landfill cap (e.g., due to flawed engineering, extreme weather events or sea level rise).
– Health effects on ISWMS Site staff, construction workers and visitors through accumulation of asbestos fibres in underlying soils, and potentially released and spread during treatment, and onward during reuse as aggregate during operation.
– Health effects on surrounding land users through the spread of wastes and contamination in floodwater/runoff leading to effects on soils beneath Area 2 and surrounding land.

It is likely that any pre-existing wastes that are present will not result in unacceptable levels of contamination. Established procedures should ensure that filling materials during construction do not contain hazardous materials which can pose a risk to workers.

Construction and operation of the ISWMS is expected to result in net, long-term environmental benefits compared to the unsustainable design and impacts to soil and groundwater quality of the current George Town Landfill.

4.5 Landscape and visual

Members of the project team analysed the effects of construction and operation of the proposed ISWMS on the landscape, concentrating on effects to the landscape and townscape character, as well as the views and visual amenity of people who live, participate in recreational activities, work and/or travel through the area around the proposed ISWMS on the western side of Grand Cayman. The team defined a landscape and visual Study Area which extends 3 miles (5 kilometres) from the ISWMS Site boundary.

The following five landscape and seascape character zones were identified within the Study Area:

- **Tourism foreshore and George Town Centre**
  (includes the designated tourism industry zone along the western coastal area and George Town Centre – the bustling hub of Grand Cayman)
- **Industrial, waste and airport**
  (includes various industrial and waste industries, as well as the Owen Roberts International Airport located primarily east and south of the Project Site)
- **Residential settlement**
  (includes a mix of low to medium-height buildings and single-family homes, with views from the north side of Keturah Street looking toward the Project south, the east side of Sorrel Drive looking southwest, the south side of Selkirk drive looking west, the south side of Crewe Road looking north, the east side of Abbey Way looking west and the west side of Canal Lane looking northeast)
- **Mangroves and recreation**
  (includes low-lying coastal mangroves and sedge vegetation dominating the Study Area's eastern and southern sides, and views from the North Sound Gated Community looking east, Pinehurst Road looking east, north of Blue Lagoon Drive and the east side of Safehaven Drive looking east)
- **Caribbean Sea and North Sound lagoon**
  (includes the distinct eastern and western seascapes that envelop the Project site on its eastern and western sides, with mangrove swamps, anchor points for cruise ships and popular tourist destinations and hotels located in the area)

Sensitive visual receivers in the Study Area include residents, pedestrians, road users, cruise liner users, and workers of the industrial zone. Eight viewpoint locations were chosen to assess the visual effects of the Project on sensitive receivers within the Study Area.

4.5.1 Baseline data and existing landscape and visual environment

The proposed ISWMS Site is situated within an area of mixed low-density residential neighbourhoods with single-family homes and high-density commercial areas with multi-story buildings. The immediate surroundings of the proposed Site are zoned for industrial or commercial use and feature warehouses, factories, and storage yards. Many key visual features were identified in the Study Area, such as West Bay Road's linear tourist drive, the observation tower at Camana Bay, the ruins of the 18th century fort on Harbour Drive and Fort Street, and a mix of historic and contemporary architecture (i.e., Town Hall and the Harquail Theatre).

Project team members gathered and viewed existing data, including the following landscape and visual resources:

- Project design information and site photographs
- Land use, and vegetation maps
- Aerial imagery, Google Earth and Google Street views

To determine the existing natural and cultural features (i.e., key seascape, landscape and spatial elements, features, and values) the following aspects were considered:

- Land use and built form
- Landform, topography, and hydrology
- Vegetation
- Views
- Historical features
- Coastal edge

- Water column depth and qualities
- Seabed geology and form
- Key habitats, features, and species

A visual analysis was also performed to establish:

- The key views
- The Project's viewsheds
- Other visual features within the Study Area

4.5.2 Impacts

Potential landscape impacts of the ISWMS include evaluating the effect of the change and development on the landscape as a resource. Potential visual impacts of the ISWMS include assessing the effects of change and development on the views available to people and their visual amenity from various locations.

The potential impacts on landscape character were determined based on the sensitivity of the existing landscape and the magnitude of change that is likely to occur. Visual considerations were evaluated from key vantage points, where there is particular interest in the view and where there are sensitive viewpoints.

The landscape assessment found that the Project would have negligible to moderate impacts on several surrounding areas. There is a moderate effect associated with the industrial, waste and airport landscape character zone, as the tall ventilation stack's height is found to have high visibility and represents the highest point of the Project on the island.

The residential settlement, and Caribbean Sea and North Sound lagoon landscape and seascape character zones were found to have minor effects because of the potential for the Project's appearance to be partly mitigated by the current vegetation that would help obscure the facilities from the distance of the settlements, and because the ISWMS is located far from the North Sound lagoon zone, causing an almost imperceptible change or no change to the landscape character of that zone, respectively.

The visual assessment found that the Project would range from having a minor to a major level of impact depending on the viewpoint. Mitigation measures will be used to ensure that real-time landscape and visual changes are kept to a minimum. The visual assessment found that the Project would have a major visual effect from the United Pentecostal Church, from tall residential properties on Seven Mile Beach, from cruise liners anchored off Seven Mile Beach, and from the North Sound Lagoon. Users of the church and residents on Woodlake Drive, residents on Seven Mile Beach, tourists and staff of the cruise liners off Seven Mile Beach and users of the North Sound Lagoon are all assessed to have a high sensitivity to the change in viewpoints, with prolonged and permanently altered views where the Project is located.

A moderate visual effect is experienced from residential properties on Lakeside Villas, as a series of large industrial buildings and the ventilation stack are visible, but partly obscured behind the existing vegetation and tree line. Users of the National Galley of the Cayman Islands, as well as residential properties on Marbel Drive, and users of the Camana Bay Observation Tower will experience a minor overall visual effect to the change in views brought on by the Project, as obstructions relegate the Project to being mostly out of sight behind existing structures, vegetation and tree lines.

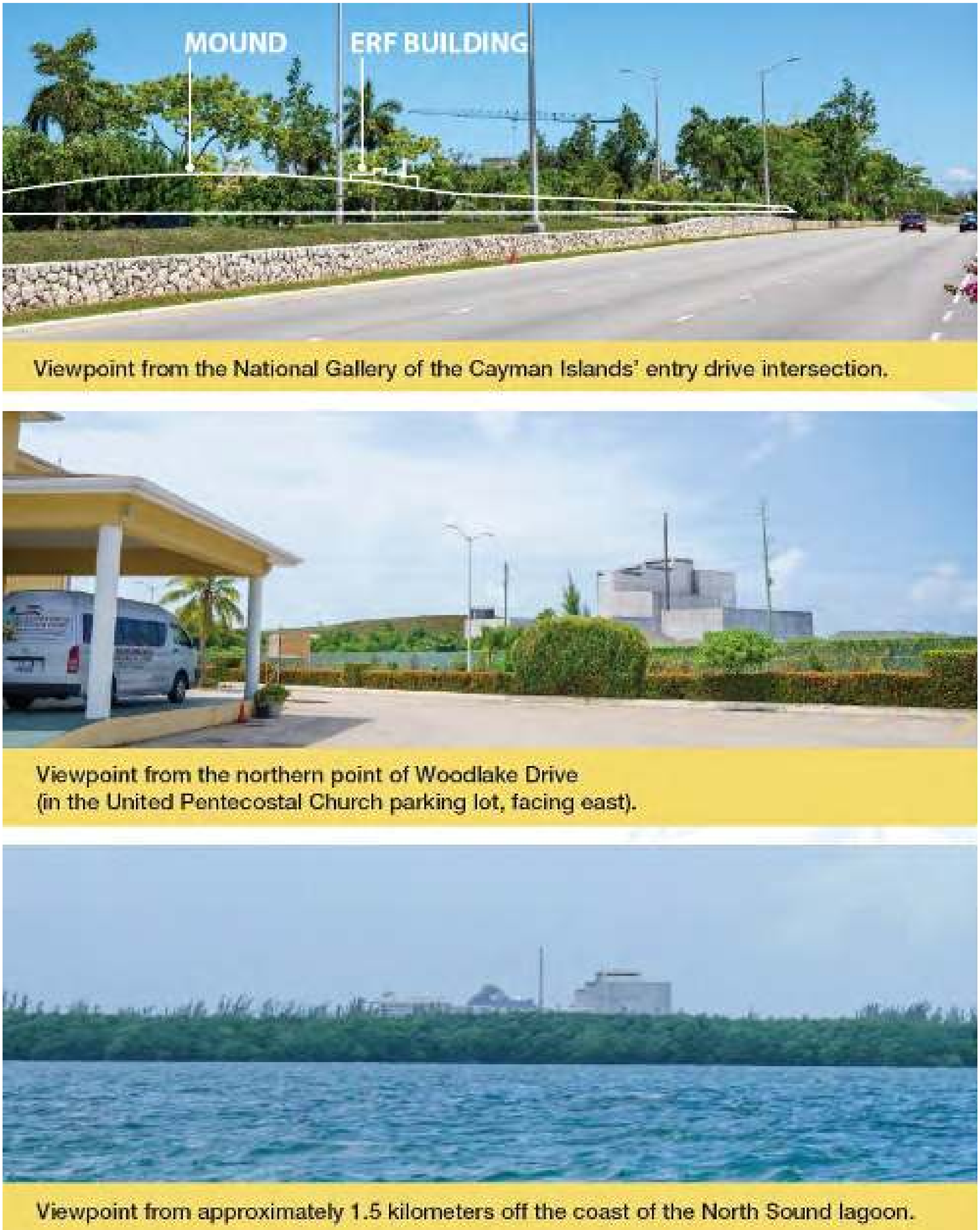

Figure 4.4 Three Viewpoints Showing an Artist's Rendering of the ISWMS

4.6 Air quality and greenhouse gases emissions

Emissions of air pollutants are known to have a negative impact on human health and surrounding ecology. The activities proposed during construction and operation of the ISWMS could potentially elevate air emissions, which can affect air quality in the vicinity of the Site.

The air quality and greenhouse gases assessment:

– States the existing sources and volume of greenhouse gases in the vicinity of the ISWMS, such as the existing George Town Landfill, Esterley Tibbetts Highway, and Owen Roberts International Airport, and which estimates that the current annual greenhouse gas emissions from the Cayman Islands is approximately 720,000 tonnes of CO_2 equivalent.
– Outlines potential impacts from the construction and operation of the facility on local air quality.
– Determines the significance of likely potential effects.

The consultant's team defined an Air Quality Study Area of up to 6 miles (or 10 kilometres) in all four cardinal directions of the ISWMS Site. A detailed assessment of the air quality-related aspects of the proposed development was undertaken, including:

– A discussion on the existing environment and baseline conditions.
– ISWMS operation key components and contaminants of concern.
– Key sensitive receptors.
– Modelling results and evaluation.

The assessment of the effect on air quality from the ISWMS was performed by conducting dispersion modelling to predict the downwind concentrations of air contaminants and comparing these predictions to regulatory standards and guidelines.

4.6.1 Baseline data and existing environment

Ambient air monitoring was conducted at seven stations: Cox Lumber, Paddington Place, George Town Primary School, OPY 20, Lakeside, Cayman International School, and Laundry for a period of up to two weeks. Using emission estimates and dispersion modelling, a theoretical background emissions assessment for nitrogen dioxide was conducted and compared to the results of a nitrogen dioxide monitoring program. Existing air quality in the Study Area was shown to be compliant with the applicable air quality standards, except for an odour-based standard for hydrogen sulphide resulting from landfilling activities. The Department of Environmental Health, GHD, Valley Environmental Services (VES), and Dart Enterprises Cayman all contributed to the creation, management and data collection for the program.

4.6.2 Impacts

The potential impacts of the ISWMS on local air quality were assessed by modelling the estimated maximum emissions of each contaminant to determine the maximum potential concentration of each that could occur off-Site. The cumulative air quality impacts were compared to relevant standards and guidelines, and to the existing air quality conditions. All cumulative impacts are shown to be within acceptable air quality standards.

By applying the proposed mitigation measures, the results of the air quality and greenhouse gases assessment indicate that there are no significant impacts to human health, quality of life or ecological receptors (plants and animals, habitats or ecosystems) anticipated.

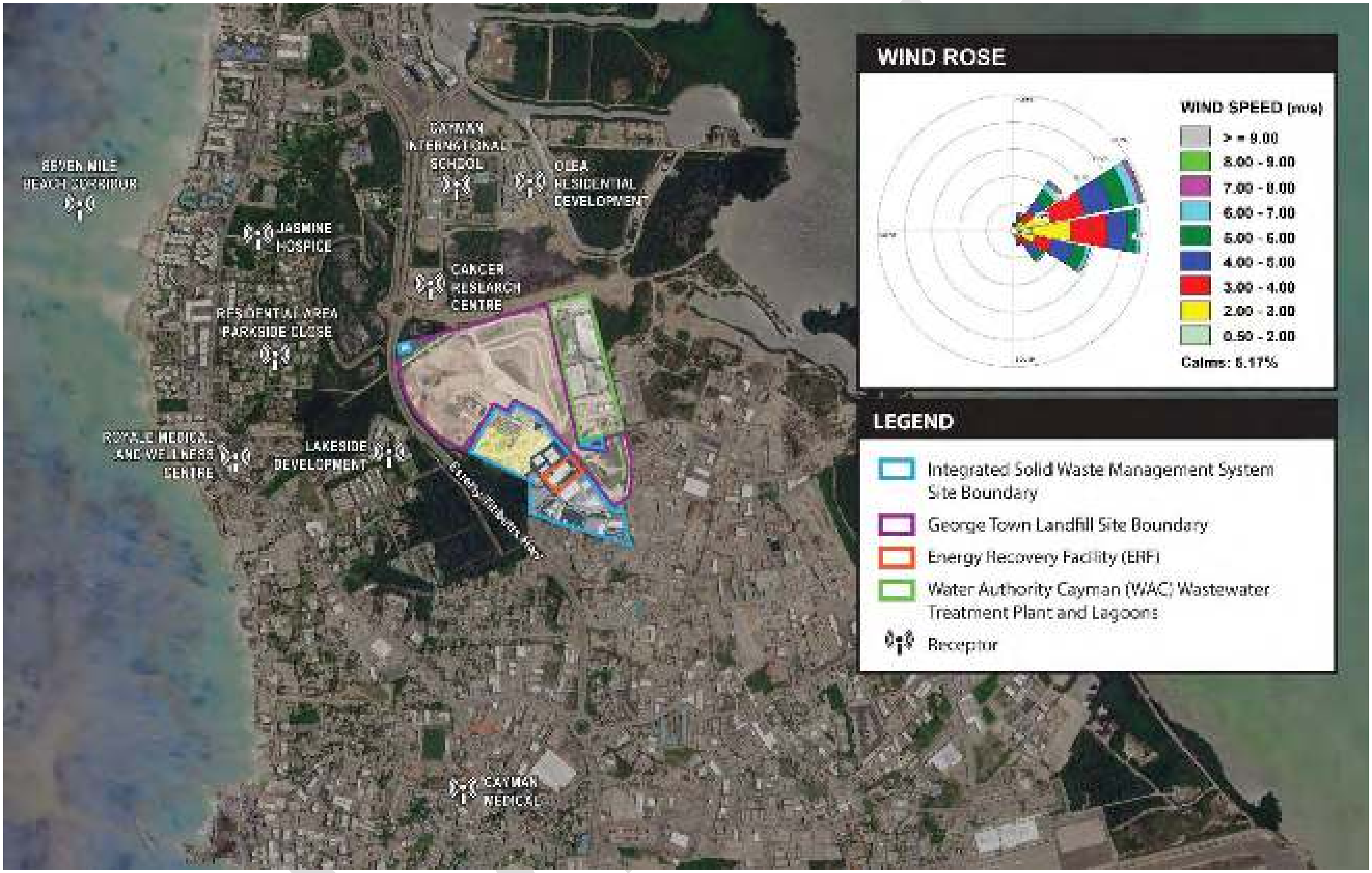

Figure 4.5 Air Quality Key Sensitive Receptors

4.7 Noise and vibration

Unwanted noise and vibration have a negative impact on human health and quality of life. The activities proposed during construction and operation of the ISWMS were evaluated to determine if they would potentially result in an increase to noise and vibration levels in the vicinity and cause significant effects on health and quality of life.

The following Study Area and assessment boundaries were established for the noise and vibration impact assessment:

- Spatial boundaries, including a Site Study Area (the land directly disturbed by project construction activities), a local Study Area (all lands within a 3,281 foot or 1,000 metre radius of the site Study Area's boundaries), and a regional Study Area (all lands connected to the Esterley Tibbetts Highway).
- Temporal boundaries, including project phases (such as construction, operation and decommissioning) and temporal characteristics (such as seasonal fluctuations in traffic volumes and composition, and fluctuations in weather patterns and their effect on how noise spreads).
- Technical boundaries, including accuracy of the sound level data and traffic data used in the assessment, modelling accuracy and level of detailed design.
- Sensitive receptor locations (such as permanent or seasonal residences, nursing and retirement homes, hotels and motels, rental residences, hospitals, campgrounds, parks, schools, cemeteries or places of worship).

4.7.1 Baseline data and existing environment

Noise and vibration monitoring data on the existing environment were collected through the use of six noise sensitive receptors, located at:

- Lakeside residential dwelling, immediately west of the proposed ISWMS Site
- Residential dwellings on Parkside Close (northwest of the Site), Seymour Road (southeast of the Site), and on Woodlake Drive/Glenwood Drive (southwest of the Site)
- Cayman International School
- Proposed new Health City Camana Bay Medical Campus (north of the ISWMS Site)

Seasonality on the Cayman Islands consists of a wet and a dry season. The dry season usually begins in early November and lasts until April. Monitoring took place beginning in October 2021, which measured noise emissions occurring during the rainy season and after the summer school break. This allowed for regular traffic to be observed and documented. Baseline monitoring to determine background sound levels was completed over a span of five to eight days and included both weekday and weekend days for evaluation.

The sound characteristics and current ambient acoustical environment at the study's four noise monitoring locations are characterized by noise that is attributed to:

- The Esterley Tibbetts Highway
- The Owen Roberts International Airport
- Landfill operations and local commercial and industry areas to the southeast
- The natural environment

Baseline noise data is a good representation of typical existing sound characteristics around the ISWMS's development. The assessment confirms that:

- The sound levels in the Study Areas near the Esterley Tibbets Highway are generally high during the day and low at night.
- Residential receptors close to commercial industries generally experience higher sound levels during the day than during the night.

– Residential areas removed from road traffic and industry areas generally experience lower sound levels, consistent with an urban area.

These documented baseline sound levels were used in comparison to the predicted noise impacts during construction and operation of the proposed ISWMS to determine the potential for noise impacts.

Figure 4.6 ***Noise Sensitive Receptor Locations***

4.7.2 Impacts

The project team considered and assessed the Project's potential construction and operational noise impacts that affect sensitive receptors. A 'worst- case' scenario wherein all ISWMS facilities are in full operation has been considered.

By applying the proposed mitigation measures the results of the noise and vibration impact assessment indicate that:

– Noise from the proposed ISWMS operations is considered to have a low or minor impact.
– Noise from ISWMS-generated road traffic is considered to have a negligible impact.
– Noise from construction activities has a minor or negligible impact.
– Vibration from construction activities will not have a significant impact.
– Noise from construction traffic along the defined haul route will not have a significant impact overall.
– No significant residual impact from noise and vibration is expected when proposed mitigation measures are implemented.

A minor adverse noise effect occurs with the Energy Recovery Facility's steam purging event during commissioning, which happens the first time the plant puts forth energy when it comes online. A one-time event during its lifecycle, this steam purge process is intended to "shock" and remove all internal piping corrosion and scale deposits between the boiler and steam turbine inlet. This event occurs during the day and is not representative of the long-term noise from the Facility.

4.8 Traffic and transport

The project team completed a Traffic Statement as part of the Environmental Impact Assessment process to assess the likely impacts of the ISWMS development on the surrounding road network. The Traffic Statement sets out the existing situation, presenting the proposed development and determining what impact, if any, the ISWMS Site-generated traffic will have on the surrounding road network.

The proposed ISWMS Site is located at the north end of Seymour Road in the Industrial Park area of George Town. The Site is accessible only via Seymour Road.

The Study Area for this impact assessment consists of an area stretching from the north end of Seymour Road at the entrance to the Site, south along Seymour Road, and encompasses the intersection of Seymour Road with North Sound Road. The Study Area also extends east to the intersection of North Sound Road and Dorcy Drive and west to the approach to the 'Bank of Butterfield' roundabout, where North Sound Road intersects with the Esterley Tibbetts Highway and Godfrey Nixon Way.

Figure 4.7 Study Area Location Plan Showing Existing Road Network

4.8.1 Baseline conditions and existing traffic volumes

Data on the existing traffic flows on the surrounding road network within the Study Area was gathered via automatic traffic counters and counts of turning movements. Existing traffic data was also provided, mainly from a 2017 island-wide traffic count study. Such traffic flow data analysed three main intersections on the surrounding road network individually showing the resulting level of congestion for each approach/lane of each intersection during both the morning and evening peak periods.

The results showed that peak traffic flows associated with the existing George Town Landfill occur mostly outside the peak traffic periods of the surrounding intersections/roads. The North Sound Road network in the vicinity of the proposed ISWMS Site is currently operating beyond capacity, with much of North Sound Road and approaches to the Bank of Butterfield roundabout experiencing a high level of congestion.

A detailed assessment of the traffic- and road-related aspects of the proposed development was undertaken, including expected trip generations due to the ISWMS. A capacity assessment was provided for the three intersections within the Study Area that could be impacted by the proposed development and future traffic flows within the Study Area were calculated. Impacts to the Study Area's road network during the ISWMS's construction are also reported.

4.8.2 Impacts and effects

The major assumptions that underpin the findings of the Traffic Statement include:

- ISWMS Site operations are expected to be similar to the existing George Town Landfill operations, with a slight increase in staff.
- Trip generation by the ISWMS is expected to be in line with the trips currently generated by the landfill.
- Trip distribution to and from the ISWMS is expected to be similar to existing trip distribution at the landfill.

The major findings of the Traffic Statement include:

- Peak traffic flows associated with the landfill occur mostly outside the peak traffic periods of the surrounding intersections and roads. Any temporary fluctuations in traffic flow at the landfill's or ISWMS's entrance will not impact peak hour operation of the rest of the road network.
- The North Sound Road network, in the vicinity of the proposed ISWMS Site, is currently operating beyond capacity, with much of North Sound Road and the approaches to the Bank of Butterfield roundabout experiencing a forced, or breakdown flow level of service.
- The intersections within the Study Area will experience a further deterioration in service in the future due to projected traffic growth for Grand Cayman.
- The opening of the ISWMS is not expected to have a direct impact on the surrounding road network, as traffic associated with the Site will be in line with existing traffic flows associated with the landfill.
- The construction of the ISWMS will cause some minor impacts on the surrounding road network during peak periods.
- Construction delivery traffic will cause a very low impact on the surrounding road network.

The impact assessment for traffic and transportation within the Study Area concludes that the impacts are expected to be negligible to moderate, and therefore not considered to be significant.

4.9 Socio-economics

The activities proposed during the construction and operation of the ISWMS may affect people's way of life, their community, economic activity, and culture. For example, there may be increased traffic and noise during the construction and operation of the Project, but there may also be job opportunities and benefits to local businesses (i.e., business supply needs, food).

4.9.1 Baseline data and existing environment

A baseline of the existing social and economic conditions was established for the local (District of George Town) and regional (Cayman Islands) Study Area. Existing conditions were determined through a review of:

- Local population census data
- Government planning documents
- International financial institutions' statistics
- Non-governmental organizations (NGOs) and industry reports
- Other assessment reports prepared for projects in proximity to the Study Area
- GIS mapping
- Information gathered through consultation with stakeholders (i.e., government, interested companies)

The main elements of the socio-economic investigation include the following demographic profile information:

- Demographic profile
- Employment and economy
- Education
- Housing and accommodation
- Natural environment
- Community health and wellbeing
- Access and connectivity
- Access to services and infrastructure

Specific examples of these elements are population, age and sex profile, labor force, police and fire service, cultural diversity, health, and income.

Key findings of research include considerable population growth over the last decade, a high foreign labor force and migrant population, and the construction industry holding the largest employing industry in the Cayman Islands making up over 15 percent of the total labor force.

4.9.2 Impacts and effects

Construction

The key potential positive socio-economic impacts to occur during construction are primarily related to an increase in employment opportunities for Cayman residents, procurement opportunities for businesses to supply goods and services, and a minor increase in revenue for local businesses due to construction workers purchasing meals and other services.

The potential temporary negative socio-economic impacts that may occur during construction are:

- A reduced sense of desirability or pleasantness (amenity) for some residents, businesses and community facilities in close proximity to construction activities.
- Minor disruptions to traffic conditions, resulting in delays and the potential for increased travel times for people travelling in the local and regional area, including local community members and regional road users.

Operation

The key socio-economic benefits of the Project during operation are primarily related to the regional economic benefits associated with the development of a new, technologically advanced method of dealing with solid waste, industry and the diversification of the economy. In particular, the Project has the potential for capacity building and upskilling of the existing workforce and provides opportunities for new business generation to support its operations in Cayman as ERF technology is a new industry for the region.

Additionally, due to the nature of the Facility, involving the production of green energy, the recovery and reusing of materials and the overall improvements to current waste management practices in Cayman, residents may experience a sense of community pride associated with the contribution to the circular economy. This may in turn support the tourism industry to achieve its aspirations for sustainable and eco-tourism practices as a large waste contributor on the Island.

The key negative socio-economic impacts during operation are related to the perception of health and safety risk associated with the operation of the Project and potential changes to local amenity for some residents and businesses in close proximity to the ISWMS Site due to changes in air quality, noise and visual amenity.

The socio-economic opportunities and impacts identified and assessed in this report would be managed and mitigated, and opportunities enhanced through a range of recommended measures, which include preparation and implementation of the following plans:

– Employment and skills plan
– Consultation framework
– Community Liaison Plan
– Enquires and complaints plan
– Procurement plan

4.10 Cumulative effects

Two types of assessments for cumulative effects were considered in the Environmental Impact Assessment: inter-project effects and inter-related effects.

4.10.1 Inter-project effects

For each environmental topic considered in the Environmental Impact Assessment, an evaluation was undertaken for how environmental effects resulting from the proposed ISWMS development could combine with similar effects that would be generated by other committed or proposed developments. No significant cumulative effects were identified in relation to the ISWMS development and other committed or proposed developments.

4.10.2 Inter-related effects

The assessment of inter-related effects considers whether any effects from an individual environmental topic that result from the proposed development could combine to create effects that are greater than the sum of these individual effects on a given receptor. No significant inter-related cumulative effects were identified for the ISWMS Project.

5. Stakeholder consultation

The ISWMS Project is a public-focused Project that will allow residents of the Cayman Islands to engage with solid waste management in new and innovative ways for many years to come. To be successful, implementation of the ISWMS requires a commitment to open dialogue and a communications campaign that reaches multiple stakeholders.

This commitment has been demonstrated by the community engagement work undertaken by the Cayman Islands Government before beginning the Environmental Impact Assessment. This work established the ISWMS's core policies and helped ensure an early dialogue around the need for non-landfill-based waste management solutions.

5.1.1 Communications

As part of its communications strategy, the proponent has developed a public-facing website, (regen.ky) that outlines a description of the Project, associated visuals, facilities, local impacts, energy recovery and recycling processes, and frequently asked questions. Users and interested parties can subscribe to an e-newsletter to receive project updates as they occur and follow ReGen's social media accounts, including:

– Facebook: https://www.facebook.com/regencayman
– Instagram: https://www.instagram.com/regen_cayman/
– Twitter: https://twitter.com/regencayman
– LinkedIn: https://www.linkedin.com/company/regencayman/
– YouTube: https://www.youtube.com/@regencayman9032

The overall communication strategy aims to provide effective communication channels, enable information to be circulated, allow for informal and formal discussion, and to provide a mechanism for service improvement, dispute resolution, communication, and education.

5.1.2 Public consultation

There are two points of mandatory public consultation that occur during an Environmental Impact Assessment:

– A review and comment period for the Draft Terms of Reference
– A review and comment period for the Draft Environmental Statement

A total of nine comments were received from members of the public during the Terms of Reference public consultation process.

Consultation on the Environmental Statement will be undertaken when the Draft Environmental Statement is completed in order to consider representations, valid views and concerns from the public and key stakeholder groups. This consultation will include, at a minimum:

– The publication of the Draft Environmental Statement or a link to the statement on the Department of Environment's website for a period of 21 consecutive days.
– Notification of the publication of the Draft Environmental Statement, and a public meeting in the local press on two separate occasions within 10 days before the statement's publication.
– Public meetings at John Gray Memorial Hall (West Bay), Harquail Theatre (George Town), and Mary Miller Hall, (George Town East) to present the Draft Environmental Statement. Meetings will be held at least seven days prior to the end of the consultation period.

The proponent will respond to, and address, representations received during consultation on the Draft Environmental Statement. These representations and responses will be appended to the Final Environmental Statement.

Glossary of Terms

AADT	Annual Average Daily Traffic
AAMP	Ambient Air Monitoring Program
ACI	American Concrete Institute
AGL	Above ground level
AISC	American Institute of Steel Construction
AMSL	Above Mean Sea Level
ANSI	American National Standards Institute
APC	Air Pollution Control
APCR	Air Pollution Control Residues
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AT	Ambient Temperature
ATEX	ATmosphere EXplosible
ATT	Advanced Thermal Treatment
AWS	American Welding Society
BA	Bottom Ash
BA Processing	Bottom Ash Processing
BAM	Beta Attenuation Monitoring
BAP	Biodiversity Action Plan
BAT	Best Available Techniques
BCU	Building Control Unit
BFE	Base Flood Elevation
BMP	Best management practices
BNL	Basic Noise Level
BOB	Bank of Butterfield roundabout
BOD	Biological Oxygen Demand
Bonn Convention	Convention on the Conservation of Migratory Species of Wild Animals
BS	British Standard
BS EN	British Standard European Norm
BSI	British Standards Institution
BWMC	Ballast Water Management Convention
CBD	Convention on Biological Diversity
CCA	Chromated Copper Arsenate
CCTL	Containment Cleanup Target Levels

CCTV	Closed Circuit Television
C&D	Construction and Demolition
CEM	Continuous Emissions Monitoring
CEMP	Construction Environmental Management Plan
CEN	European Committee for Standardization
CIEEM	Chartered Institute of Ecology and Environmental Management
CIFS	Cayman Islands Fire Service
CIG	Cayman Islands Government
CIS	Cayman International School
CITA	Cayman Islands Tourism Association
CLP	Community Liaison Plan
CMCs	Controlled modulus columns
COs	Conservation Objectives
COD	Chemical Oxygen Demand
CoPCs	Chemicals of Potential Concerns
CPA	Central Planning Authority
CPI	Consumer Price Index
CRSI	Concrete Reinforcing Steel Institute
CRTN	UK Calculation of Road Traffic Noise
CSM	Conceptual Site Model
CTMP	Construction Traffic Management Plan
CUC	Caribbean Utilities Company
CV	Calorific Value
DCP	Development Control Plan
DD	Dorcy Drive
DEH	Department of Environmental Health
DFE	Design Flood Elevation
DIN	Deutsches Institut für Normung
DMRB	UK's Highways Agency Design Manual for Roads and Bridges
DMR	Dry Mixed Recyclables
DoE	Department of Environment
DSM	Digital Surface Model
DTM	Digital Terrain Model
EA	UK Environment Agency
EAB	Environmental Assessment Board
EC	European Commission
EcIS	Ecological Impact Assessment

EHS	Environmental, Health & Safety
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
ELV	End of Life Vehicle
EMP	Environmental Management Plan
EN	European Norm
ERF	Energy Recovery Facility
ERT	Electrical Resistivity Tomography
ES	Environmental Statement
ESA	Endangered Species Act
ESO	Economics and Statistics Office
EU	European Union
EWC	European Waste Catalogue
FAC	Florida Administrative Code
FDOT	Florida Department of Transportation
FEM	Federal Equivalent Method
FEMA	US Federal Emergency Management Agency
FFR	Framework for Fiscal Responsibility
FGT	Flue Gas Treatment
FHWA	The United States Department of Transportation, Federal Highway Administration
FRM	Federal Reference Method
FTE	Full-Time Equivalent
GAC	Generic Assessment Criteria
gCSM	Gas Conceptual Site Model
GDP	Gross Domestic Product
GHD	GHD Pty Ltd
GHG	Greenhouse Gas
GIS	Geographic Information System
GLCC	Global Land Cover Characterization
GLVIA	Guidelines for Landscape and Visual Impact Assessment
GTLF	George Town Landfill Site
GVW	Gross Vehicle Weight
GWDTEs	Groundwater-dependent terrestrial ecosystems
Hazardous	Something that poses a danger
HAP	Habitat Action Plan
HGV	Heavy Goods Vehicle
HI	Heavy Industrial

HIFA	Hurricane Ivan Fill Area
HSA	Health Services Authority
HVAC	Heating, Ventilation, and Air Conditioning
HWRC	Household Waste Recycling Centre
IBC	International Building Code
ICC	International Code Council
IEC	International Electrotechnical Commission
IED	Industrial Emissions Directive
IEMA	Institute of Environmental Management and Assessment
IMO	International Maritime Organization
IAQM	Institute of Air Quality Management
ISO	International Organization for Standardization
ISRI	Institute of Scrap Recycling Industries
ISWMS	Integrated Solid Waste Management System
IUCN red list	International Union for the Conservation of Nature Red List of Threatened Species
Km	Kilometre
KPI	Key Performance Indicators (including those derived in the Operating sub-Contracts)
kW	Kilowatt
kWh	Kilowatt Hour
Landscape	All aspects of a tract of land, including landform, vegetation, buildings, villages, towns, cities and infrastructure.
Landscape character	The combined quality of built, natural and cultural aspects which make up an area and provide its unique sense of place.
Landscape character zone	An area of landscape with similar properties or strongly defined spatial qualities, distinct from areas immediately nearby.
LBS	Land Based Sources of Marine Pollution
LCRM	Land Contamination Risk Management
LCZ	Landscape character zone
LEP	Local Environmental Plan
LFG	Landfill Gas
LGA	Local Government Areaha
LHV	Lower Heating Value
LOAEL	Lowest Observable Adverse Effect Level
LoD	Limit of Detection
LOS	Level of Service
LSA	Local Study Area

LT	Long-Term
LVIA	Landscape and Visual Impact Assessment
m	Metre
MAGICC	Model for the Assessment of Greenhouse-gas Induced Climate Change
MARPOL	International Convention for the Prevention of Pollution from Ships
MBMA	Metal Building Manufacturer's Association
MCR	Maximum Continuous Rate
MEPC	Marine Environment Protection Committee
MLE	Maximum Likelihood Estimator
MMIF	Mesoscale Model Interface Program
MMPA	Marine Mammal Protection Act
MRCU	Mosquito Research & Control Unit
MRF	Material Recycling Facility
MT	Medium-Term
MW	Megawatt
MWI	Medical Waste Incinerator
MW*th*	Megawatt Thermal
NA	Not Applicable
NBAP	National Biodiversity Action Plan
NCC	National Conservation Council
NCL	National Conservation Law
NCMA	National Concrete Masonry Association
NCMPR	National Conservation Marine Parks Regulations
NEC	National Electrical Code
NEP	National Energy Policy
NFPA	National Fire Protection Association
NGO	Non-governmental organization
NMVOCs	Non-methane volatile organic compounds
NO*x*	Oxides of Nitrogen
NR	Not Reversible
NRA	National Roads Authority
NRCS	The United States Department of Natural Resources Conservation Service
NSR	Noise Sensitive Receptors
NSR	North Sound Road
NSWMP	National Solid Waste Management Policy
NTP	National Tourism Plan
NTS	Non-Technical Summary

OBC	Outline Business Case
OBHs	Observation Boreholes
OEM	Original Equipment Manufacturer
OfReg	Utility Regulation and Competition Office
OHWSA	Oil and Hazardous Waste Storage Area
'Old Landfill'	Previous GTLF landfilling area before ReGen development
O&M	Operations and Maintenance
OSA	Outside Study Area
OSHA	Occupational Health and Safety Administration (US)
OSTSA	Old Scrap and Tyre Stockpile Area
PAHs	Polyaromatic Hydrocarbons
PAMS	Pamphlets
PAS	Publicly Available Specification
PCBs	Polychlorinated biphenyls
PET	Polyethylene Terephthalate
POI	Point of impact
PPA	Power Purchase Agreement
PPE	Personal Protection Equipment
PR	Partially Reversible
PRIME	Plume Rise Model Enhancements
PSD	Passive sampling devices
QA	Quality Assurance
QEMS	Quality and Environmental Management System
QSHE	Quality, Health, Safety, and Environment
Ramsar Convention	Convention on Wetlands of International Importance especially as Waterfowl Habitat
RCICP	Royal Cayman Islands Police Force
RCRA	Resource Conservation and Recovery Act
RH	Relative humidity
RSA	Regional Study Area
RWL	Residual Waste Landfill
SAPs	Species Action Plans
SCZ	Seascape character zone
Seascape character	An area of land, coastline, and sea whose combined interactions define an area
SCTLD	Stony coral tissue loss disease
Seascape character zone	A specific locality compromising defined attributes and characteristics distinct from neighbouring areas.

SDI	Steel Doors Institute
SEIA	Socio-Economic Impact Assessment
SLM	Sound Level Meters
SMACNA	Sheet Metal and Air Conditioning Contractor's National Association
SOC	Strategic Outline Case
SPAW	Specially Protected Areas and Wildlife
SPT	Standard Penetration Test
SR	Seymour Road
SRTM	Shuttle Radar Topography Mission
SSA	Site Study Area
ST	Short-Term
SWMP	Site Waste Management Plan
SWM Plan	Stormwater Management Plan
TCLP	Toxicity Characteristic Leaching Procedure
TDM	Travel Demand Model
TDS	Total Dissolved Solids
TOC	Total Organic Carbon
ToR	Terms of Reference
TS	Traffic Statement
TUV	Technical Uberwachus Verien
UNCLOS	United Nations Convention on the Law of the Sea
USEPA	United States Environmental Protection Agency
UV	Ultra Violet
VC	Valued Component
VER	Virtual Engagement Room
VES	Valley Environmental Services
View	The sight or prospect of a landscape or scene.
Viewpoint	The point from which a view is observed that represents a visual receiver.
Viewshed	The area within which a project can be seen at eye level above ground. Its extent will usually be defined by a combination of landform, vegetation and built elements.
Visual impact	The impact on the views from residences, workplaces and public places.
Visual receiver	A selected location of view representing a visual receiver.
VOC	Volatile Organic Compounds
WAC	Water Authority Cayman
WAP	Waste Acceptance Protocol
WB	Wheel Base
WCS	Waste Collection Service

WD	Wind direction
WEEE	Waste Electrical and Electronic Equipment
Weighbridge	A scale system with the capacity to weigh vehicles and heavy trucks/machinery
WFD	European Water Framework Directive
WHO	World Health Organization
WMF	Waste Management Facility
WRF	Weather Research and Forecasting
WS	Wind speed
WTF	Water Treatment Facility
WWTP	Wastewater Treatment Plant
ZoI	Zone of Influence
ZTV	Zone of Theoretical Visibility - A map, usually digitally produced, showing areas of land within which a development is theoretically visible.
3D	Three dimensional

1. Introduction

1.1 Overview of the proposed development

This Environmental Statement (ES) has been prepared collaboratively with ReGen and the Cayman Islands Government (CIG) and its respective consultants and relates to the development of an Integrated Solid Waste Management System (ISWMS) for the Cayman Islands (the 'Proposed Development'). The proposed ISWMS is a multi-facility development, including an energy recovery facility (ERF) and supporting non-ERF waste processing, treatment and disposal facilities. Construction and operation of the ISWMS would allow the existing landfills in George Town, Cayman Brac and Little Cayman to be closed and remediated.

1.2 The Proponent

This ES has been prepared collaboratively with ReGen, CIG, and its respective consultants on behalf of the Dart Consortium, which is hereafter referred to as 'the Proponent'. It is anticipated that a special purpose vehicle (SPV) will be established, with Waste Solutions Cayman Ltd. being the legal entity, once financial close is achieved. ReGen is the collaborative organization for the new energy recovery and recycling facilities that form the CIG's ISWMS designed to deliver sustainable waste management and promote the international waste hierarchy (reduce, reuse, recycle, recover, dispose).

1.3 Purpose and context of this Environmental Statement

This ES reports on the findings of the Environmental Impact Assessment (EIA) undertaken for the Proposed Development in accordance with the approved Final Terms of Reference (ToR)[1].

The central aim of an EIA, as defined by the Institute of Environmental Management & Assessment (IEMA), is to *assess and evaluate the impacts of policies, projects, processes and products, to better inform decisions, and facilitate management and mitigation activities, prior to approval*[2].

The legislative framework for EIA for the Cayman Islands is set out by the *Directive for Environmental Impact Assessments Section 43, National Conservation Act (Extraordinary Gazette No. 50/2016, June 29, 2016)* issued in accordance with *Sections 3(12)(j) and 43(2)(c) of The National Conservation Act (Supplement No. 1, Extraordinary Gazette*, February 5, 2014). Collectively, this is referred to as 'the EIA Directive'. The flow chart below (**Figure 1.1**), provided in the EIA Directive, outlines the EIA process for the Cayman Islands. As illustrated in the process flow chart, preparation of the draft ES is the initial stage of Step 5 of the EIA process, following on from Step 1: initiation of the proposal/project; Step 2: screening of the project/proposal; Step 3: scoping of the proposal/project, including preparation of and consultation on a draft ToR; and Step 4: conducting the EIA.

1 Wood Environment & Infrastructure Solutions UK Limited. *Integrated Solid Waste Management System for the Cayman Islands: Environmental Impact Assessment – Final Terms of Reference*. October 2021.

2 Institute of Environmental Management & Assessment (IEMA). *Impact Assessment*. 2023. https://www.iema.net/impact-assessment

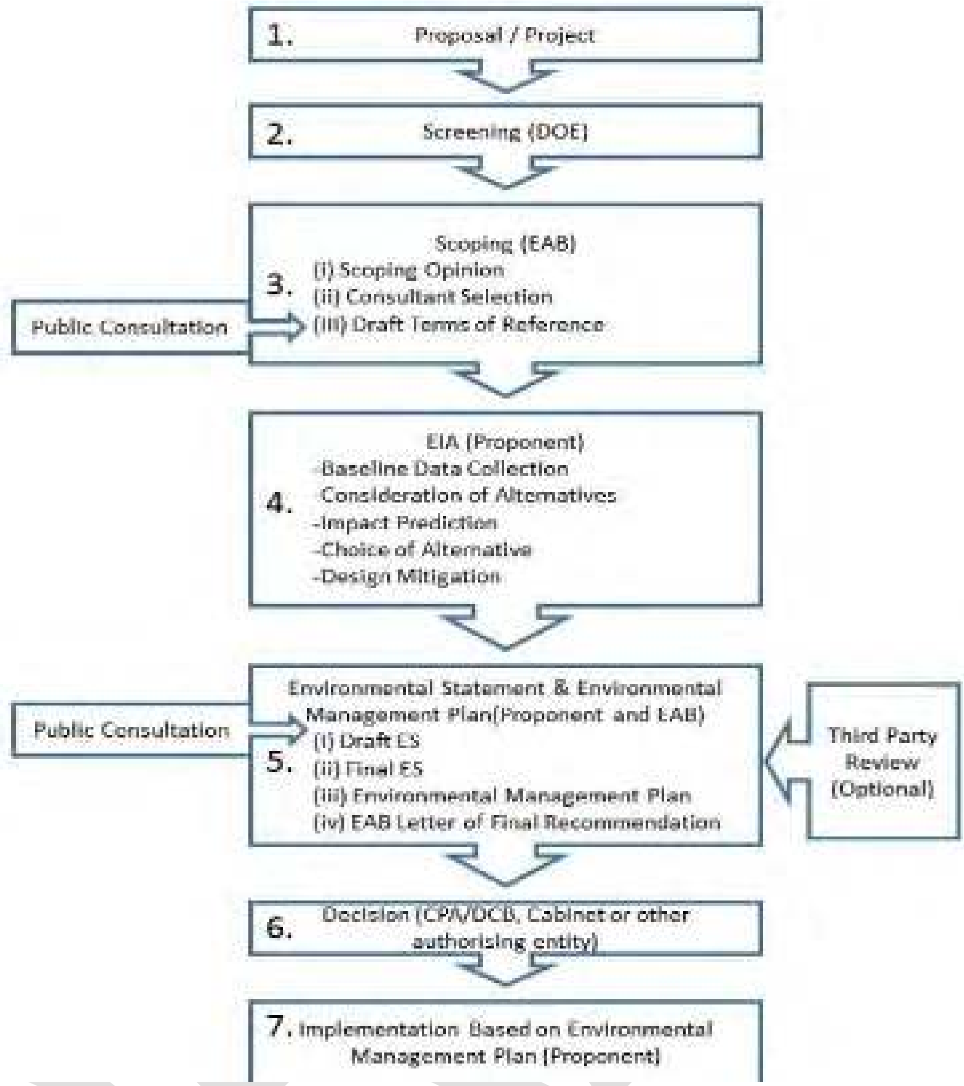

Figure 1.1 EIA process for the Cayman Islands[3]

As required by the EIA Directive, the Draft ES will be subject to public consultation which, as a minimum, will comprise the following:

- Publication of the draft ES or a link thereto on the Department of Environment's website for a period of 21 consecutive days.
- Notification of the publication and public meeting in the local press on two separate occasions, within 10 days prior to the publication of the draft ES.
- A public meeting at a venue to be agreed with the EAB to present the draft ES. The meeting shall be held at least 7 days prior to the end of the consultation period.

The Draft ES will be updated following public consultation to take into account the feedback received during the consultation process.

[3] Cayman Islands Government. *Directive for Environmental Impact Assessments, Section 43, National Conservation Act (Extraordinary Gazette No. 50/2016.* June 29, 2016.

Per the ToR, there are two specific elements of the overall solution which sit outside the EIA process, but which remain an integral part of the overall ISWMS. These are:

– The associated developments on the sister islands (Cayman Brac and Little Cayman).
– Some smaller components of the wider scheme on Grand Cayman, for which separate planning consent will be sought, such that these elements can be delivered in advance of the larger parts of the overall scheme. These include site weighbridges, Materials Recycling Facility, Household Waste Recycling Centre, and ancillary facilities (admin building, maintenance building, and CUC substation).

Further discussion and details of these parts of the ISWMS are set out in Chapter 4 of this ES.

1.4 Approach to EIA

This ES has been prepared in accordance with applicable EIA legislation, specific policies around the environment and waste management and the approved Final ISWMS ToR. Further detail on policy context and legislation is provided in Chapter 2 of this ES. The ToR identified the people and environmental resources (collectively known as 'receptors') that could be affected by the Proposed Development as well as the work required to take forward the assessment of these potentially significant effects in the EIA. Methodology and assessment of the potentially significant effects identified in the ToR is presented within the applicable environmental topic chapters of this ES (Chapters 6 through 14). Both the ToR and the EIA have been informed by the simple rule that, to be significant, an effect must be of sufficient importance that it should influence the process of decision-making about whether or not consent should be granted for the Proposed Development or an element of it. In this ES, this is referred to as the 'significance test'. The conclusion that is made using the significance test is based upon professional judgement, with reference to the project description, and available information about:

– The magnitude and other characteristics of the potential changes that are expected to be caused by the Proposed Development.
– The sensitivity of receptors to these changes.
– The effects of these changes on relevant receptors; and (where relevant).
– The value of receptors.

1.5 Overview of assessment methodology

1.5.1 Identification of baseline conditions

As the various elements of the ISWMS project will be built over a period of three years, starting in 2024, and then operated for a minimum period of 25 years, it cannot be assumed that the baseline conditions in the absence of the project would be the same as the current baseline.

To determine the baseline conditions that should be used for the assessment of the potential likely significant effects of the proposed development, it is necessary to define the current baseline conditions and then to decide whether these conditions are likely to change by the 'assessment years' that are selected for the construction, operation or, where appropriate, the decommissioning of the proposed development. If this future baseline is more likely to occur than the current baseline, the future baseline should be used for the assessment of likely significant effects. However, in many cases it will be concluded that the current baseline is just as likely, or even more likely to occur in the assessment years than would be the case with any future baseline conditions. In this case, the current baseline will be used for the assessment.

The current baseline should be determined for each environmental topic by a combination of desk-based research, including consultation with the relevant stakeholders, together with field survey work, in order to identify the current baseline conditions within the 'study area' that is relevant to each environmental topic or to each receptor within a given environmental topic.

In its simplest form, the study area is likely to comprise the area of land required for the development. However, it may also include land outside the proposed boundary of the site, especially where the effects of the proposed development are likely to extend beyond such geographical limits to reflect the 'zone of influence' where the proposed development could affect off-site areas.

1.5.2 Overview to approach to significance evaluation methodology

One of the requirements of an ES is to set out the conclusions that have been reached about the likely significant environmental effects resulting from the proposed development. Reaching a conclusion about which effects, if any, are likely to be significant is the culmination of an iterative process that involves the following stages:

– Identifying those effects that could be likely to be significant
– Assessing the effects of the proposed development against the baseline (current or future, as appropriate)
– Concluding whether or not these resultant effects are likely to be significant

1.5.2.1 Mitigation

The assessment of the significance of effects for each technical topic will take into account any inherent mitigation to the proposed ISWMS (i.e., features which form an integral part of the proposed ISWMS, e.g. appropriate lining in the Residual Waste Landfill, etc.). Additional mitigation measures which are required to avoid, reduce or remedy significant adverse effects will be listed and detailed (e.g., a Stormwater Management Plan). The residual effects which remain significant after the implementation of additional mitigation measures will be identified. It may be that there are no additional mitigation measures required, or that there are no residual effects after mitigation measures are applied.

1.5.2.2 Significance evaluation

The receptors that could be significantly affected, and therefore taken forward for further detailed assessment, are identified within each topic section. The proposed approach to determine whether the effects on these receptors are significant is to apply a combination of professional judgement and a topic-specific significance evaluation methodology that will draw on the results of the assessment work to be carried out.

In applying this approach to significance evaluation, it will be necessary to ensure that there is consistency between each environmental topic in the level at which effects are considered to be significant. Thus, it is inappropriate for the assessment of one topic to conclude that minor effects are significant, when, for another topic, only comparatively major effects are significant.

In order to achieve the desired level of consistency, the specialist responsible for writing each of the technical chapters should consider the 'significance test' to inform their decision on whether effects are likely to be significant or not, as well as the relevant topic-specific significance evaluation methodology.

The conclusion about significance should be arrived at using professional judgement, with reference to the project description, and available information about the magnitude and other characteristics of the potential changes that are expected to be caused by the proposed development, receptors' sensitivity to these changes and the effects of these changes on relevant receptors.

Having applied the relevant topic-specific significance evaluation methodology, the topic specialists should check the conclusions against the significance test. If this test results in a different conclusion to that reached through the use of the significance evaluation methodology, a detailed justification should be provided as to why this different conclusion is valid.

Evaluation matrices

Significance evaluation involves combining information about the sensitivity or value of a receptor, and the magnitude and other characteristics of the changes that affect the receptor. The approach to using this information for significance evaluation is outlined below.

Receptor sensitivity of value

The sensitivity or value of a receptor is largely a product of the importance of an asset, as informed by legislation and policy, and as qualified by professional judgement. For example, receptors for landscape, biodiversity or the historic environment may be defined as being of international or national importance. Lower value resources may be designated as being sensitive or important at a county or district level. For each environmental topic, it is necessary to provide a detailed rationale that explains the categories of value/sensitivity have been used and how these have been defined.

The use of a receptor will also play a part in its classification. For example, when considering effects on the amenity of a human population, a receptor used for recreational purposes may be valued more than a place of work as the environmental quality of the recreational receptor is more likely to be an important part of that receptor's use.

Magnitude of change

The magnitude of change affecting a receptor that would result from the development proposals will be identified on a scale from minor alterations or change, up to major changes or the total or substantial loss of the receptor. As with receptor sensitivity and value, a detailed rationale should be provided that explains how the categories of environmental change are defined. For certain topics, the magnitude of change will be related to guidance on levels of acceptability (e.g. for air quality or noise), and be based on numerical parameters, whilst for others it will be a matter of professional judgement to determine the magnitude of change, using descriptive terminology.

Determination of significance

The determination of significance is derived with reference to information about the nature of the development, the receptors that could be significantly affected and their sensitivity or value, together with the magnitudes of change that are likely to occur.

Other than for environmental topics for which significance evaluation does not involve the use of matrices, sensitivity/value and the characteristics of environmental changes can be combined using a matrix (see Table 1.1). In addition, professional judgement is applied because, for certain environmental topics, the lines between the sensitivities or magnitudes of change may not be clearly defined and the resulting assessment conclusions may need clarifying.

Variations to this approach, which may be applicable to specific environmental topics, will be detailed in the relevant 'Assessment methodology' sub-section contained in each environmental topic chapter.

Definitions of how the categories that are used in the matrix are derived for each topic are also set out in each environmental topic chapter, along with the relevant explanation and descriptions of receptor sensitivity, magnitude of change and levels of effect that are considered significant in terms of the EIA Directive.

Within the matrix that is used in most significance evaluation exercises, reference is made to:

– Major effects, which will always be determined as being significant.
– Moderate effects that are likely to be significant, although there may be circumstances where such effects are considered 'not significant' based on specific scenarios and professional judgement.
– Minor or negligible effects, which will always be determined as 'not significant'.

Table 1.1 Significance evaluation matrix

		Magnitude of change				
		Very high	**High**	**Medium**	**Low**	**Very low**
Sensitivity	**Very high**	Major (Significant)	Major (Significant)	Major (Significant)	Major (Significant)	Moderate (Possibly significant)
	High	Major (Significant)	Major (Significant)	Major (Significant)	Moderate (Possibly significant)	Minor (Not significant)
	Medium	Major (Significant)	Major (Significant)	Moderate (Possibly significant)	Minor (Not significant)	Negligible (Not significant)
	Low	Major (Significant)	Moderate (Possibly significant)	Minor (Not significant)	Negligible (Not significant)	Negligible (Not significant)
	Very low	Moderate (Possibly significant)	Minor (Not significant)	Negligible (Not significant)	Negligible (Not significant)	Negligible (Not significant)

1.6 Structure of the Environmental Statement

The draft ES is structured as follows:

– **Non-Technical Summary** (NTS): summary of the main findings of the EIA.

– **Chapter 1 – Introduction**: provides an overview of the Proposed Development, Proponent, purpose of the ES and context, approach to EIA, and structure of the ES.

– **Chapter 2 – Project need and policy context**: identifies the need for the ISWMS for the Cayman Islands, including consideration of alternative technologies, and describes the legislative and policy context for the Proposed Development.

– **Chapter 3 – Project site, existing facilities and key constraints**: describes the Project Site, surroundings, existing George Town Landfill (GTLF) operations, and key constraints to the Proposed Development.

– **Chapter 4 – Proposed project and overview of concerns**: details all components of the proposed ISWMS and highlights potential risks associated with the Proposed Development.

– **Chapter 5 – Stakeholder engagement and public consultation**: describes the EIA consultation process undertaken for the Proposed Development.

– **Chapters 6 to 14**: environmental topic evaluation methodologies and assessments

- Chapter 6 – Marine Ecology
- Chapter 7 – Terrestrial Ecology
- Chapter 8 – Hydrology and Hydrogeology
- Chapter 9 – Land Quality
- Chapter 10 – Landscape and Visual
- Chapter 11 – Air Quality and Greenhouse Gases Emissions
- Chapter 12 – Noise and Vibration
- Chapter 13 – Traffic and Transport
- Chapter 14 – Socio-Economics

– **Chapter 15 – Summary of Impact Assessmen**t: summarises the environmental topic impact assessment results, provides an assessment of cumulative effects for the Proposed Development, and tabulates the mitigation and monitoring commitments identified in the environmental topic assessments to be carried forward into the Environmental Management Plan (EMP).

– **Technical Appendices**: technical documentation to support the text presented in ES Chapters 1 to 15.

2. Project Need & Policy Context

2.1 Project need

2.1.1 Cayman Islands waste management

Waste disposal operations at the current George Town Landfill (GTLF) started in the early 1970s and the GTLF has since grown to be the primary solid waste management site for Grand Cayman. The GTLF is an unlined 'dilute and disperse' site that has seen sustained and significant organic growth supported by aging and often non-functional plant, equipment and infrastructure.

The available capacity of the existing GTLF has already exceeded its original design capacity with the North West expansion area being created to ensure continuity of waste disposal services. The availability of waste disposal void capacity in the North West expansion area is rapidly reducing due to increased waste volumes generated by the growing population and continued expansion in development. A more detailed description of the existing GTLF Site is provided in Chapter 3 of this ES.

The continued use of non-engineered landfills is considered inconsistent with a modern waste hierarchy based on sustainable waste practices. The challenges facing waste management in the Cayman Islands has been discussed widely in the local community and in social media for a significant period of time.

The Cayman Islands Government (CIG), in response to widespread consensus that the solid waste situation requires urgent attention, initiated the development of an Integrated Solid Waste Management System (ISWMS) to address this problem. The proposed ISWMS will replace the existing non-engineered GTLF and aging infrastructure with modern facilities that reflect waste hierarchy best practices and are consistent with the policies and strategies developed by CIG.

The policy and strategy context are described in Section 2.2. The relevant policies and legislation that are outlined in this section also influence the scope of the Environmental Impact Assessment (EIA).

2.1.2 Overview of site selection & technology

The EIA Directive[1] states that the reasons for choosing a proposed development, taking account of the environmental effects, should be justified in the Environmental Statement (ES)[2] and that the consideration of alternatives (including alternative sites, alternative site layouts, alternative processes and alternative phasing of construction) is good EIA practice[3]. The EIA Directive further states that where no alternative sites were considered, the reason why alternatives were not feasible should, where appropriate, be explained in the ES[4].

The ISWMS EIA did not start at the stage of site and process selection[5], with both the site location and the preferred technology determined during the development of the ISWMS policy and strategy for the Cayman Islands, as described in the subsections below. With this in mind, the evaluation of alternatives was agreed to be scoped out in the ToR (Section 2.2.4 of the approved ToR). Therefore, an evaluation of alternatives is not included as part of the EIA.

In view of the need to develop new recovery facilities and to divert wastes from landfill, it is considered that the 'do-nothing' option is neither a viable nor sustainable one.

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1 National Conservation Council, published in the Cayman Islands Gazette – Extraordinary No. 50/2016. *Directive For Environmental Impact Assessments, Section 43, National Conservation Law*. June 29, 2016.
2 Ibid. *Section 1.4*
3 Ibid. *Section 1.5*
4 Ibid. *Section 1.6*
5 Ibid. *Section 1.5*

2.1.2.1 Alternative technologies

The CIG carried out a review of various technologies capable of processing residual municipal waste and concluded that a solution that includes Energy from Waste (EFW) as the primary technology, in addition to supporting waste reduction and management measures as described in Section 2.2.1, best meets the Island's requirements for a long-term, sustainable waste solution whilst also delivering approximately 9.4 megawatts (MW) of power into Grand Cayman's grid[6,7]. EFW is a proven solution for the effective treatment of residual waste, with numerous operational facilities in the U.K. and continental Europe; in particular it is a strong solution for the diversion of biodegradable waste from landfill.

Mass Burn is the most common type of EFW technology although others are available, including pyrolysis and gasification (otherwise described as Advanced Thermal Treatment (ATT) plants). These three technology options are all available at the size and scale required for the waste produced by the three Islands and feasible at the chosen Site; however, Mass Burn is by far the most common, with a significant track record of working efficiently and safely internationally to process residual municipal waste. For these reasons, Mass Burn has been selected by CIG as the preferred EFW technology for the proposed ISWMS.

2.2 Policy context

2.2.1 Waste management policy and ISWMS development history

The Cabinet of CIG issued a policy directive on 6th December 2013 for the development of an ISWMS for all three islands to address challenges in solid waste management. A Strategic Outline Case (SOC) that described the background information and situational analysis was published by CIG in 2014 as a first step in the process[8]. The SOC informed stakeholders of relevant facts and the strategic context of the proposed investment in concordance with the Framework for Fiscal Responsibility (FFR) process. The FFR was signed by CIG and the Foreign Office UK in 2011 to facilitate an understanding of the impacts of fiscal decisions, ensure effective medium-term planning based on value for money and effective management of risk, and thereby provide accountability in public sector operations.

Following the publication of the SOC, a National Solid Waste Management Policy (NSWMP) was presented in 2015 with an outline of the vision, values, and strategic directions to underpin the future of waste management in the Islands[9]. The NSWMP included an analysis of options that covered waste hierarchy best practices with respect to recycling and reuse and treatment of residual waste. The analysis of options guided the development of a Reference Project that included best practices like waste reduction, recycling and reuse, bulking and transfer facilities, composting and treatment of residual waste using EFW technology in an Energy Recovery Facility (ERF). The Reference Project was compared against the vision, values and strategic directions outlined in the NSWMP and it was noted that an integrated waste management-based Reference Project was compatible with the vision, values and strategic directions set in the NSWMP. The options analysis also provided approximate costs for key elements of the Reference Project.

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6 Cayman Islands Government, prepared by Amec Foster Wheeler Environment & Infrastructure UK Limited. *National Solid Waste Management Strategy for the Cayman Islands*. 2016.

7 Cayman Islands Government, prepared by Amec Foster Wheeler Environment & Infrastructure UK Limited. *Integrated Solid Waste Management System for the Cayman Islands – Outline Business Case*. 2016.

8 Cayman Islands Government. *Strategic Outline Case – Integrated Solid Waste Management System*. 2014.

9 Cayman Islands Government. *National Solid Waste Management Policy for the Cayman Islands*. 2015.

The CIG also formulated a National Solid Waste Management Strategy (NSWMS) in 2016[10] to align efforts and resources towards the achievement of short-, mid- and long-term goals. The NSWMS for the Cayman Islands, an overseas territory of the U.K., was guided by the Waste Framework Directive of the European Commission (Directive 2008/98/EC). The Directive outlines the key elements of the waste management hierarchy, (in decreasing order of importance), as prevent/reduce, reuse, recycle, recover and dispose. The NSWMS is the official plan that guides policy and decision making related to solid waste management over the next 50 years.

As a next step towards a better understanding of ISWMS, an Outline Business Case (OBC) was published in 2016[11]. The OBC is based on the NSWMP and the NSWMS and describes the means through which a sustainable ISWMS could be delivered for the Islands. The OBC analyzed the Reference Project developed in the NSWMP that had a preferential bias on options higher up in the waste hierarchy. The Reference Project consisted of the following elements: waste reduction measures, reuse and refurbishment of bulky waste, Household Waste Recycling Centres, transfer and bulking facilities (one per island), windrow composting and recycling of construction and demolition (C&D) waste. The Reference Project was examined under five business case principles, namely the strategic case, the economic case, the commercial case, the management case and the financial case. A high-level “value for money” analysis was also conducted and various delivery options were presented in the OBC. The OBC also included a fully costed Reference Project that was deliverable, bankable and in line with standards for sustainable waste management.

During the development of the OBC, CIG arrived at a Reference Project following an evaluation of alternatives to the project, including the ’do nothing’ alternative and other methods of solid waste management. Hence, the EIA does not assess alternatives or alternative methods of waste management to those included in the Reference Project. No recent developments that may impact the basis for the strategy have been identified.

In summary, the effort for an ISWMS is driven by recognition that the existing landfill-focused solid waste management regime is not sustainable, poses a potential threat to the environment and local amenity, and does not make best use of potential resources that could benefit the Islands. The continued use of aging, non-engineered and over-capacitated landfills on each of the islands was deemed inconsistent with modern and sustainable waste management practices, as reflected in the waste hierarchy, and conflicts with the NSWMP.

Other policies and legislation that have a bearing on the EIA are outlined below in brief.

2.2.2 Planning policy

The plan for zoning and physical development of the Cayman Islands falls under the purview of Development Plan 1997. The Development Plan 1997 is under review and the Central Planning Authority (CPA) published a draft National Planning Framework for consultation in 2018. The ES considers relevant planning policy as presented in the Development Plan 1997 and takes note of any new policy that emerges from the National Plan review.

10 Cayman Islands Government, prepared by Amec Foster Wheeler Environment & Infrastructure UK Limited. *National Solid Waste Management Strategy for the Cayman Islands*. 2016.

11 Cayman Islands Government, prepared by Amec Foster Wheeler Environment & Infrastructure UK Limited. *Integrated Solid Waste Management System for the Cayman Islands – Outline Business Case*. 2016.

2.2.3 Planning approval

The ISWMS Project Agreement identifies that CIG has secured a planning waiver for the Project in accordance with section 53 of the Development and Planning Act by way of a Cabinet Order published in the edition of the Cayman Gazette dated 11 April 2023. Dart Consortium will carry out the planning requirements in accordance with the ISWMS Project Agreement, which includes the development and submission of a Development Application Pack (DAP) to the scope and standard that would normally be required when making an application for a Project Planning Permission.

2.2.4 Other policy

The ES has been prepared in accordance with the Institute of Environmental Management and Assessment (IEMA) EIA Quality Mark scheme and resources, particularly commitments 4, 5 and 6, as relevant.

2.2.5 Legislative context

The need to carry out an EIA and to report the results in an ES is established by the Directive for Environmental Impact Assessments Section 43, National Conservation Act (Extraordinary Gazette No. 50/2016, June 29, 2016) issued in accordance with Sections 3(12)(j) and 43(2)(c) of The National Conservation Act (Supplement No. 1, Extraordinary Gazette, February 5, 2014).

Specifically, Section 41(3) of The National Conservation Act states:

> *"Every entity shall, in accordance with any guidance notes issued by the Council, consult with Council and take into consideration any views of the Council before taking any action including the grant of any permit or license and the making of any decision or the giving of any undertaking or approval that would or would be likely to have an adverse effect on the environment generally or any natural resource."*

Section 43(1) of The National Conservation Act then goes on to state:

> *"In any consultation pursuant to Section 41(3) or before granting an approval under Section 41(4), the Council may, in its discretion and within such times as it may specify, require an environmental impact assessment to be carried out of the proposed action."*

Further, Section 43(2) stipulates that:

> *"An environmental impact assessment shall –*
>
> *(a) Assess the proposed action having regard to its direct, indirect and cumulative impact and the need to –*
>
> > *(i) protect and improve public health and social and living conditions;*
> > *(ii) preserve natural resources, ecological functions and biological diversity;*
> > *(iii) protect and conserve protected areas and conservation areas;*
> > *(iv) protect and conserve protected, endemic and migratory species and their habitats; and*
> > *(v) avoid any adverse effects of climate change on the quality of the environment;*
>
> *(b) be carried out by a person approved by Council; and*
> *(c) comply with any directives of the Council and regulations made under this [Act]."*

While Section 43(3) stipulates that:

> *"All documents relating to an environmental impact assessment shall be available for public inspection and review."*

The EIA has been prepared with this legislative context in mind, as well as in accordance with the Approved Terms of Reference.

3. Project Site, Existing Facilities & Key Constraints

3.1 Project site

3.1.1 Site description

The proposed Site for the Integrated Solid Waste Management System (ISWMS) is a consolidation of parcels that are either a part of or located in the vicinity of the current George Town Landfill (GTLF), with the new ISWMS operations totaling 30 acres (12.4 hectares (ha)), as shown on Figure 3.1. Henceforth, these parcels are referred to as the ISWMS Site and comprise the on-site study area for the Environmental Impact Assessment (EIA). The parcels that contain the ISWMS Site include:

– Block 13D Parcel 431 (16.78 acres (6.79 ha))
– Parts of Block 13D Parcel 1 and Block 13C Parcel 1 (11.91 acres (4.82 ha))
– North east portion of Block 13D Parcel 287 (0.70 acres (0.28 ha))
– North portion of Block 13C Parcel 1 (0.61 acres (0.25 ha))

Block 13D Parcel 431

This presently undeveloped parcel is located south of GTLF and does not include any infrastructure related to the existing GTLF operations. The majority of this parcel is filled land, with the exception of the southwest corner that is an extension of the off-Site mangrove community.

Block 13D Parcel 431 is zoned Heavy Industrial (HI). This designation includes all of the activities proposed at the ISWMS Site: power generation, solid waste disposal and recycling. The proposed ISWMS activities are consistent with existing zoning designations and activities on the lands surrounding the proposed ISWMS development.

Parts of Block 13D Parcels 1 and 287, Parts of Block 13C Parcel 1

These parcels contain the existing GTLF, with the South Mound being located in Block 13D 287, the North Mound in Block 13C1 and the North West Expansion Area in Block 13D1.

Both the South and North Mound areas are closed, with the older, inactive South Mound having naturally revegetated over time and the newer North Mound currently undergoing capping and restoration. Tipping operations are currently taking place in the North West Expansion Area, which will continue until the ISWMS facilities come on line.

The southern part of Block 13D1 houses a number of other existing waste management operations, as described below, together with the current Department of Environmental Health (DEH) waste operations depot, weighbridge and household waste recycling center (see Figure 3.2). DEH will be demobilizing and vacating to a new location as part of the ISWMS development.

The ISWMS Site is currently accessed via the existing GTLF gatehouse and fence line access point off Seymour Road which can be accessed off North Sound Road.

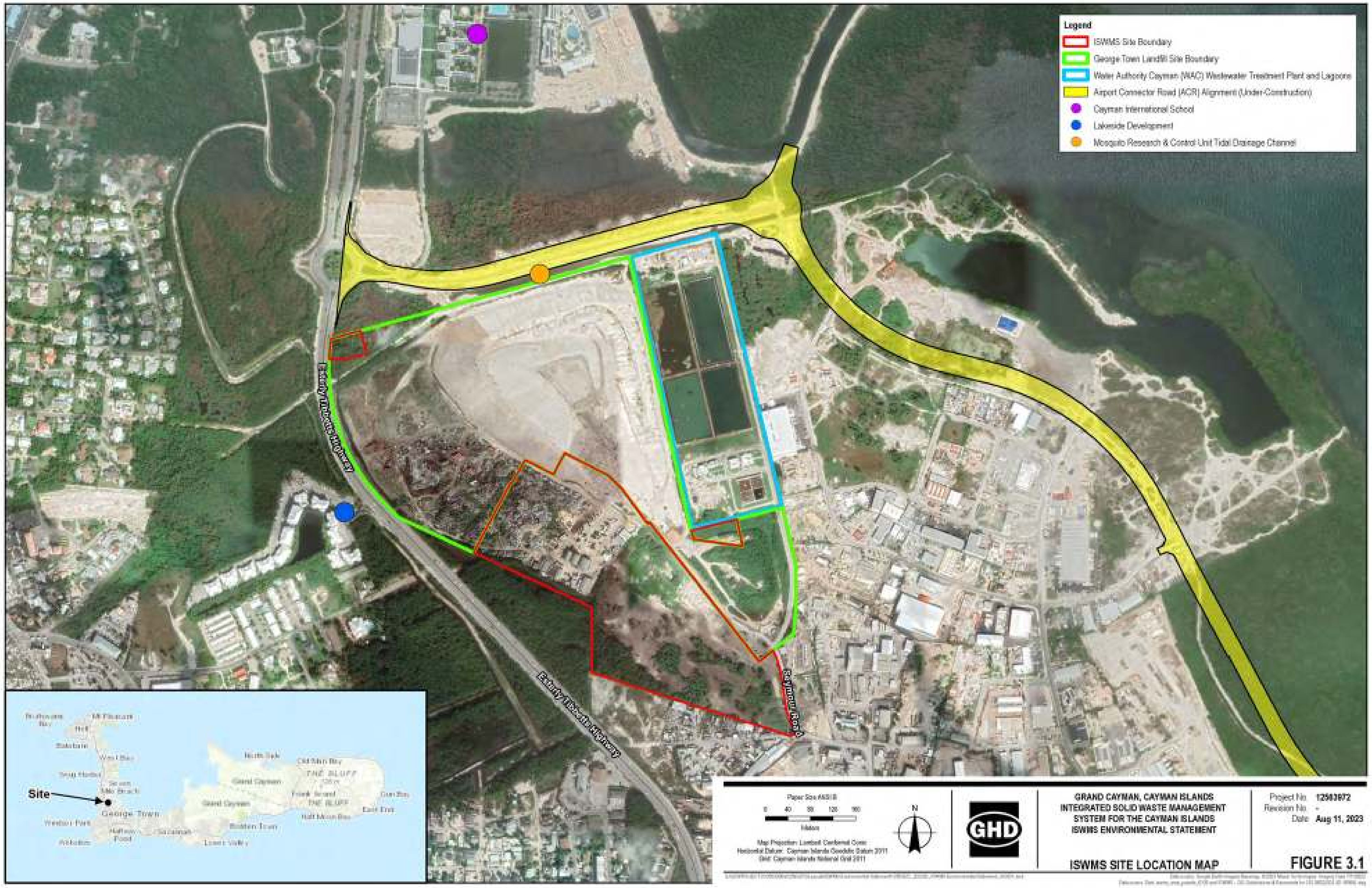


Figure 3.1 ISWMS Site Location Map

3.1.2 Project site surroundings

The land usage surrounding the ISWMS Site is outlined below:

The existing GTLF lies immediately north and east of the proposed ISWMS Site. North of the GTLF is a tidal drainage channel managed by Mosquito Research & Control Unit (MRCU) for mosquito control that connects with North Sound about 0.7 miles (1.23 kilometres (km)) to the east. The area immediately north of the drainage channel is the alignment of the under-construction Airport Connector Road (ACR) and further north lies a swathe of disturbed mangrove area. The under-construction Health City Hospital, Cayman International School and Camana Bay development are located within 0.5 mile (0.8 kilometres) to the north of GTLF.

The land east of the GTLF houses the wastewater treatment plant operated by Water Authority Cayman (WAC). The facility includes Sequential Batch Reactors (SBR) and four large former defunct wastewater treatment lagoons that are used for excess sewage inflow management and sludge storage. South of the lagoons are the current wastewater treatment plant including some buildings and the SBRs. Lands located east of the WAC are zoned for industrial use and include an operational Central Laundry Facility, warehouses, and small industrial units.

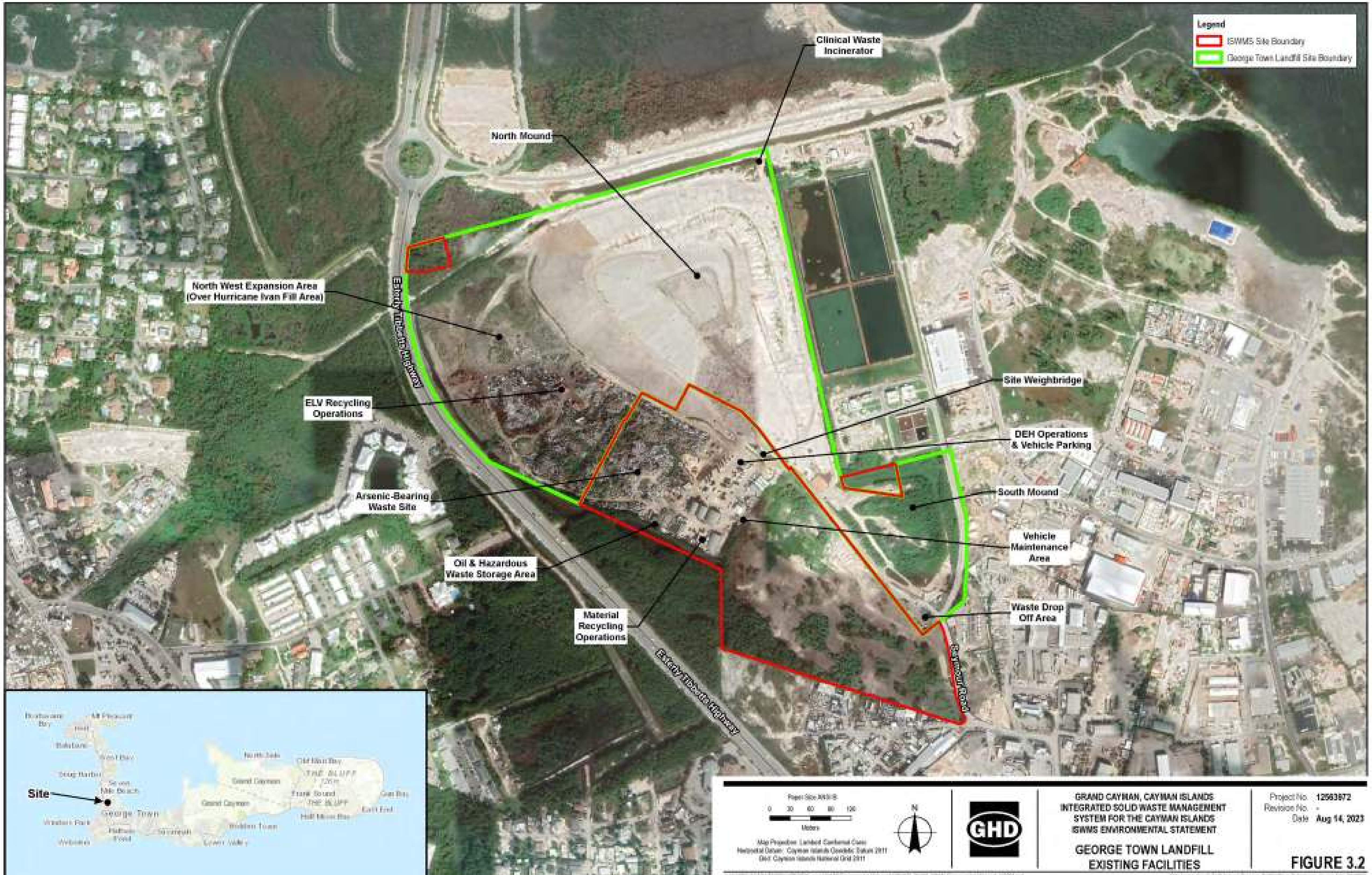
The land south of the proposed ISWMS Site comprises mangroves and cleared land. Further south is industrial and commercial development occupied by a variety of businesses, including a concrete batching plant and a concrete block and paver stone manufacturer.

The Esterly Tibbetts Highway (ETH) lies immediately adjacent to the fence line forming the western boundary of the proposed ISWMS Site. The Lakeside development, composed of 12 three-storey residential apartments with car parking and leisure/landscape areas (including a small lake), is located west of ETH.

3.1.3 Site history

The main operational facilities at the existing GTLF are described below and their locations illustrated on Figure 3.2.

Figure 3.2 George Town Landfill Site Existing Facilities



3.1.3.1 GTLF landfilling operations

The existing GTLF is predominantly a land raise, formed by tipping over an area of former mangrove swamp that was partially excavated to recover the underlying marls (calcareous soils). The existing GTLF has a fully engineered cap and gas management system, but no basal lining system, operating generally on an uncontrolled dilute and disperse basis.

Tipping operations commenced in the mid-1960s, with the waste volume being reduced by burning until 1985. Thereafter, the mode of tipping switched to placing and compacting waste with heavy equipment (with no formal landfill engineering) in 1989, which approach continues to this day.

Waste inputs comprise a combination of residential and commercial waste, with small ad hoc quantities of other materials.

Overall, the existing GTLF comprises three interlinking parts:

– The closed South Mound (approximately 8.0 acres (3.24 ha))
– The closed North Mound (approximately 25.2 acres (10.20 ha))
– The active North West Expansion Area (approximately 11.0 acres (4.45 ha), including approximately 5.7 acres (2.31 ha) of previous pond created by mining for marl and infilled with debris created by Hurricane Ivan in 2004)

The GTLF's official opening hours are 7 am to 5 pm Monday to Friday and 7 am to 3 pm Saturday. The Site also receives minor amounts of other material from external and internal sources on Sundays.

In general, the landfill receives around 200 vehicles per day Monday to Friday, reducing to 140 vehicles per day on Saturdays and 10 vehicles per day on Sundays.

Overall, the GTLF received around 140,050 tons (127,051 tonnes) of waste in 2022, at a rate of between 9,610 and 14,073 tons (8,718 and 12,766 tonnes) of waste per month.

3.1.3.1.1 GTLF landfill capacity

Tipping operations are currently taking place in the North West Expansion Area of the GTLF. Originally planned to occupy an area of approximately 5.7 acres (2.31 ha), delays in the ISWMS project reaching Financial Close mean the footprint of the North West Expansion Area has grown to a current footprint of approximately 8 acres (3 ha) and is expected to reach an area of approximately 11 acres (4 ha) at a height of approximately 75 feet (23 metres) above mean sea level (AMSL) prior to discontinuation of use upon completion of commissioning of the ERF (estimated to be end of 2026).

Figure 3.3 Non-engineered Landfill Tipping Face (looking north)

Remediation of the landfill is not considered in this EIA, but is ongoing and being undertaken in phases under cover of a separate project landfill remediation scheme agreed between ReGen, the Cayman Islands Government (CIG) and the Environmental Assessment Board (EAB).

Figure 3.4 Existing GTLF (looking southeast)

3.1.3.2 Other waste management facilities

In addition to the GTLF's landfilling activities, the GTLF Site houses a number of other current waste management operations as shown in Figure 3.2 and described below.

Figure 3.5 Medical Waste Facility (looking north)

Figure 3.6 Waste Oil Storage (looking southwest)

– Arsenic-Bearing Waste Pit – A lined pit immediately south of the North West Expansion Area containing arsenic-bearing waste material deposited at the site following Hurricane Ivan in 2004.

– Medical Waste Facility – A dual chamber incinerator that was installed in 2005 and is reaching end of life that processes waste collected from medical facilities and assisted living facilities.

– Waste Oil Reception and Storage – The facility collects and consolidates waste oils (cooking and motor) dropped off at GTLF. The consolidated waste oils are then shipped to overseas processing facilities after due testing and shipping protocols.

– End of Life Vehicle (ELV) Facility – The facility depollutes and processes ELV and other metals delivered to the landfill. The ELVs and metals are crushed, baled, containerized, and then shipped to overseas facilities/importers.

- Household Waste Recycling Centre – A public drop-off centre for wastes, such as batteries, green waste, metals, furniture, and electronic wastes.
- Weighbridge – The manned bridge weighs DEH, commercial and public vehicles dropping off wastes at GTLF and maintains records of details recorded during the process.
- Recycling Operations – Fixed and mobile equipment for the processing of green waste and recyclables like metal cans and plastic bottles.

Figure 3.7 DEH Depot (looking southeast)

- Office space for DEH operations (portable buildings) and vehicle parking facilities for the waste collection fleet and staff private vehicles.
- Maintenance workshop for on-site repairs of vehicles, bins, etc.

3.1.4 Existing waste infrastructure impacts

Overall, the ISWMS project considers that the existing infrastructure at GTLF, comprising of non-engineered landfill and aging recycling and recovery facilities, does not meet the solid waste disposal and processing needs of the National Solid Waste Management Strategy[1].

The existing outdated waste management methodology and regime is impacting the environment and residents in the vicinity of GTLF, as demonstrated by the Risk Based Assessment[2] and subsequent Remediation Options Report[3] published in 2021. Some of the more noticeable impacts in the vicinity are odour, visual, source of mosquitoes and other pests and toxic smoke plumes due to landfill fires.

Figure 3.8 20 December 2013 Fire

[1] Cayman Islands Government, prepared by Amec Foster Wheeler Environment & Infrastructure UK Limited. *National Solid Waste Management Strategy for the Cayman Islands.* 2016.
[2] GHD, on behalf of DECCO Consortium. *George Town Landfill Environmental Risk Based Assessment*. 2021.
[3] GHD, on behalf of DECCO Consortium. *Remedial Operations Report.* 2021.

3.1.5 Land transfer

As part of its commitment to the ISWMS project, parcel 13D 431 of the ISWMS Site was purchased by DART in November 2020.

3.2 Key constraints

The ISWMS Site is limited by a number of key constraints that must be acknowledged and managed through the EIA and construction period, including *inter alia* the following:

– The ISWMS Site is geographically constrained, being bounded by the GTLF to the north and east, ETH to the west and developed industrial land to the south. As such, any potential for expansion of the Site area is extremely limited.
– The current GTLF is receiving ever increasing annual quantities of waste. Given the finite amount of space available at the GTLF Site, continuing landfilling operations indefinitely will result in Grand Cayman running out of space for waste management and landfill disposal operations.
– The existing GTLF has suffered a number of major fires in recent years, brought about by the gradual increase in landfilling operations, difficulty sourcing and deploying landfill cover, and resulting increase in the size of the open tipping area. As such, adopting better operating practices in the short term and developing a sustainable alternative solution in the longer term will be required to eliminate these fires and mitigate the corresponding loss of amenity to the surround areas.
– The other existing waste management is aging and reaching the end of its usable life. As such, significant investment will be required to renew or replace this infrastructure in the near future going forward. In addition, alternative locations for these operations will need to be found in future as the GTLF footprint continues to grow.
– The area available for the ISWMS Site is being gradually reduced – including since issuing the Terms of Reference (ToR) for this project – by the continued growth of the expansion of the GTLF. This has already impacted the space available for the ISWMS Site operations, reducing the space available for the Residual Waste Landfill (RWL) and laydown area for the ERF construction, and continues to be a time-sensitive concern with the potential to further impact the northern extents of the ISWMS Site boundary in the event of further project delays.
– The maximum height of the ERF stack is currently limited by the Civil Aviation Authority of the Cayman Islands (CAACI). This constraint will need to be carefully considered when developing the ERF design and evaluating the required stack height.
– The historic arsenic-bearing waste pit is currently located within the footprint of the new RWL. As such, the EIA will need to consider the acceptability of ‘piggybacking’ over this material from an environmental perspective, with the findings being factored into the resulting RWL design.
– The current DEH depot and recycling operations will be required to demobilize and relocate to a new site during the construction phase.
– Site remediation of hydrocarbon contaminated soil and water will be required.
– Access and operation of the GTLF must continue during construction of the ISWMS Site facilities.

4. Proposed Project and Overview of Concerns/Constraints

4.1 Project Description

The proposed Integrated Solid Waste Management System (ISWMS) consists of various new waste management facilities, the majority of which are subject to the Environmental Impact Assessment (EIA) process. The development also includes some smaller elements that would not on their own attract the need for an EIA, but are still considered as part of the overall development in order to assess their 'in combination' effects with the major components of the ISWMS. In this regard, the EIA considers the cumulative effects of all aspects of the ISWMS.

The various components of ISWMS are as follows:

– Energy Recovery Facility (ERF) (subject to EIA)
– Non-Energy Recovery Facilities:
  - Site weighbridges (excluded from the EIA)
  - Green Waste Processing Facility (subject to EIA)
  - Construction and Demolition Waste Processing Facility (subject to EIA)
  - Bottom Ash Processing Facility (subject to EIA)
  - Abandoned and End of Life / Scrap Metal Processing Facility (subject to EIA)
  - Medical Waste Facility (subject to EIA)
  - Materials Recycling Facility (excluded from the EIA)
  - Household Waste Recycling Centre (excluded from the EIA)
  - Landfill Gas Facility (subject to EIA)
  - Residual Waste Landfill (RWL) (subject to EIA)
– Ancillary Facilities:
  - Admin Building (excluded from the EIA)
  - Maintenance Building (excluded from the EIA)
  - CUC Substation (excluded from the EIA)

A general ISWMS Site arrangement, detailing the proposed infrastructure is depicted on Figure 4.1.

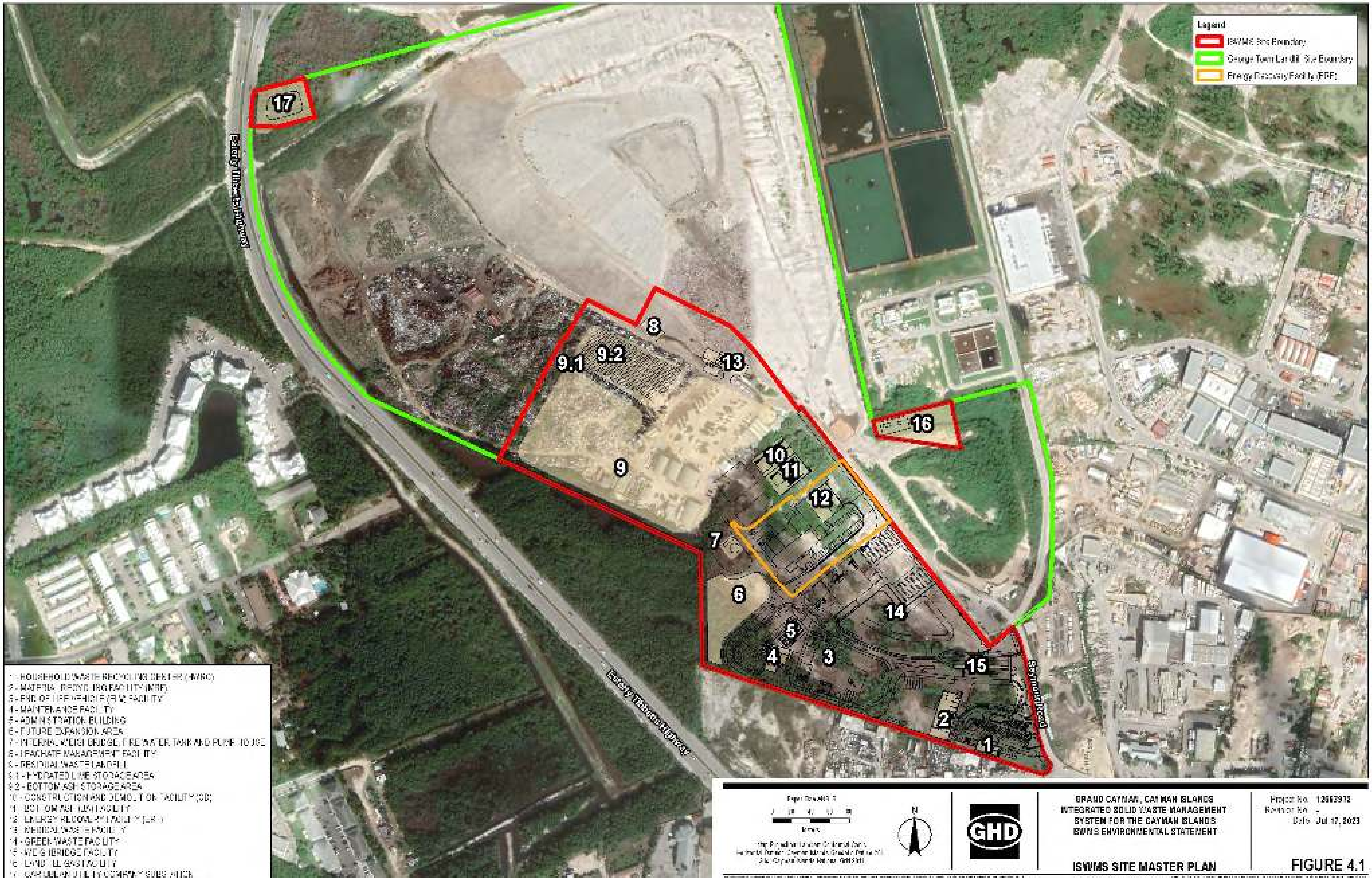


Figure 4.1 ISWMS Site Master Plan

A flow diagram indicating how the major waste components by volume will be accepted and managed through the various ISWMS facilities is provided on Figure 4.2 and Table 4.1 lists the management options for 'special wastes' that typically will be received in relatively small volumes but will require special attention due to the specific nature of these materials. It is not anticipated that waste will be accepted or processed from cruise ships.

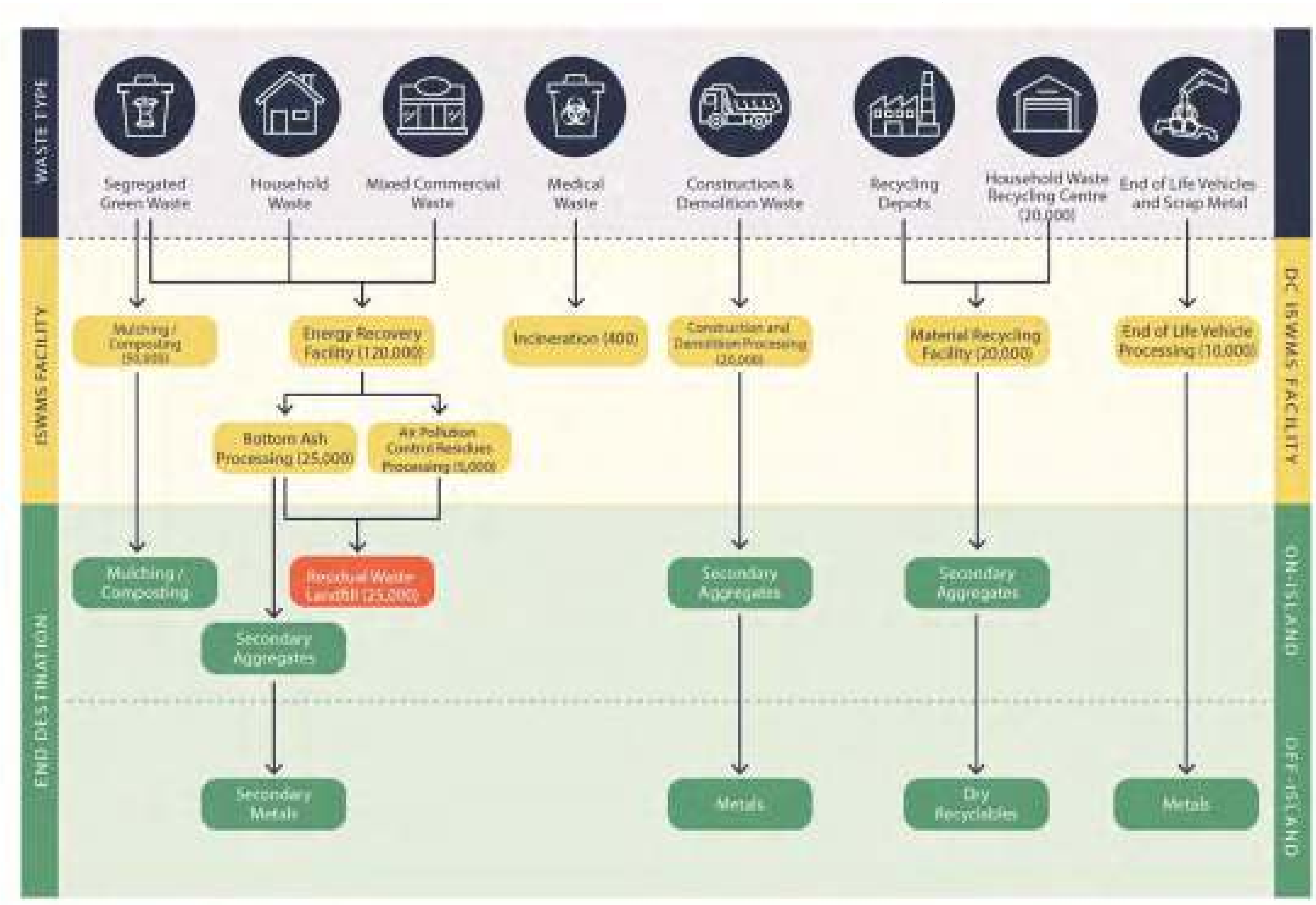


Figure 4.2 Waste (by type) to be managed through the ISWMS facilities[1]

[1]( ) = maximum annual tonnage; Energy Recovery Facility includes allowance for combustible residues from other processing facilities; Residual Waste Landfill includes non-recoverable residues from other facilities, plus allowance for potential additional landfilling in later years of contract.

Table 4.1 Waste management options for special wastes

Material Type	Disposal Options
Tyres	ERF
Auto and marine batteries	Overseas recycling
Household batteries	Overseas recycling
Vegetable oils	Bulked for ERF, overseas recycling
Vehicle oils	Bulked for ERF, overseas recycling
Paints	Re-use, bulked for ERF
Medical waste	Medical Waste Incinerator, ash to RWL
Electronic waste	Re-use, overseas recycling (de-manufacture)
Fluorescent bulbs	Pulverised and overseas recycling
Small animal carcass	ERF
Large animal carcass	RWL
Abattoir waste	ERF
Chemicals	Based on material: ERF, overseas recycling
Pharmaceuticals	Medical Waste Incinerator
Confiscated illegal drugs	Medical Waste Incinerator
Asbestos	RWL
Ad Hoc wastes (including sewage sludge and contaminated soils)	RWL
Emergency Waste (including Sargassum)	RWL
Other	Case by case

Building on the previous work completed to establish the need for the ISWMS[2,3,4], the overall design life/capacity is based on projected waste generation rates and future population. Proposed indicative capacities (where appropriate) for each of the ISWMS components are outlined in Table 4.2.

Table 4.2 Proposed ISWMS components and capacities[1]

Facility	Maximum capacity/yr (short ton per annum)[2]	Maximum capacity/yr (tonne per annum)[2]	Location
Energy Recovery Facility	120,000	108,862	ISWMS Site
Site Weighbridges[3]	n/a	n/a	ISWMS Site
Green Waste Facility	50,000	45,359	ISWMS Site
Construction & Demolition Waste Processing Facility	20,000	18,144	ISWMS Site
Bottom Ash Processing Facility	25,000	22,680	ISWMS Site
End of Life Vehicle / Scrap Metal Processing Facility	10,000	9,072	ISWMS Site

2 Cayman Islands Government. *National Solid Waste Management Policy for the Cayman Islands*. 2015.
3 Cayman Islands Government, prepared by Amec Foster Wheeler Environment & Infrastructure UK Limited. *National Solid Waste Management Strategy for the Cayman Islands*. 2016.
4 Cayman Islands Government. *Strategic Outline Case – Integrated Solid Waste Management System*. 2014.

Facility	Maximum capacity/yr (short ton per annum)[2]	Maximum capacity/yr (tonne per annum)[2]	Location
Medical Waste Incinerator	400	363	ISWMS Site
Materials Recycling Facility[3]	20,000	18,144	ISWMS Site
Household Waste Recycling Centre[3]	20,000	18,144	ISWMS Site
Landfill Gas Facility	600 normal metre cubed per hour (nm^3/hr)		George Town Landfill (GTLF)
Residual Waste Landfill	25,000	22,680	ISWMS Site
Administration Building & Maintenance Building[3]	n/a	n/a	ISWMS Site

Sister Islands Developments

The ISWMS located in Grand Cayman will be built and operated by the DART Consortium (DC) and will be supported by 'satellite' waste infrastructure located in the two Sister Islands – Cayman Brac and Little Cayman. Details of this infrastructure is set out below[5]:

Cayman Brac

The Cayman Brac facility will consist of composting, recycling, End of Life Vehicle (ELV) processing and waste transfer infrastructure (including a site weighbridge) that will be designed and built by ReGen and operated by the CIG.

The main facility will be accessible only to service vehicles but will be supported by a recycling site that will be accessible to the public during established operating hours and will be used for the collection of a range of non-recyclable waste and recyclable household waste materials.

As such, in addition to conventional household and commercial waste, the overall types of materials that the Cayman Brac facility will accept will include:

- Paper, cardboard, boxboard, glass, ceramics, tin and aluminium cans, no. 1 and no. 2 plastics;
- Larger ferrous and non-ferrous metals including derelict vehicles, propane and other empty/unusable gas containing cylinders, white goods including fridges, stoves, etc., large domestic appliances (washing and drying machines, dishwashers, etc.) and small domestic appliances (waste electrical and electronic equipment);
- Medical waste from Faith Hospital;
- Household hazardous waste including paints, thinners, used oil, batteries, fluorescent bulbs, etc.; and
- Yard waste including grass, leaf, hedge and tree cuttings and sea grasses.

Where possible, composted and recycled materials will be re-used on island or sent for third party reprocessing following consolidation in Grand Cayman where applicable (ELVs potentially being sent direct to off-island third parties for reprocessing). The remaining materials will be compacted (in the case of residual municipal waste) or loaded into dedicated shipping containers (for recyclables, ad hoc wastes and medical waste) for shipping to Grand Cayman where they will be offloaded and transported for processing at the ISWMS Site.

The materials that will be processed at the Cayman Brac facility will be (i) green waste, which will be composted and then used on island as a compost product, (ii) end-of-life vehicles, which will be depolluted on-island for shipping and reprocessing off-island and (iii) dirt, brick, rubble and glass materials, which will be crushed for use as aggregate. It is anticipated that up to 577 tons (523 tonnes) per year of green waste will be generated in Cayman Brac for compost processing, 161 tons (146 tonnes) of ELVs and 200 tons (181 tonnes) of dirt, brick, rubble and glass.

[5] Assessment of the proposed facilities and infrastructure in Little Cayman and Cayman Brac excluded from the ISWMS EIA (see below), but details included here for scheme understanding.

It is anticipated that approximately 2,712 tons (2,460 tonnes) of non-recyclable and recyclable waste will be generated in Cayman Brac for subsequent processing in Grand Cayman in 2026, rising to approximately 3,836 tons (3,480 tonnes) in 2050. The waste materials will be shipped periodically - assumed at this time to be weekly to monthly.

A hurricane debris storage area will also be developed within the boundary of the existing Cayman Brac landfill. It is intended that any hurricane-related waste that cannot be immediately accommodated by the Cayman Brac facility be temporarily stored in this area. These wastes will be segregated according to waste type and managed based on available processing capacity both in Cayman Brac and Grand Cayman. The precise location of the hurricane debris storage area will be determined in conjunction with the landfill restoration plan that will be developed for the Cayman Brac landfill.

Little Cayman

The Little Cayman facility will consist of recycling, ELV processing and a transfer station that will be designed and built by ReGen and operated by the CIG.

The main facility will be accessible only to service vehicles but will be supported by a recycling site that will be accessible to the public during established operating hours and will be used for the collection of a range of non-recyclable waste and recyclable materials.

In addition to conventional household waste, the types of materials that the Little Cayman facility will accept will include:

– Paper, cardboard, boxboard, glass, ceramics, tin and aluminium cans, no. 1 and no. 2 plastics;
– Larger ferrous and non-ferrous metals including derelict vehicles, propane and other empty/unusable gas containing cylinders, white goods including fridges, stoves, etc, large domestic appliances (washing and drying machines, dishwashers, etc.) and small domestic appliances (waste electrical and electronic equipment);
– Household hazardous waste including paints, thinners, used oil, batteries, fluorescent bulbs, etc.; and
– Yard waste including grass, leaf, hedge and tree cuttings and sea grasses (to be combined with residual waste).

Where possible, recycled materials will be re-used on island. The remaining materials will be loaded into dedicated shipping containers (for recyclables, ad hoc wastes and medical waste) for shipping to Cayman Brac where they will be offloaded and transported for processing at the Cayman Brac Facility.

The materials that will be processed at the Little Cayman facility will be (i) end-of-life vehicles, which will be depolluted on-island for shipping and reprocessing off-island and (ii) dirt, brick, rubble and glass materials, which will be crushed for use as aggregate. It is anticipated that up to 16 tons (15 tonnes) of ELVs and 64 tons (58 tonnes) of dirt, brick, rubble and glass will be generated in Little Cayman each year.

It is anticipated that approximately 263 tons (239 tonnes) of non-recyclable and recyclable waste will be generated in Little Cayman for subsequent processing in Grand Cayman in 2026, rising to 372 tons (337 tonnes) in 2050. The waste materials will be shipped periodically – assumed at this time to be weekly to monthly via the Cayman Brac Facility.

A hurricane debris storage area will be developed within the boundary of the existing Little Cayman Landfill. It is intended that any hurricane-related waste that cannot be immediately accommodated by the Little Cayman facility be temporarily stored in this area. These wastes will be segregated according to waste type and managed based on available capacity both in Little Cayman and Grand Cayman. The precise location of the hurricane debris storage area will be determined in conjunction with the Landfill Restoration Plan that will be developed for the Little Cayman landfill.

ISWMS EIA Context

The proposed developments in Cayman Brac and Little Cayman are geographically separated from the proposed ISWMS in Grand Cayman. Indeed, Cayman Brac and Little Cayman are approximately 95 miles (152 kilometres [km]) and 80 miles (129 kilometres [km]) respectively from Grand Cayman.

On their own, it is not considered that these small developments would attract the need for an EIA. Furthermore, from a planning perspective, development in the Sister Islands is controlled by separate procedures[6]. As such, the EIA for the ISWMS excludes an assessment of the proposed facilities in Little Cayman and Cayman Brac. Instead, separate planning applications would be made to the CIG, as appropriate, for the two separate developments.

Notwithstanding this approach, it is recognised that the importation of waste from the Sister Islands to the port at Grand Cayman has the potential to contribute directly to the environmental effects of the main ISWMS Site – most notably in the context of transporting material from the port to the facility itself. Such effects are considered in the relevant sections of this EIA (i.e., those that relate to the assessment of transport, noise and air quality effects). Transport of material from the Sister Islands to the Port is reviewed and described in the EIA.

4.1.1 ISWMS Facilities

The ISWMS facilities are described in detail in the sections that follow. Design features relevant to all ISWMS facilities are outlined in brief below.

Access

The ISWMS Site will be accessed along the same route as the current GTLF operations: from the South via Seymour Drive. Security has been addressed on the ISWMS Site by the proposed construction of a 12 foot (ft) (3.66 metre [m]) high metal chain link perimeter fence. Access to the ISWMS Site is provided via a 24 ft (7.32 m) main gate on the south side of the proposed property. The ISWMS Site design and construction will enable the safe movement of vehicles and pedestrians at all times. The Site layout has been designed to allow free flow of vehicles that access both the public and back-of-house areas. Vehicle swept path movements have been tested using Autodesk's Vehicle Tracking software to ensure that sufficient space has been provided for turning maneuvers.

Security and lighting

As 90 percent of the activity at the ISWMS Site occurs from dawn to dusk, lighting is restricted to the main access road (to allow for solid waste deliveries) and building eves. A lattice of closed-circuit television cameras will populate the ISWMS Site ensuring total coverage.

Proposed working hours

The working hours will vary between the facilities based on the specific work demands and needs, as well as open hours for the public and companies using the facilities. Open hours for each of the ISWMS Site facilities is provided in the relevant subsections below.

Employment

The Project is anticipated to result in the creation of approximately 70 full-time positions during operation.

Design standards

All designs will, in so far as these are relevant, be in accordance with the following codes with amendments referenced in The Building Code (Amendments) Regulations (2016):

– 2014 National Electrical Code
– 2009 International Building Code
– 2003 ICC/ANSI A117.1 American National Standard for Accessible and Usable Buildings & Facilities
– 2009 International Mechanical Code
– 2009 International Plumbing Code

6 CIG. *The Development Plan for the Cayman Islands Planning Statement, Appendix 1: The Development Plan 1977 – Guidelines for Development Control in Cayman Brac & Appendix 2: The Development Plan 1977 – Guidelines for Development Control in Little Cayman*. 1997.

– 2009 International Fuel Gas Code
– 2009 International Fire Code

All structures will be designed to ANSI/ASCE 7 with wind design criteria and seismic design criteria as set out in the Cayman Islands Building Code.

The design, construction and testing of the ISWMS facilities will generally follow harmonised European Standards (EN) as well as meeting all Legislation. Where EN standards are not available, appropriate national (ASME, ASTM, etc.,) or international (ISO, IEC, DIN etc.) standards will be used in line with Good Industry Practice.

The design, operations and services for the ISWMS facilities will be in accordance with the following standards, where applicable:

– 2009 International Building Code® as modified by the Cayman Islands Building Control Unit (BCU)
– 2009 International Residential Code®
– 2009 International Mechanical Code®
– 2009 International Plumbing Code®
– 2009 International Fuel Gas Code®
– 2009 International Fire Code®
– NFPA 70®: National Electrical Code® (NEC®) 2014 Edition
– ICC/ANSI A117.1 - 2003 Standard & Commentary: Accessibility Standard
– 1999 Standard Building Code amended by "Blue Sheets" issued by Cayman Islands Building Control Department
– ACI, American Concrete Institute
– AISC, American Institute of Steel Construction
– AISI, American Iron and Steel Institute
– ANSI, American National Standards Institute
– ASCE, American Society of Civil Engineers
– ASTM, American Society for Testing and Materials
– AWS, American Welding Society
– CRSI, Concrete Reinforcing Steel Institute
– MBMA, Metal Building Manufacturer's Association
– NCMA, National Concrete Masonry Association
– NFPA, National Fire Protection Association
– SDI, Steel Door Institute
– SMACNA, Sheet Metal and Air Conditioning Contractor's National Association
– BS. British Standard
– DIN, Deutsches Institut für Normung
– EN, Euro Norm
– ISO, International Organization for Standardization
– TUV, Technical Uberwachus Verien
– OSHA, Occupational Health and Safety Administration (US)

Certain ISWMS facilities will conform to other specific design standards, as described in the subsections below.

Water use

The approximate volume of water anticipated to be used at each ISWMS facility is provide in Table 4.3.

Table 4.3 ISWMS projected water use

Water Type	Source	Processing	Demand	Estimated Quantity	Comments
Potable	Water Authority Cayman	None	Domestic	609 US gal/h ($2.3m^3/h$)	Maximum demand during construction
Potable	Water Authority Cayman	None	Fire water replenishment	27,475 US gal/h ($\sim100m^3/h$)	8 hr duration following a fire event
Saline	Boreholes	None	System capacity	649,140 US gal/h (2,457 m^3/h)	
	Borehole water system	None	ERF cooling	605,812 US gal/h (2,293 m^3/h) 35,192 US gal/h (133.23 m^3/h)	Main condenser Auxiliary cooler
	Borehole water system	None	WTF #1 feed	4,002 US gal/h ($15.2m^3/h$) 8,005 US gal/h ($30.3m^3/h$)	1 x 100 percent train 2 x 100 percent trains
Desalinated	WTF #1 product discharge	Desalination	Service water	1,100 US gal/h ($4.16m^3/h$)	Assumed daily demand = storage tank capacity
			Non-ERF	520 US gal/h (2 m^3/h)	Composting, vehicle wash, wheel wash, landscaping, dust sup.
			WTF # 2 feed	792 US gal/h ($3m^3/h$) 1585 US gal/h ($6m^3/h$)	1 x 100 percent train 2 x 100 percent trains
			Fire water	11 US gal/h ($0.042m^3/h$)	1000 L/day allowance for systems losses through leaks, tests and flushing of lines

Design considerations

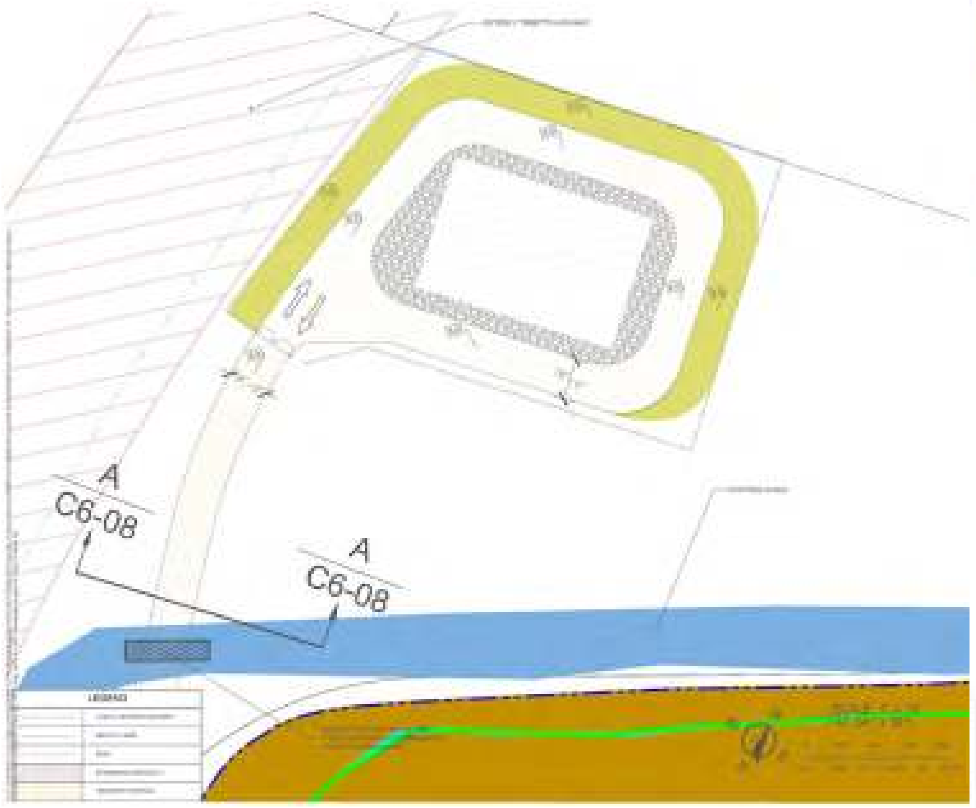
The following considerations have been incorporated into the design of the ISWMS facilities:

Table 4.4 Design considerations

Design Consideration	Summary
Energy and water efficiency, renewable energy and recycling	Facilities have been designed to include synergies from co-locating elements within an integrated solution. Preference for equipment with high energy efficiency specifications and sustainable life cycle costs. The main operations at the ISWMS Site will primarily focus on electricity generation by the ERF, which will be partly classified as renewable energy. The ERF has also been designed to achieve R1 status (an energy efficiency factor relating to incineration as an energy recovery operation) and therefore would meet the classification as a Recovery facility rather than a disposal facility. Water conservation measures will be adopted throughout the design of each ISWMS facility.
Landscaping	The landscaping strategy will incorporate the planting of native species to create an attractive setting, with visual interest as well as softening the appearance of the development and enhancing biodiversity across the ISWMS Site. A sympathetic selection of materials will be included in the proposed development to complement the surrounding landscape, any reflective materials and bright colours will be avoided wherever possible. The landscape strategy incorporates small trees and bushes in certain areas, especially towards the edge of the ISWMS Site, providing relief where possible and helping to create a degree of connectivity

Design Consideration	Summary
	between habitats. This will be carefully managed to avoid overhanging branches that would aid access to the Site by unauthorised personnel. Tree planting around the entrance will help to soften the perimeter fence and create a more interesting gateway. The spaces between and round the internal ISWMS Site infrastructure will be planted with native species and xerophytic plants to reduce water consumption and on-going maintenance. The proposed retention lagoon at the Green Waste Facility will be created with a shape that is appropriate and with consideration for landscaping. The retention lagoon for the Green Waste Facility retention lagoon is rectangular in shape and will be planted with suitable marginal and aquatic plant species.
Environmental setting, weather and geographic conditions	Structural steel elements, cladding and roofing will be dimensioned with sufficient strength and thickness to withstand the local marine climate and hurricane effects (up to 200 mph/ 3 second gust) over a lifetime of not less than 30 years. Cladding panels will be coated to provide protection from the saline atmosphere. Cover structures over particular items of equipment (e.g., over the static compactor) may be constructed from wood, with a reduced foundation provision. In this case, the structures are considered 'sacrificial' in that they are likely to require on-going maintenance plus may require occasional replacement following a hurricane event. A still water elevation of 8 ft (2.4 m) above mean sea level (AMSL) has been established based on Hurricane Ivan (a 1 in 100 year return period) records US Federal Emergency Management Agency (FEMA) guidance has been used to arrive at Base Flood Elevation (BFE) of +12 ft (3.7 m) AMSL and Design Flood Elevation (DFE) of +13 ft (4.0 m) AMSL.
Stormwater management	A general Site drainage system to manage surface water run-off from non-operational areas of the Site is provided on Figure 4.3 Stormwater Management Plan. The design of the Site's drainage system will incorporate pollution control features and system divisions to isolate specific areas as appropriate. Drainage systems will be designed to manage the impacts of extreme weather conditions and reduce risk of flooding and will comply with all applicable building design codes and regulations. Surface water from impermeable and low-permeability running surfaces will be managed via Site grades to shed water away from these running surfaces and drain into the underlying ground. Surface water in permeable areas of the Site will be drained into the underlying ground without impacting the operability of the running surfaces.
Storage and material handling equipment	Facility designs include consideration of laydown areas which will be set aside for the storage of construction materials and waste management activities and located away from potential contaminant pathways. Where practicable, all waste generated on-Site during construction will be segregated into waste categories that correlate with recycling services provided by waste management operators. Facility designs incorporate various techniques and measures such as manufacturing products off-Site, modern methods of construction and/or using building products that correspond to standard building dimensions therefore reducing waste from cut-off residues on-Site. Site management will ensure all materials are stored in a safe manner in accordance with construction industry good practice such that damage and the subsequent need for scrapping is reduced. Whenever safe and practical, materials and equipment should be reused. If reuse is not viable, surplus materials and equipment will be recycled, where economic and practicable.
Incorporating vehicles	Each ISWMS facility has been designed to provide access to all road legal vehicles up to a wheel base (WB) of 40 feet (12.2 metres) (WB 40), and to allow adequate space for manoeuvring within each Facility and across the ISWMS Site. Movement of large industrial equipment to the Site during construction will be managed by specific plans that will consider Health & Safety and protection of any utilities along the path.

Design Consideration	Summary
Traffic control arrangements	All vehicles entering the ISWMS Site (other than for public vehicles accessing the Household Waste Recycling Centre (HWRC) via its own dedicated entrance) will have to pass through the Main Weighbridge and therefore access will only be available to Authorised Vehicles. Authorised Vehicles arriving at the ISWMS Site will follow the signs which will direct them to the Weighbridge Facility. Public visitors to the HWRC will follow the clearly signposted roadway to the HWRC so that these visitors are kept separate from the Weighbridge Facility. Signs posted from the entrance and throughout the ISWMS Site will: direct users where to go and where to drop off Waste; describe how to use the Facilities properly; explain which containers are to be used for the receipt of various materials at the HWRC; and advise on general safety notices. Traffic controls (in the form of street markings on roadways) will be present at the entrance and exits to each of the Non-ERF Facilities and to the ERF. A traffic light system will control the entry of vehicles into the Main Weighbridge and to the tipping hall at the ERF. Vehicles will be required to wait at traffic controls before entering the Facility. Pedestrians may only enter the Facilities via pedestrian walkways protected by fixed barriers. The ISWMS Site has been designed to avoid the potential for vehicles queuing onto main roadways such as Seymour Drive through a number of fundamental design considerations.
Turnaround time analysis	Each ISWMS facility is designed to ensure that the turnaround times from weigh-in to weigh-out at the Weighbridge Facility (once operational) under normal circumstances are no more than 22 minutes on Site for Authorised Vehicles using the ERF and Materials Recycling Facility, and 25 minutes for all other facilities (excluding the Medical Waste Facility) taking account of the travel distances anticipated across the ISWMS Site and including time for tipping/unloading.



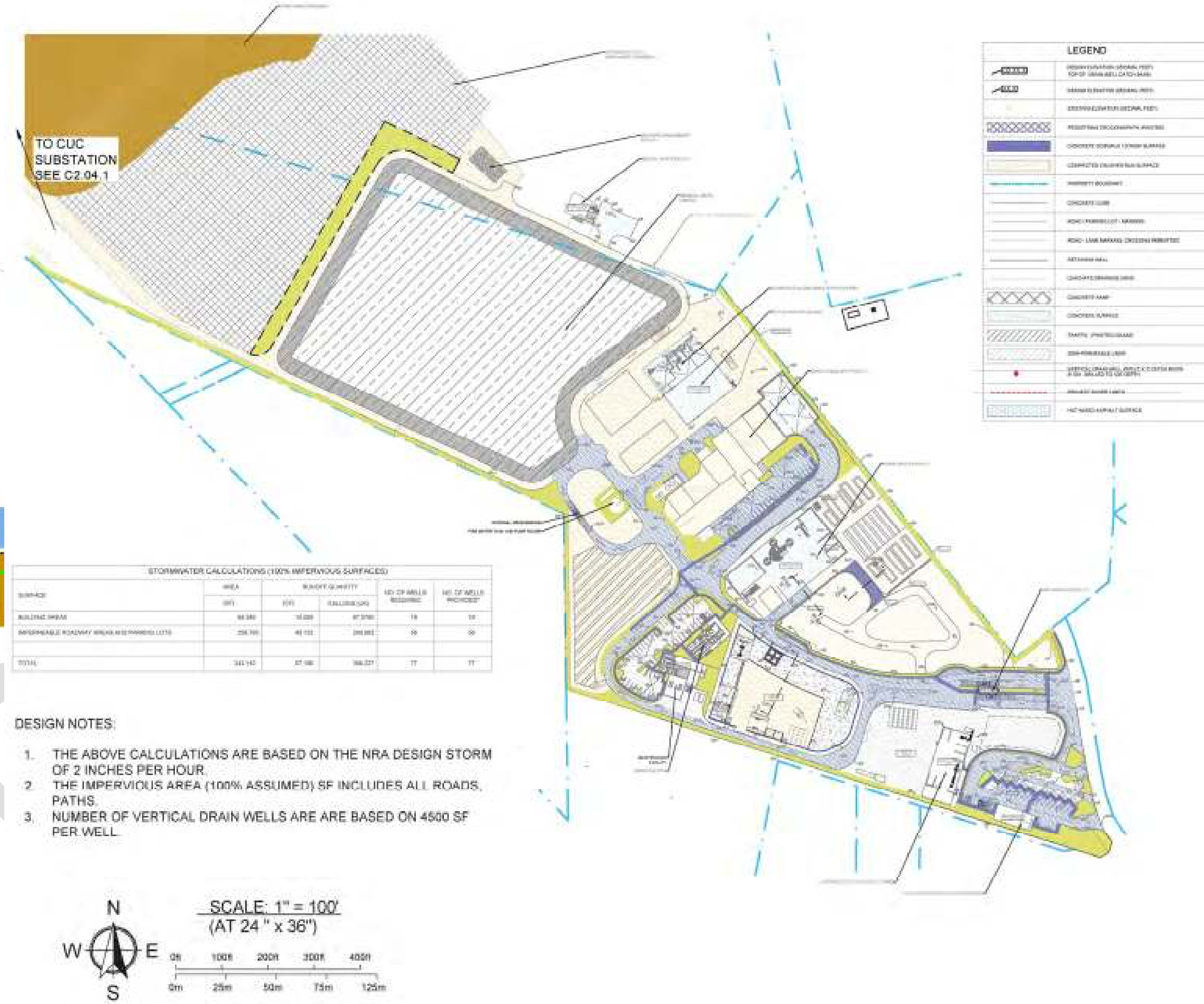


Figure 4.3 Stormwater Management Plan (right) and Interconnection Stormwater Management Plan (left)

4.1.1.1 Energy Recovery Facility

The ERF will be a state-of-the-art controlled combustion (mass burn) facility that will render combustible, non-recyclable waste to an inert ash and reduce the volume of incoming waste by 90 percent; or about 75 percent on a tonnage basis. It is anticipated that the ERF will process a maximum of approximately 120,000 tons (108,862 tonnes) per year of municipal solid waste (depending on the energy content (calorific value; CV) of the waste being managed). The heat of combustion will be harnessed to generate pressurised steam, driving a steam turbine which in turn will produce electricity for sale to the Caribbean Utilities Company (CUC). Advanced air pollution control (APC) and continuous emissions monitoring (CEM) systems will ensure that ERF emissions are able meet current and future standards and not pose an adverse effect to the environment.

The capacity of the ERF is determined by the amount of thermal energy that the installed appliances (furnace and boiler) can safely manage. In the case of the ERF the capacity is 35.5 megawatt thermal (MW_{th}). The average annual throughput capacity of the ERF, in tons treated, will be dependent upon the energy content (CV) of the waste, and is anticipated to be between 12.5 and 15.0 tons (11.3 and 13.6 tonnes) per hour. The ERF will operate at least 8,000 hours per year. The residence time in the tipping hall bunker is foreseen to be two to three days, however, it will be designed to have a normal filling capacity of five to six days and an emergency capacity of approximately 10 to 14 days.

Cooling water for the ERF will be sourced from an array of three 51-149 ft (15.5-45.4 m) deep borehole wells beneath the ISWMS Site. Once passed (non-contact) through the condensers, the 'spent' cooling water will then be returned to groundwater using a further array of three 270-600 ft (82.3-182.9 m) deep discharge wells. In the event of the initial hydrogeological assessment indicating any unacceptable impacts (e.g., relating to drawdown or temperature effects), potential mitigating options include providing additional boreholes (to reduce flow rates in the intake and / or discharge wells), switching to an air-cooled condenser system or, as a last resort, exploring the options for discharge to surface water and APC residue (APCR). The bottom ash will be managed via the proposed Bottom Ash Processing Facility. The APCR and boiler ash will be stabilised with cement and / or pozzolan by means of a pan mixer at the ERF and thereafter discharged to a concrete mixer truck for transfer to and disposal at the proposed RWL.

An artistic impression of the ERF (in the absence of visual mitigation measures) is shown on Figure 4.4.

Figure 4.4 Artistic impression of ERF in the absence of visual mitigation measures

Figure 4.5 *ERF Site Plan*

A summary of key ERF design features is provided in Table 4.5.

Table 4.5 ERF key design features

ERF Components	**Main facility building**: tipping hall, bunker building, boiler building, combustion grate and furnace, cooling water system, flue gas treatment building, turbine generator building, electrical, stack (approximately 146 ft (44.5 m) AMSL)[7]. **External structures and equipment**: fire water tank, fuel oil tank, various other storage vessels, other external structures.
Estimated Annual Tonnage	Up to 120,000 tons (108,862 tonnes) per annum
Storage Capacity	Primary: 5.6 days Secondary: 10-14 days
ERF Target Materials (receive, treat, and recover value from)	– Combustible non-recycled Waste – Tyres / pallets as stockpiled at the GTLF Site prior to commencement of ERF operations – CH4 methane contribution as captured from existing GTLF – Yard Waste diverted from composting as required to balance ERF capacity – Oils – as supplied by Department of Environmental Health (DEH) and other Facilities at the Project Site The ERF will also recover ferrous and non-ferrous metals and produce an ash suitable for beneficial use and an air pollution control residue that may require disposal.
ERF Waste Sources	– Waste collected by DEH from residential and commercial properties – Third Party deliveries from the commercial collection of waste – Waste that was delivered to the Non-ERF Facilities but that could not be treated at those Facilities – Residues and back-end rejects from processing Waste at the Non-ERF Facilities – Methane (Landfill Gas) from the remediation of the GTLF Site and waste oil from DEH and other on-island sources, to the extent these can be commercially contracted
Products & Secondary Materials	– Electrical energy for on-island market – Bottom ash aggregate for on-island market – Bottom ash metals (ferrous and non-ferrous) for off-island reprocessors – APCR for RWL
Cooling Water System	ERF will be cooled using a saline water supply, sourced from three 16 inch (in) (0.41 m), 425 ft (129.5 m) deep boreholes, each equipped with a dedicated pump rated at 33 percent of the system capacity. Maximum total borehole system flow rate during normal operating conditions is indicated as 2,418 tons/hr (2,194 tonnes/hr) (equivalent to approximately 28,923 cubic ft (ft^3)/hr (819 m^3/hr) per pump, assuming a flat system curve). Bulk of borehole water will be used as cooling medium for the ERF process (main condenser (2,257 tons/hr (2,048 tonnes/hr)) and auxiliary cooling system (131 tons/hr [119 tonnes/hr]). Small quantity of borehole water (14.91 tons/hr [13.53 tonnes/hr] per 100 percent train) will be supplied to the wider water treatment operations. With a waste flow thermal heat input of 35.5 MWt_h at 100 percent maximum continuous rating (MCR), the anticipated cooling water heat removal load is anticipated to be approximately 21 MW. With the above cooling water flow rate, temperature rise across the cooling water system (condenser and auxiliary cooler) is anticipated to reach 46.0°F (7.8°C) during normal plant operating conditions. Under upset operating conditions (with one of the three cooling water pumps out of operation), the temperature rise may temporarily reach 54°F (12.2°C).

7 Development Planning Regulations (2021 revision) Section 8.2 specifies general requirements for building height; however, does not apply to chimneys or smokestacks or the like, provided that "*in Grand Cayman the maximum permitted height of any such structure and appurtenance, if any, shall not exceed the height limitation prescribed by the Director of Civil Aviation within the flight approach zone pattern of the Owen Roberts International Airport.*" November 2020 email correspondence from the Cayman Islands Airport Authority indicates that regulatory requirements due to the location of the proposed ISWMS in proximity to the airfield are restricted to a height of 45 m.

ERF Specific Standards	– EU Directive 2010/75/EU – Pressure Equipment Directive no. 97/23/EC – The boiler design according to EN 12952 – EN codes and ISO codes in general – EU Directive 2006/42/EC – Fans according to ISO 14694 – Pipes according to unfired pressure vessel EN 13445 – Valves according to EN – ATEX Directive no. 2014/34/EU
Environmental Controls	Dust, odour, traffic, lighting, fire, drainage and effluent treatment, ventilation, unsheeted open top authorised vehicles, smouldering loads and ad hoc waste
Maintenance	– Combustion grate bars (air cooled) Zones 1-3: 3-5 years (average) – Boiler Superheater tubes: 6-8 years – Boiler Evaporator tubes: 10 years – Boiler economiser tubes: 10 years – Boiler refractory: 15 percent replaced each year – Flue Gas Treatment (Bag House filter bags): 4 years – Civil works: Tipping Floor: 10 years – Crane festoon and drums: 13 years – Emission Control System: 14 years – Digital Control Interface System: 15 years
Design Life	No less than 30 years or 240,000 hours operation
Opening Hours	Monday to Friday: 04:00-18:00* Saturday & Bank Holidays: 06:00-16:00 Sunday, Christmas Day, Good Friday: Closed *ERF may be automated for receipt of Waste from 4:00 – 6:00 am Monday to Friday.
Staff	ERF operations will be undertaken 24/7 on a three shift per day basis staffed by the following trained and qualified personnel. – 1 x ERF Facility/ General Manager – 1 x ERF Assistant Facility/ Deputy Manager – 1 x ERF Facility Admin – 5 x ERF Facility Supervisors – 16 x ERF General Operators – 2 x ERF Maintenance Supervisors – 1 x ERF Electrician – 1 x ERF Mechanic/ Fitter – 1 x ERF Maintenance Operator – 1 x ERF QSHE Manager/ Chemist Additional maintenance and administrative support will be provided on a one shift per day basis, 5 days a week with out of hours call-off. Appropriate personal protective equipment (PPE), as identified by the necessary risk assessment process, will be worn by all staff.

Table 4.6 details the key ERF plant equipment.

Table 4.6 Key plant equipment

Stage	Interaction	Purpose
Tipping hall	Provides a fully enclosed area for Authorised Vehicles to discharge waste into the for mixing and storage prior to combustion in the ERF.	Provides an enclosed area for Authorised Vehicles to unload under negative pressure conditions, reducing the risk of uncontrolled dust, odour and other emissions from the ERF tipping hall.
Bunker	Enables incoming Waste to be mixed and stored before loading into the combustion process.	Provides storage capacity for incoming Waste and enables the waste to be mixed by the overhead cranes before combustion.
Combustion/ Boiler	The bunker cranes feed waste into the hopper and it enters the grate for combustion. Heat from combustion process generates steam for steam turbine generator.	Combustion of the waste and generation of steam.
Flue gas treatment (FGT)	FGT system treats the cooled combustion gases to ensure emission standards are met.	To ensure air emission standards are compliant with design and regulatory requirements.
Steam turbine	Steam from the boiler is utilised in the steam turbine to generate electricity.	To generate electricity for supply to CUC and use on the Project Site.
Ash management	Bottom ash from the combustion process will be managed and recovered in the Bottom Ash Processing Facility. APCR will be stabilised by mixing with cement/pozzolan.	To collect the bottom ash residues produced by the ERF and treat these as appropriate to create a product that can be sold as aggregate. To stabilise APCR and disposed of at the RWL.
Electrical	To supply electricity to the grid and other on-Site facilities.	To provide the electrical connections.

Waste will be delivered to the ERF by Authorised Vehicles, which shall include refuse collection vehicles, roll-on/off vehicles or bulk trailers. It will be the responsibility of the driver of the Authorised Vehicles to tip the Waste into the reception bunker located in the tipping hall.

The Waste will be mixed in the bunker (to improve homogeneity) and transferred into the furnace hopper by means of two grab cranes, whereupon it will be transferred onto the furnace moving grate. Combustion of the waste takes place on the moving grate, generating radiant heat and hot flue gasses with bottom and fly ash as by-products. Energy in the form of heat is recovered throughout a number of passes in the steam raising boiler. A urea solution is injected into the first vertical boiler pass to reduce NOx formation. Combustion air is supplied through the grate bars to facilitate the combustion process. Combustion flue gasses pass through the various boiler passages, transferring heat to water filled tubes and steam filled superheater tubes before entering the flue gas treatment plant. Combustion air is supplied by primary and secondary air systems while induced draft fans promote flue gas flow through the boiler, the gas treatment plant and bag filter system before being discharged to atmosphere through the stack. The flue gas treatment plant neutralises the acidic gases and injects activated carbon to absorb dioxins and furans. The gas then passes through the bag filters to remove particulate. Residue from the flue gas treatment system shall be stabilised and disposed of in the RWL.

Superheated steam drives the steam turbine and connected generator which generates electricity to be utilised both on the Project Site and exported to the transmission grid. Power exported to the grid will be sold by means of a Power Purchase Agreement (PPA) with the CUC.

The Substation from which power is exported to the grid (the "CUC Connection Assets") will be designed and constructed by CUC and is located in the north-western corner of the GTLF. The Contractor is responsible for constructing the grid connection infrastructure between the ERF and the CUC Connection Assets which comprises a sequence of riser poles running from the battery limits of the ERF, along the boundary of the Landfill Facility to the CUC Connection Assets.

Bottom ash from the combustion process will be quenched and conveyed to the bottom ash storage bunker. From there, the 'raw' bottom ash will be removed by dump truck to temporary storage in a lined area of the RWL where it will be weathered for a period of six to eight weeks[8] before being moved (via dump truck) to the Bottom Ash Processing Facility for further processing. Subject to market conditions, metals extracted from the weathered bottom ash during processing will be sent for recycling, with the remaining weather bottom ash being screened and sorted to produce a secondary aggregate for use in construction use.

The ERF heat and mass balances and energy balance are provided in the Sankey diagram below (Figure 4.6).

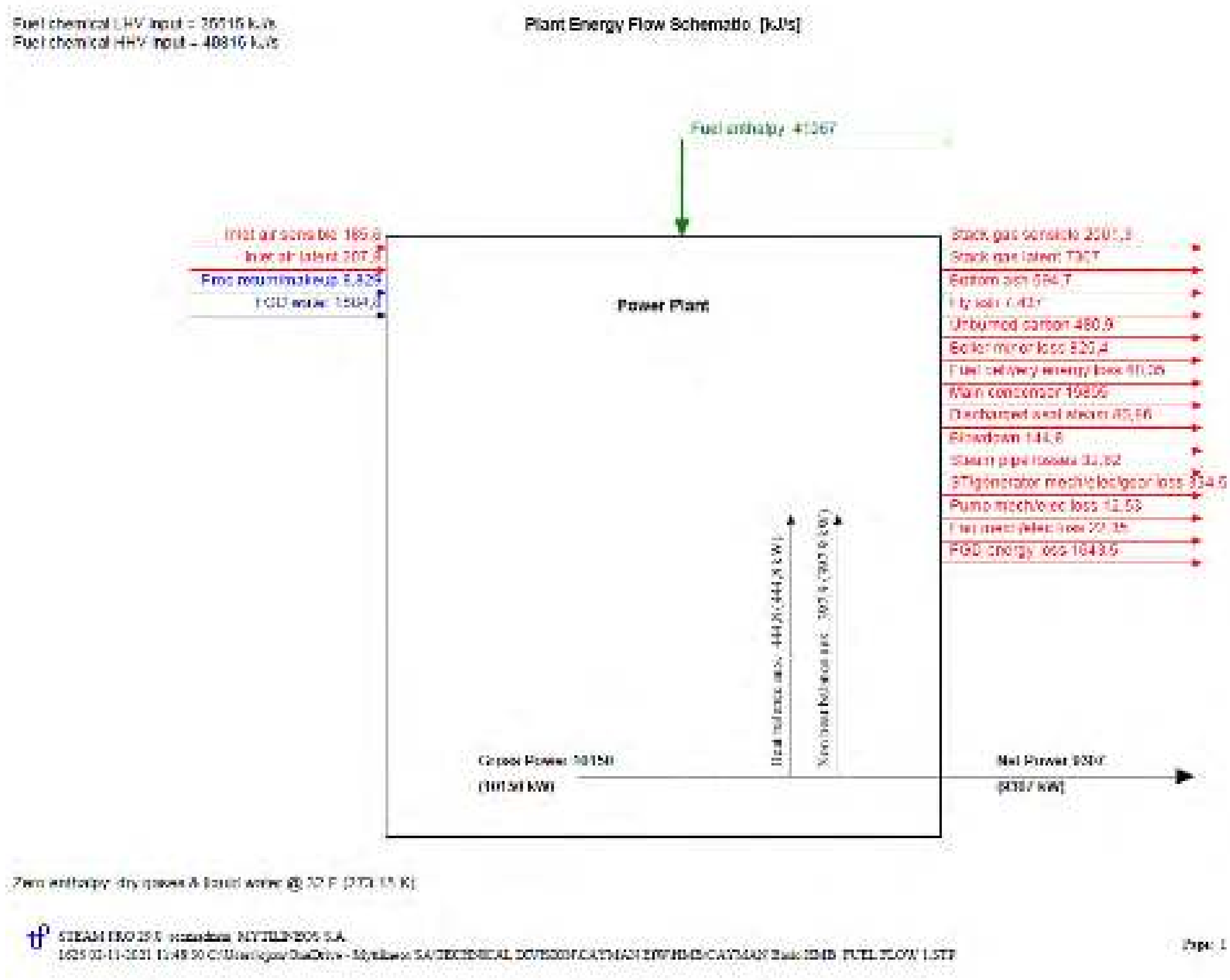


Figure 4.6 Plant Energy Flow Schematic (Sankey Diagram)

4.1.1.2 Weighbridges[9]

Among the first non-ERF facilities to be seen upon entrance to the ISWMS is the Main Weighbridge. The Main Weighbridge will act as a primary point of control for accepting vehicles onto the Project Site. It will establish net weight of all Waste and secondary products and recyclables derived from Waste entering the ISWMS facility.

8 Storm water collected through the leachate collection system will be recirculated (sprayed) over the bottom ash to assist with the weathering process and reduce dust emissions.
9 Assessment of main and secondary weighbridges excluded from the ISWMS EIA, but details included here for scheme understanding.

Weighbridge tickets will be issued to each Authorized Vehicle that delivers Waste to the Site, and to all vehicles transporting secondary materials. The Main Weighbridges' design is meant to enable the Contractor on duty to process vehicles at a sufficient rate and capacity to achieve a turnaround time of 22 minutes for ERF materials and 25 minutes for all other Facilities materials.

The Secondary Weighbridge within the ISWMS Site will be used by the Contractor to track internal movements between Facilities and/or for the export of products and residues off-Site. The Contractor will install static overhead cameras and CCTV to provide additional real time information on vehicles visiting and leaving the Site. All vehicles entering the Project Site (except for those entering the HWRC through its own entrance) will be required to use the Main Weighbridge on entering and exiting the Project Site.

Not all materials will need to be weighed at the Weighbridges. Consumables such as fuel oil or spare parts will be ordered in set quantities and therefore will not be weighed in or out.

The following Table 4.7 provides key design information.

Table 4.7 Weighbridges key design features (same for Main and Secondary)

Maximum Number of Vehicles to the Site	350 per day
Design Measurements	59 ft 1 inch ft x 9 ft 10 inch (18 m x 3 m) deck dimensions
Load Capacity	60 te x 20 kg (66t x 50 lbs)
Standards	European Waste Catalogue (EWC) codes
Design Life	25 years
Key Plant & Equipment	
Opening Hours	Monday to Friday: 04:00-18:00* Saturday & Bank Holidays: 06:00-16:00 Sunday, Christmas Day, Good Friday: Closed *Automated for Authorised Users from 4:00 – 6:00 am Monday to Friday.

4.1.1.3 Green Waste Processing Facility

The Green Waste Processing Facility will receive and process source segregated Yard Waste and will store the resulting compost and mulch products for onward resale into the Cayman marketplace. The Green Waste Processing Facility comprises four distinct areas: receiving and storage where incoming green waste and Yard Waste undergoes a rough pre-sort before shredding and screening and where final product (compost and mulch) are stored prior to transfer off-Site, composting where Yard Waste is placed in windrows and the composting process takes place, mulch where green waste is placed in windrows and mulched, and a green waste run-off retention lagoon. During an initial rough sort (manual or machine automated) at the waste receiving area, materials are checked that the waste is approved/acceptable waste for this facility for quality assurance. Residual materials that cannot be composted or mulched will be sent to the ERF or to the RWL.

The unprocessed green waste storage bay has been sized to accommodate approximately five days of incoming Yard Waste which acts as a buffer capacity until the waste is further processed. It is anticipated that around 90 percent of incoming waste will be sent to mulching (involving and 10 percent will go to composting. In the case of composting, the incoming material will be wetted, shredded and screened to produce a nominal 3-12 inch (80-300 mm) shred material, which will then be placed into windrows and regularly turned for a period of 6 to 8 weeks before being returned to the processing area for further screening and finishing to produce three compost products (0-3/8 inch, 3/8-2 inch and >2 inch). In the case of mulching, the incoming material will be shredded and screened to produce a nominal 3-12 inch (80-300 mm) shred material, which will then be sent for grinding to produce a 2 inch down (0-2 inch) mulch product. The processed products will then be moved to the compost/mulch storage areas on Site awaiting resale on island.

The run-off retention pond will have capacity to hold approximately 275,000 US gallons (1,040,988 litres) of water providing for up to 38 days or six weeks of demand.

The Green Waste Processing Facility layout is provided below on Figure 4.7.

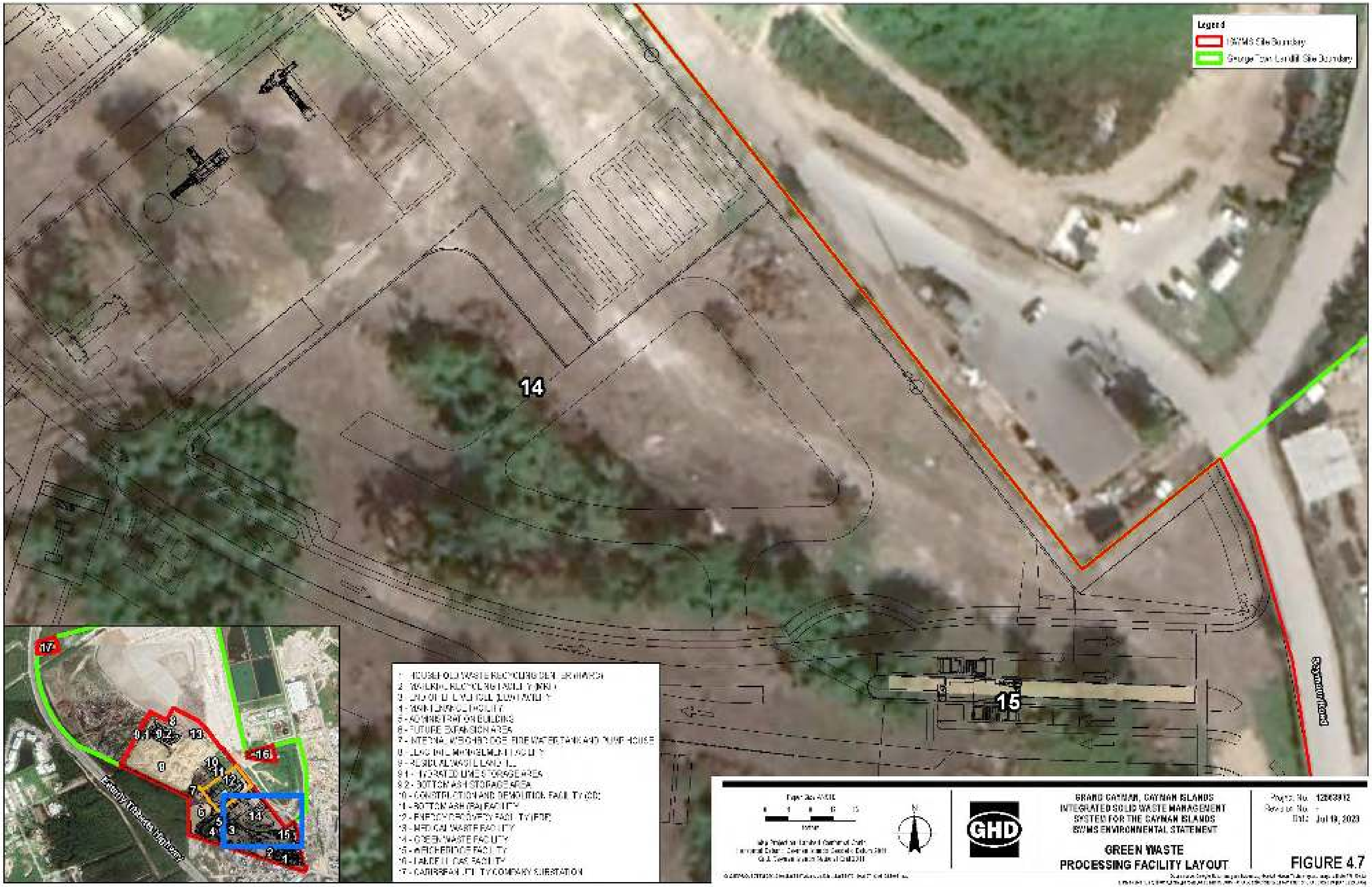


Figure 4.7 Green Waste Processing Facility layout

The following Table 4.8 provides key design information.

Table 4.8 Green Waste Facility key design features

Treatment Capacity	55 tons /hr (49.9 tonnes /hr) (four times the maximum expected daily tonnage)
Maximum Annual Tonnage Capacity	50,000 tons (45,359 tonnes)
Design Measurements	Green waste receiving area: 35 ft x 35 ft (11 m x 11 m) Unprocessed green waste storage area: 49 ft x 76 ft (15 m x 23 m) Compost storage area: 2 x 38 ft x 26 ft (2 x 11 m x 8 m) Mulch storage area: 38 ft x 70 ft (11 m x 21 m)
Estimated Electrical Load for Facility Equipment (based on 20hrs/week of operation)	Total load: 289 kW Duty load: 5,682 kWh
Estimated Additional Water Requirement for Operation (based on 25% of green waste weight produced annually)	7,192 US gallons (27,225 litres)/day
Standards	Resale secondary Yard Waste materials – Florida Administrative Code - FAC 62-709.550
Design Life	30 years
Key Plant & Equipment	
Opening Hours	Monday to Friday: 08:00-18:00 Saturday: 08:00-16:00 Sunday, Bank Holidays: Closed

4.1.1.4 Construction and Demolition Waste Processing Facility

The Construction and Demolition Waste Processing Facility (C&D Facility) is to be constructed to allow for the recycling, recovery and diversion of construction and demolition wastes into aggregates, scrap metals and combustible material (using a shredder for bulky materials) for energy production in the ERF. It is located away from sensitive receptors, in a separate area adjacent to the Bottom Ash Processing building. The facility is comprised of three distinct areas: a waste receiving area (constructed on a compacted crusher run surface), a waste processing area where the various incoming materials are sorted, crushed and screened, and a product storage area where separate processed fractions are transferred to other ISWMS facilities as appropriate (in the case of scrap metals, waste wood) or stored in bays await re-sale into market (in the case of inert aggregate material). Accordingly, C&D waste will go through a pre-sorting procedure followed by mechanical sorting and separation as follows:

– Deposition onto the C&D feed area floor
– Sort 1: transfer material to processing line, removing large items (i.e., bulky combustibles, metals) which will be sent to their appropriate facilities
– Sort 2: processing line to undertake the second sort. The excavator will load the line with nominal 400 mm / 16-inch C&D material which will then pass through a trommel, overband magnet, air separator and receive further sorting and screening

The facility will be able to receive up to 8 loads of incoming C&D waste at any one time, providing a minimum four days of primary storage and 20 days of secondary storage for processed C&D material.

The C&D Facility layout, along with the Bottom Ash Processing Facility layout, is provided on Figure 4.8 .

Figure 4.8 Construction and Demolition Facility and Bottom Ash Processing Facility layout

The following Table 4.9 provides key design information.

Table 4.9 C&D Facility key design features

Treatment Capacity	4 tons/hr (3.6 tonnes/hr)
Maximum Annual Tonnage Capacity	20,000 tons (18,144 tonnes)
Design Measurements	C&D Waste receiving area: 125 ft x 50 ft (38 m x 15 m) C&D tipping area: 39 ft x 39 ft (12 m x 12 m) Shredder area: 28 ft x 32 ft (8 m x 10 m) C&D final product receiving area: 50 ft x 90 ft (15 m x 27 m) Total: 9,432 square feet (876 m²)
Estimated Electrical Load for Facility Equipment (based on 10hrs/week of operation)	Total load: 349 kW Duty load: 3,462 kWh
Standards	Primary and Secondary steel used in building structures will be minimum grade S235 to EN 10025, EN 10029 and EN 10210 European Standards (ENs)
Design Life	30 years
Key Plant & Equipment	
Opening Hours	Monday to Friday: 08:00-18:00 Saturday: 08:00-16:00 Sunday, Bank Holidays: Closed

4.1.1.5 Bottom Ash Processing Facility

The Bottom Ash (BA) Processing Facility will be designed to process bottom ash from the ERF into a recovered aggregate which is suitable for use on the Cayman Islands and recovered ferrous and non-ferrous metals that can be recycled through overseas markets for those materials. The facility will be enclosed to provide complete containment for security purposes during non-operational periods and to reduce dust and noise emissions during operations. The primary components include a 'raw' bottom ash storage where BA received from the ERF will be stored and weathered for 6-8 weeks on the engineered RWL prior to processing, a building where weathered bottom ash will be processed into products for sale (i.e., as a secondary aggregate for construction projects), and various storage areas around the ISWMS Site of the storage of processed BA products. Overall, the BA Processing Facility will be able to receive, process and store up to 4 months of processed bottom ash materials.

The Bottom Ash Processing Facility layout, along with the C&D Facility layout, is provided on Figure 4.8, above.

The following Table 4.10 provides key design information.

Table 4.10 Bottom Ash Processing Facility key design features

Storage Capacity	Stockpile up to 8 weeks of unprocessed bottom ash Stockpile up to 4 months of processed product material in Bottom Ash storage area
Ash Storage & Weathering Area	43,176 sq ft (4011 m²)
Bottom Ash Processing Facility Building	10,960 sq ft (1018 m²)
Estimated Bottom Ash Annual Tonnage	25,000 tons (22,680 tonnes)
Bottom Ash Density	52 lb/ ft² (23 oz)
Bottom Ash Windrows	Width of access aisles between windrows: 10 ft (3 m) Type 1: 6.5 ft (h) (2 m) x 16.5 ft (w) (5 m) x 145ft (l) (44 m) in larger area / 115 ft (l) (35 m) in smaller area Type 2: 17ft (h) (5 m) x 43 ft (w) (13 m) x 145ft (l) (44 m) in larger area / 115 ft (l) (35 m) in smaller area
Estimated Electrical Load for Facility Equipment (based on 10hrs/week of operation)	Total load: 122 kW Duty load: 1,192 kWh
Estimated Additional Water Requirement for Operation (based on 10% of bottom ash weight produced annually)	257,684 US gallons (975,440 litres)
Standards	Primary and Secondary steel used in building structures will be minimum grade S235 to EN 10025, EN 10029 and EN 10210 European Standards (ENs)
Design Life	30 years
Key Plant & Equipment	
Opening Hours	07:00 – 19:00

4.1.1.6 Abandoned and End of Life / Scrap Metal Processing Facility

The Abandoned and End of Life (ELV) Facility will be constructed to allow for the recycling, recovery and diversion of vehicles that have been abandoned or surpassed their useful life, as well as the processing of bulky scrap metals. ELVs will be received, inspected, stripped of batteries, catalytic converters, airbags, tyres, etc. before being depolluted of all coolants, oils, and fuels to allow the recyclable components of the vehicles to be separated for re-use. Waste fuels and tyres will be recovered through combustion in the ERF. Mechanical shearing and baling equipment will prepare the remaining scrap metal for export off-island. The main bulk of the ELVs will be exported for final recycling into new materials including steel, non-ferrous metals and plastics. The ELV Facility will also be used to process scrap metals arising from the C&D Facility, Bottom Ash Processing Facility and HWRC. Overall, the ELV Facility has been designed to treat and process up to 10,000 tons (9,070 tonnes) of ELVs and scrap metals per year (estimated max. 2,000 vehicles plus 2,700 tons of scrap metal), providing on-Site storage for 7 days of processed ELVs and 15 days of scrap metal.

The ELV Facility layout is provided on Figure 4.9.

Figure 4.9   ELV Facility layout

The following Table 4.11 provides key design information.

Table 4.11 ELV Facility key design features

Component	ELV Facility	Depolluting Area	Baled Vehicle Area	Scrap Metal Processing/ Storage Area
Vehicle Storage Compound	9,440 sq ft (9440 m²) (80 ft x 118 ft) (24 m x 36 m)	1,720 sq ft (160 m²) (40 ft x 43 ft) (12 m x 13 m)	2.5 ft x 2.5 ft x 6.5 ft (0.7 m x 0.7 m x 2 m)	Processing: 289 sq ft (27 m²) (17 ft x 17 ft) (5 m x 5 m) Storage: 289 sq ft (17 ft x 17 ft) (5 m x 5 m)
Storage Capacity	(2 week's estimated volume) approx. 3,600 sq ft (334 m²)	1,013 sq ft (94 m²)	54 vehicles (7 days storage)	Processing: 2,312 cubic ft (65 m³) Storage: 2,312 cubic ft (65 m³) Total: 4,624 cubic ft (131 m³)
Estimated Vehicle Allowance	2000 vehicles per year / 167 vehicles per month			
Estimated Vehicle Processing Time		30 minutes (approx. 7 vehicles per day capacity)	30 min (approx. 20 vehicles per day capacity)	
Estimated Electrical Load for Facility Equipment (based on 30hrs/week of operation)	Total load: 467 kW Duty load: 4,940 kWh			
Estimated Additional Water Requirement for Operation	41.7 US gallons/hr (158 litres/hr)			
Standards	(Depollution of vehicles) EC Directive 2000/53/EC Annex I and II DG Environment 'Ex-Post Evaluation 'fitness check' The Labour (Occupational Safety and Health) (Construction Industry) Regulations, 2008 The Labour Law Health and Safety at Work Act 1974 (UK) Occupational Safety and Health Other as applicable			
Design Life	30 years			
Key Plant & Equipment				
Opening Hours	Monday to Friday: 08:00-18:00 Saturday: 08:00-16:00 Sunday, Bank Holidays, Christmas Day / Good Friday: Closed			

4.1.1.7 Medical Waste Facility

The Medical Waste Facility will be constructed to receive, store and process medical waste, and occasional other wastes such as expired currency and confiscated illicit drugs and other combustible materials not suited for treatment at the ERF for security or other practicalities. Medical wastes include: clinical/sharps, pharmaceutical, pathological, and infectious materials. In terms of composition, the medical waste material is estimated to comprise approximately 25 percent infectious waste and 75 percent pathological / other medical waste.

The Facility operations will be housed in a small warehouse building, which will be divided into distinct operating areas. These include a split-level waste reception area where bins will be received and transferred into the waste processing area, a waste processing area where waste will be securely stored before being loaded into and combusted in a purpose-designed medical waste incinerator, and a bin storage area where empty bins are stored awaiting use. The Medical Waste Facility building will be open sided with a roof to protect the equipment beneath. Bottom ash from the incineration process will be transferred to and stored in a rollonoff container within the covered processing area and periodically transferred to the RWL for final disposal.

It is estimated that the Medical Waste Facility will receive up to 6.2 tons (5.7 tonnes) of medical waste per week, compared to an incinerating capacity of 2.65 tons (2.4 tonnes) per day based on a single eight-hour shift. As such, allowing for a gradual increase in medical waste arisings over time, it is anticipated that the Medical Waste Facility will operate around 2 days per week in the early years of operation, rising to around 3 days per week in later years.

The Medical Waste Facility layout is provided on Figure 4.10.

Figure 4.10 Medical Waste Facility layout

The following Table 4.12 provides key design information.

Table 4.12 Medical Waste Facility key design features

Treatment Capacity	660 lbs (300 kgs) per hour
Estimated Clinical Waste Annual Tonnage	324 tons (294 tonnes)
Waste Reception/ Bin Transfer Area/ Residual Waste Discharge Area	274 sq ft (25 m²) (22 ft x 12 ft) (7 m x 4 m)
Wheeled Bin Storage Area	1,500 sq ft (139 m²) (30 ft x 50 ft) (9 m x 15 m)
Processing Area	2,254 sq ft (209 m²) (46 ft x 49 ft) (14 m x 15 m)
Ash Store	240 sq ft (22 m²) (24 ft x 10 ft) (7 m x 3 m)
Slab for Diesel Storage Tank	64 sq ft (6 m²) (8 ft x 8 ft) (2 m x 2 m)
Estimated Electrical Load for Facility Equipment (based on 30 hrs/week of operation)	Total load: 70 kW Duty load: 1,879 kWh
Estimated Additional Water Requirement for Operation	3,386 US gallons (12,817 litres) / batch
Standards	Chapter 64-16E - Florida Administrative Code
Design Life	30 years
Key Plant & Equipment	
Opening Hours	Nominally Tuesday and Thursday only: 04:00-16:00

4.1.1.8 Material Recycling Facility

A warehouse-style Material Recycling Facility (MRF) will be constructed to allow for the diversion and recovery of dry mixed recyclables (DMR) from Waste in Grand Cayman and the Sister Islands; receiving, processing, baling and/or storing DMR for onward resale into local and off-island recycling markets. The MRF will be configured to accommodate DMR collected by CIG and other third parties, as well as material delivered from the HWRCs on Grand Cayman and the Sister Islands.

Incoming DMR will generally comprise a combination of source-segregated materials such as mixed paper and card, plastic containers, glass containers, ferrous and non-ferrous materials, and glass aggregates, which will be stored in separate material storage bays within a MRF building. Each storage bay will have capacity for a minimum 3 days of incoming material. Separation by material stream will then be undertaken as follows:

– Mixed paper and card will be handpicked to remove gross contaminant materials and thereafter baled using a hydraulic baler
– Mixed plastics will be handpicked to remove gross contaminant materials and thereafter baled using a hydraulic baler
– Ferrous/non-ferrous cans and other small containers will be mechanically sorted using a magnet to segregate ferrous from non-ferrous metals, then baled
– Glass will treated through a glass pulveriser/trommel to reduce its size, producing two material sizes to be conveyed to an external storage container and a reject fraction to be deposited within an internal storage container

The MRF building will include a separate dry recyclate storage area where up to 320 bales of weather-sensitive DMR (e.g., baled paper and card, or UV sensitive baled plastic) can be stored prior to transfer off the Project Site. An external MRF area will also be provided for the storage and transfer of baled ferrous and non-ferrous metal and non-UV sensitive baled plastic into awaiting shipping containers (6 nr capacity). Baled DMR materials will be moved depending on their type and weather sensitivity, being periodically shipped off-island for reprocessing at other third-party facilities. Market permitting, glass products will be sold back into market on-island in Grand Cayman.

The following Table 4.13 provides key design information.

Table 4.13 MRF key design features

Maximum Annual Tonnage of DMR	Paper: 154 tons (140 tonnes) Cardboard: 484 tons (439 tonnes) Plastic containers: 110 tons (100 tonnes) Glass containers: 199 tons (180 tonnes) Ferrous containers: 30 tons (27 tonnes) Non-ferrous containers: 32 tons (29 tonnes)
MRF Building	8,778 sq ft (815 m²)
DMR Storage	1,782 sq ft (165 m²)
Receiving Bays	15 ft x 25 ft (4 m x 8 m)
Estimated Electrical Load for Facility Equipment (based on 20hrs/week of operation)	Total load: 64 kW Duty load: 645 kWh
Estimated Additional Water Requirement for Operation	41.7 US gallons (158 litres) /hr
Design Life	30 years
Key Plant & Equipment	
Opening Hours	Monday to Friday: 08:00-18:00 Saturday: 08:00-16:00 Sunday, Christmas Day / Good Friday: Closed Bank Holidays: 08:00-16:00

4.1.1.9 Household Waste Recycling Center

The HWRC is the public's central drop-off point for recyclable/non-recyclable household waste, including specialist waste items such as hazardous household wastes. The HWRC will comprise two distinct areas: a covered, single level re-use centre and an open, split level recycling centre close to the Project Site main entrance and the Main Weighbridge.

Users of the recycling center will be directed to a dedicated one-way roadway system up onto the raised platform of the HWRC, where they will park in designated areas and deposit recyclable and non-recyclable household waste into dedicated containers depending on the type of waste being deposited. The containers will be emptied regularly each day and the waste transferred to the relevant Facility (via the Secondary Weighbridge) for processing as appropriate.

The recycling center will be accompanied by a re-use center which will be used to receive end of life goods together with unwanted but serviceable or repairable products that can be re-used or repurposed. These will then be made available free of charge to other members of the public or third sector organisations for beneficial re-use. Users of the re-use center will be directed to drive up onto the main HWRC depositing platform, park in designated bays and off-load waste into the designated separate waste containers. Secondly, drivers, if necessary, will then drive to the quarantine bay to dispose of any prohibited materials or hazardous waste.

The HWRC will consist of a fully concreted working platform with designated bays at the lower level for rollonoff container placement. Target materials for the lower-level bays include paper, cardboard, plastic, glass, metal, source segregated green waste, and inert and non-inert household waste. A part of the upper drop-off area will also be set aside for storage of smaller containers / bring banks. Target materials for the upper drop-off area include textiles, waste electronics, waste oils, used metal food/beverage cans, and other hazardous household waste. The containers will be emptied on a fill-and-exchange basis, with an estimation that containers will be emptied twice daily. Visitors will park opposite the designated bays and 'drop' recyclable waste from the raised deck into the containers below. To deposit materials into the rollonoff containers, members of the public will approach a nominal 3 ft (1 m) high wall or guard rail and 'drop' their waste into the designated bin.

The following Table 4.14 provides key design information.

Table 4.14 HWRC Facility key design features

HWRC Storage Capacity	20,000 tons/year (18,144 tonnes/year) - 55 tons/day (50 tonnes/day)
Receiving Bin Rollonoff Containers	20 - 40 cu yard (9 total containers) Additional space for 4 replacement/exchange rollonoff containers
Protective Guard Rails for Facility	Re-use Center: 42 inch high (1 m) (south and east end of open-sided Center) HWRC Waste drop-off spot: 3 ft high (1 m high)
Re-use Center Measurements	Covered drop-off area: 1,947 sq ft (181 m²) Re-use Center: 396 sq ft (37 m²) Workshop: 320 sq ft (30 m²) Office: 59 sq ft (5 m²) Secure storage room: 37 sq ft (3 m²) Restrooms: (male) 37 sq ft (3 m²), (female) 31 sq ft (2.5 m²) Security Fence: 8 ft high (2 m high)
Public & Staff Parking Bays	23 vehicle spaces 2 disabled spaces 1 servicing space
Estimated Electrical Load for Facility Equipment (based on 20hrs/week of operation)	Total load: 17 kW Duty load: 340 kWh
Estimated Additional Water Requirement for Operation	41.7 US gallons (158 litres)/hr
Design Life	Rollon/Rolloff bins: from year 5, replace 2 bins every year Rollon/Rolloff Site vehicles: replace every 8 years Building Structures: 30 years
Key Plant & Equipment	
Opening Hours	Wednesday to Friday: 07:00-19:00 Saturday, Sunday, Bank Holidays: 08:00-16:00 Christmas Day / Good Friday: Closed

4.1.1.10 Landfill Gas Facility

The Landfill Gas (LFG) Facility will be constructed to allow for the capture and destruction of LFG from the North Mound of the GTLF. Where possible, the captured LFG will be injected into the ERF to supplement the energy that will be recovered from the combustion of Waste. Otherwise, the captured LFG will be combusted using an LFG flare.

The elements that will be installed as part of the GTLF remediation scheme include gas field boreholes, control valves and manifolds, dewatering and condensate management equipment, and extraction blower and flare. Landfill gas will be extracted from the GTLF using a conventional gas extraction system of vertical wells bored into the landfill site, operating under slight negative pressure. The gas extraction will be controlled using established gas monitoring equipment (e.g., GEM 5000) to measure flow, pressure, and gas composition (including methane, carbon dioxide, carbon monoxide, nitrogen (as balance), hydrogen sulphide and oxygen).

The Landfill Gas Facility will be sized to accommodate the landfill gas projected to arise from the North Mound of the GTLF (including the North West Expansion Area). The LFG burner within the ERF furnace shall have a thermal capacity of 3 MW_{th}, with a 'turndown' limit of 1:4 (meaning the minimum LFG contribution that can be accommodated with this system is approximately 0.75 MW_{th} or 130 m^3/hr). The LFG burner design parameters will enable treatment of the maximum annual flowrate of gas as stated in the Waste Flow Model for up to around 2045. During times when the ERF is not operational and/or once the LFG contribution drops below 0.75 MW_{th}, the captured LFG will be diverted to the LFG flare. The LFG flare shall have a nominal capacity of 500 m^3 (17,657 cubic ft) /hr with a turndown limit of 1:5 (meaning the minimum LFG flow rate that can be accommodated by the LFG flare is approximately 100 m^3 (3531 cubic ft) /hr or up to around 2050).

The Landfill Gas Facility Responsibility Diagram below shows the demarcation boundary between those responsibilities under the landfill remediation contract, and those that are managed by ReGen.

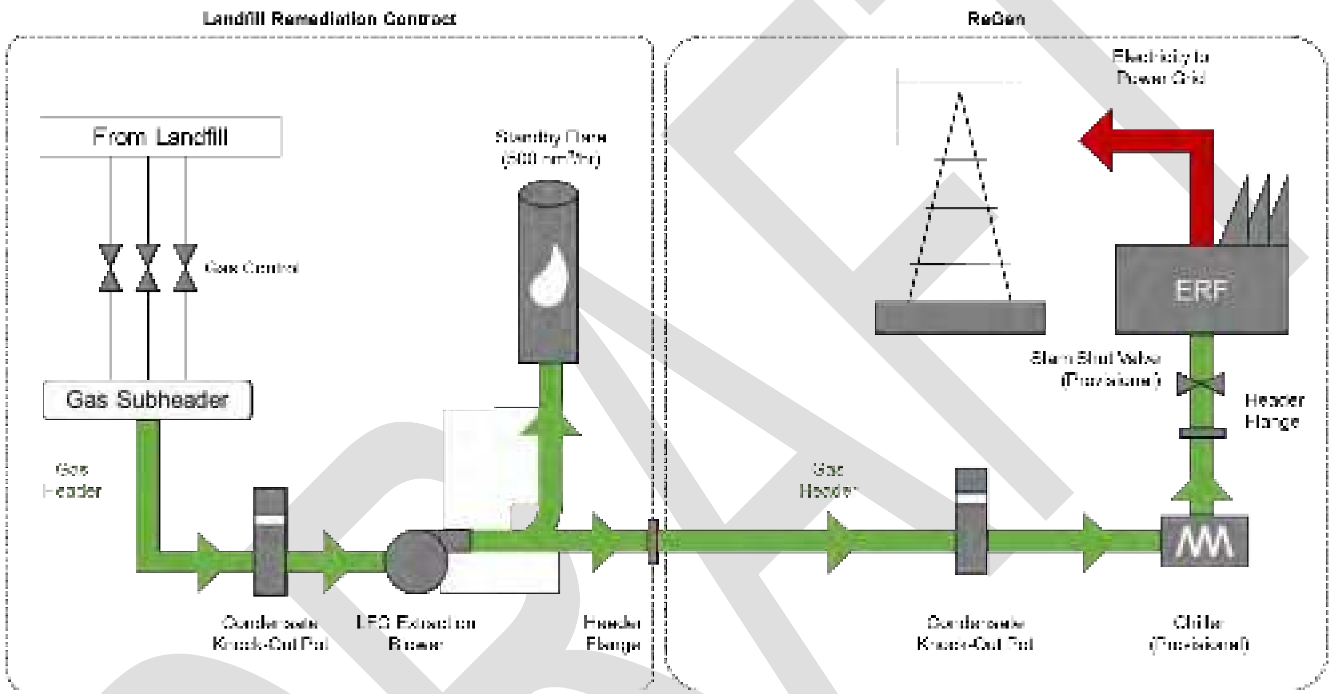


Figure 4.11 Landfill Gas Facility Responsibility Diagram

The following Table 4.15 provides key design information.

Table 4.15 Landfill Gas Facility key design features

LFG Flare Delivery Pipeline	Temperature: 55 degrees Celsius (131 degrees Fahrenheit) Pressure: 200 mbar(g)
Thermal Capacity of LFG Burner within ERF Furnace	3 MW_{th} ('turndown' limit of 1:4)
Methane Content of LFG Burner	35-60 percent (by volume)
LFG Flare Compound	8 ft high (2 m high) palisade fence
Standards	Florida Administrative Code No. 62-701.530: Gas Management Systems
Design Life	ERF burner & LFG flare: 15 years Structures: 30 years
Opening Hours	Restricted access to Contractor staff and pre-arranged visitors only.

4.1.1.11 Residual Waste Landfill

The RWL will be an engineered facility with a composite liner, leachate containment, leachate treatment, environmental controls and monitoring. The Landfill Facility will in part be located over the site of a previously constructed arsenic containing waste cell. As such, the new Landfill Facility will be developed to allow construction over the emplaced and lined arsenic pit. It will be designed to receive non-hazardous non-recoverable and / or residual wastes arising from ReGen's operations as well as receiving Wastes that cannot be processed at the other Facilities. Non-hazardous waste refers to all wastes, treated or otherwise that are considered non-leachate toxic as determined by the USEPA TCLP testing protocol. ReGen will commission a study that establishes the optimal mix of APCR, cement and pozzolan. The RWL will be capped and restored on a rolling basis and when suitable areas/cells of the Facility reach final levels. Capping will encompass provision of an engineered layer of material topped off with overlying soils and native grasses for general parkland after use.

The RWL will be developed as a single phase and operated in two phases as follows:

(Basal liner works)

– Phase 1: 2026 development for 2027 operational start
– Phase 2: 2026 development for 2042 operational start (timing to be revisited based on actual filling rates within Phase 1 of the RWL)

(Capping and restoration works)

– Phase 1:
  - 2032 works (20 percent of Phase 1 capping)
  - 2037 works (20 percent of Phase 1 capping)
  - 2042 works (20 percent of Phase 1 capping)
  - 2047 works (40 percent of Phase 1 capping)
– Phase 2:
  - 2047 works (20 percent of Phase 2 capping)
  - 2052 works (60 percent of Phase 2 capping)
  - 2053 works (20 percent of Phase 2 capping)

The RWL will in part be located over the site of a previously constructed arsenic containing waste cell. As such, the new RWL will be developed to allow construction over the emplaced and lined arsenic pit.

The RWL Facility layout is provided on Figure 4.12.

Figure 4.12 Residual Waste Landfill Facility layout

The following Table 4.16 provides key design information.

Table 4.16 RWL facility key design features

RWL Facility Capacity	240,000 tons (217,724 tonnes) (over Contract Period)
Estimated Annual Tonnage	25,000 tons (22,680 tonnes)
Total Size of Facility (in phased development)	Total: 8.1 acres (7.87 acres usable landfill) (3.27 hectares) Phase 1: 4.2 acres (1.7 hectares) Phase 2: 3.67 acres (1.5 hectares)
Slopes of Facility	1V(volume):3H(height) Maximum height: 50 ft (15 m) (above top of liner)
Estimated Electrical Load for Facility Equipment (based on 70hrs/week of operation)	Total load: 10 kW Duty load: 252 kWh

RWL Specific Standards	– Resource Conservation and Recovery Act (RCRA) (Sub-Title D Non-Hazardous Rules and Sub-Title C Hazardous Rules)
	– RCRA Subtitle D (258) Seismic Design Guidance for Municipal Solid Waste Landfill Facilities.
	– 40 Code of Federal Regulations
	  – Part 258 – Criteria for Municipal Solid Waste Landfills
	  – Part 264 – Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
	  – Part 265 – Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, And Disposal Facilities
	Standards for the GTLF design (remediated as part of the ISWMS Project):
	– Florida Administrative Code No. 62-701.500: Landfill Operation Requirements
	– Florida Administrative Code No. 62-701.600: Landfill Final Closure

Design Life	23 years
Key Plant & Equipment	
Opening Hours	Monday to Friday: 06:00-18:00 Saturday, Bank Holidays: 06:00-16:00 Sunday, Christmas Day / Good Friday: Closed

4.1.1.12 Ancillary Facilities

Administration Building – a two storey metal cladded, on a steel frame superstructure building of approximately 5500 square feet with a wrap-around balcony on the 2nd floor to complement educational and related viewing events. The Administration Building can accommodate supervised visitor groups of up to 35 people and provides space for meetings, educational displays, an eating area and associated toilets. The building is designed to enable wheelchair access. The building is adjacent to the main parking lot (67 spaces) for the ISWMS facility.

Maintenance Building – this will be for the storage of plant and equipment and for carrying out general maintenance of equipment associated with the ISWMS operation. It is metal cladded on a steel frame superstructure two storey, 6000 sf building, with bathroom, lunchroom, workshop, 2nd storey maintenance products mezzanine and a two-vehicle covered garage area. It is located centrally on the ISWMS for easy access by all areas of the Site in need of maintenance services.

CUC Substation - this will be a pre-fabricated building(s) with specialized switchgear for connecting to the grid. The Substation is a single story building that will be rated for CAT 5 hurricane winds. The floor will be approximately 12-13 ft above sea level to ensure it is well above the flood plain. The area around the substation will be filled and compacted to allow service vehicles to access the Site, park and service the equipment. The typical occupancy will be 1-2 people for monitoring and service.

4.1.2 Construction

A Construction Environmental Management Plan (CEMP) will be prepared prior to any construction activities taking place at the ISWMS Site. The CEMP will define the specific environmental mitigation measures to be applied on-Site, which will be consistent with the output of the EIA and associated Environmental Management Plan (EMP) and will demonstrate application of the relevant pollution prevention Legislation and Good Industry Practice. A Construction Traffic Management Plan (CTMP) will be prepared as part of CEMP and will include consideration of any abnormal loads; protocols for the movement of large industrial equipment to the ISWMS Site, considering Health & Safety and protection of utilities along the path; signage warning other users of the construction; information regarding road maintenance and cleaning; specific timings to avoid peak traffic within the surrounding area; wheel cleaning/dirt control arrangements at key stages of construction; and provision of temporary signs and traffic control where necessary.

Similarly, a Site Waste Management Plan (SWMP) will be prepared prior to commencing works at the ISWMS Site. The SWMP will include measures to identify the volume and type of material likely to arise from Site clearance operations, opportunities for the reuse and recovery of materials and demonstrate how volumes of waste will be minimised and managed. The SWMP will set standards and strategies for effective waste minimisation that will be followed by all of the Construction Sub-Contractors.

All works and ancillary operations that are audible at sensitive receptors beyond the ISWMS Site boundary shall be carried out between the hours of 8 am and 6 pm only.

Pre-Construction

Prior to commencing the construction of the ISWMS facilities, appropriate geotechnical investigations and surveys to supplement the existing information on soil conditions carried out prior to financial close for the Project as part of the Site investigation studies will be undertaken. The purpose of the additional geotechnical investigation is to provide detailed geological and geotechnical information for layers of made ground (which will be used mainly for road design), peat and unconsolidated limestone and characteristics of the underlying Dolostone bedrock (which will be used mainly for foundation design). Consideration will be given to the appropriate use of either a traditional shallow and/or a piled foundation design. The structures constructed at each facility may be founded on piles, hence special attention will be paid to relevant characteristics such as cementation of both the limestone and the Dolostone bedrock.

Sustainable construction practices that will be adopted include:

– Buildings will be designed as 'flexible' where practicable and sustainable to enable them to be reused and reconfigured to meet future needs (e.g., Legio type blocks for internal pushwalls).
– The use of locally available material in construction will be maximized (including C&D waste).
– Prefabrication of structural / mechanical elements will be used where practicable.

Site Preparation

Site preparation will involve clearance works, Site levelling, compaction and demolition, as required.

Extents of the existing arsenic pit will be carefully defined and marked out and thereafter prepared to receive the overlying RWL.

Similarly, the hydrocarbon contaminated area of the Site currently occupied by DEH's Site operations will be prepared to receive the overlying RWL, including any identified remediation works.

Construction

The intention is that all ISWMS facilities should come online at approximately the same time.

It is anticipated that design, engineering, procurement and construction – including Site preparation and auxiliary works – for the ERF and non-ERF facilities will take approximately 130 to 140 weeks, anticipated to begin in 2024 and complete in 2027.

For the purposes of reviewing the potential impacts from a construction perspective, the effects may arise from the construction activities themselves, or from the temporary occupation of land. With this in mind, when assessing construction related impacts, a combination of Site preparation activities and the following major works will be taken into consideration:

- Piling and foundation works/ other hard surfaces (i.e. internal road construction).
- Erection of buildings.
- Construction machinery required.

Construction staff

It is expected that at its peak activity period approximately 300 construction staff would be required to construct the ISWMS Site including the associated buildings. The construction phase is a temporary condition and the 300 personnel will only be on-Site during the peak construction stage. There is aspiration for up to 100 personnel to be local Caymanian residents as employees or subcontractors. The sourcing of construction personnel from the Cayman Islands will be prioritised, however, for the remaining workforce, and where workers are unable to be sourced from within the Cayman Islands, personnel may be engaged from elsewhere, including from other surrounding Caribbean islands and overseas. Apprenticeships, traineeships and work experience opportunities will be provided to construction employees throughout the works period.

An Employment and Skills Plan will be prepared prior to the commencement of Site works with the aim to:

- Promote the availability of both skilled and unskilled employment opportunities within the Project.
- Encourage the workless and new entrants into the workforce.
- Ensure compliance with the relevant labour Legislation in the Cayman Islands by setting out the particular requirements.
- Improve the skills of the local workforce, both new and existing by encouraging transition from expats to local employment over the course of time.
- Provide apprenticeships, traineeships and work experience opportunities throughout the Works Period.

The Employment and Skills Plan will include, at a minimum:

- Staffing capacity
- Staff training and performance assessment procedures
- Details of induction training for staff and visitors
- Working hours and shift patterns for each Facility
- Number of supervisors and use of sub-contractors
- Details of experience and qualifications required of key Project personnel
- Staff welfare policy
- Job descriptions
- Backup arrangements in case of shortages, seasonal and exceptional staffing requirements

Annual reviews of the Employment and Skills Plan will be undertaken to ensure relevance and appropriateness and to monitor performance. As part of the Employment and Skills Plan, an "Employees Handbook" will be developed that sets out the rights and responsibilities of all members of staff during the Services period.

Procurement

ReGen is committed to supporting the Cayman Islands through the procurement with local businesses. ReGen will develop a procurement plan, to support procurement activities required for the construction and operation of the Project, and to leverage local contractors, where feasible. Procurement for the Project will, at a minimum, involve:

- Bid packages: which will be developed to make best use of local contractors and their capabilities.
- A procurement plan will be developed to include target dates for scope development.

Procurement planning will be developed to assist local contractors and businesses in understanding the opportunity and scope of the Project procurement requirements and allow for involvement in the tendering process for bid packages.

4.2 Concerns and Constraints

The following table provides a summary of potential risks associated with the ISWMS Project.

Table 4.17 ISWMS risk summary table

Risk description	Impact	Likelihood	Initial Risk	Mitigation	Mitigated Risk
Cayman Island does not have an environmental regulatory framework to establish requirements for emission limits for energy from waste and other waste management facilities. There is a risk that a new waste facility may be required to be redesigned as a result of the EIA assessment.	High	Possible	High	The Project has adopted EU Directive 2010/75/EU (Industrial Emissions Directive) and requires the energy from waste facility processes to comply with European emissions criteria which is recognised as a leading industry standard.	Low
Cayman Islands does not have engineering standards for the design, construction and safe operation of an energy from waste and other waste management facilities. There is a risk during the EIA process that CIG relevant authorities take a different view to that of the Project on standards and consent requirements for the new facilities.	High	Possible	High	ReGen has adopted proven internationally recognised engineering codes and standards from mature markets for the design and construction of ERF and non-ERF facilities. It has specified a hierarchy for standards, prioritising European standards but also accepting alternative American standards. CIG has reviewed and agreed with the use of these standards.	Low
Waste composition is different to that anticipated baseline waste composition.	Moderate	Possible	Moderate	This is mitigated by the following: Weighbridge data contains a split between different waste types to provide a granular view of historic waste flows. Analysis has been undertaken comparing the waste flows to similar geographies. Equipment has been designed with redundancy (as sized for the maximum of the 25 year stream) and flexibility in mind. The ERF is designed to take a wide range of unprocessed waste. ReGen is able to direct differing quantities of Waste to the ERF and non-ERF on as 'as needed' basis.	Low
The Project runs out of Residual Waste Landfill space meaning the Project cannot landfill APCR / other items	Moderate	Possible	Moderate	If the original landfill is full, alternative locations will need to be identified nearby or otherwise on island.	Low

Risk description	Impact	Likelihood	Initial Risk	Mitigation	Mitigated Risk
Potential limitations of the ERF to process waste with lower or higher NCV.	Moderate	Possible	Moderate	The ERF operating range for acceptable waste heat rate, as indicated in the firing diagram, is significantly wider (LHV range of 7 to 13 MJ/kg) than the anticipated blended waste CV range.	Low
Landfill gas yield is higher than anticipated, resulting in the input reaching or exceeding the ERF input limit.	Moderate	Possible	Moderate	Surplus gas able to be diverted to LFG flare. Possible additional source of revenue if divert to new LFG to energy engine (out of ISWMS scope).	Low
Risk of hurricane flooding which will negatively impact or prevent operation of the ISWMS waste facilities and could result in water damage of equipment. The Cayman Islands does not currently have FEMA flood maps or established Flood Insurance Study reports.	High	Possible	High	APEC has utilised documented flood data from Hurricane Ivan which it considers equate closely to a 100-year design flood event. Based on the proposed location of the Facility and associated FEMA coastal zoning assessed by APEC, project Design Flood Elevation (DFE) for each facility building have been developed in accordance with their occupancy categories. These have been adopted by the Project. The location of the Site is in the centre of the island, approximately 1640 ft (500 m) from the shoreline. This location is anticipated to reduce exposure to storm surges and exposure to flooding.	Moderate
Risk of damage to buildings and equipment as a result of hurricane strength wind force and wind-borne debris.	High	Possible	High	Project technical specifications for the ERF incorporate civil design standards (e.g., ASCE 7-10) to augment the design and incorporate hurricane wind design parameters (89.4 m/s – 200 mph) to reduce the risk impact of damage to buildings and structures.	Low
Grand Cayman is in a tectonically active area. There is a risk of damage to buildings and equipment due to seismic activities.	High	Possible	High	The seismic design for structures in the Cayman Islands is in accordance with the 2009 International Building Code (IBC) as modified by the Cayman Islands Building Control Unit (BCU). The IBC references the American Society of Civil Engineers (ASCE) standard ASCE 7: "Minimum Design Loads for Buildings and Other Structures" as an acceptable design standard. The Project has adopted the above codes and standards for the design of all buildings and structures.	Moderate
Inadequate design of Site roads and access does not accommodate heavy vehicles with large turning circles.	Low	Low	Moderate	Concept design for Site roads have included full swept path analysis undertaken for the longest wheel base delivery vehicles (WB-40) of waste and other materials.	Low
Nuisance complaints concerning odours from the ERF waste bunker.	Moderate	Possible	Moderate	The ERF Site location minimises exposure to nearby receptors. The location of the ERF on the Site places it as far as possible from the nearest private residence (receptor), located towards the West. To the east and south are light industrial areas while to the north is the GTLF area which will be capped. During ERF operation, the waste bunker and tipping hall buildings are kept at a slight negative pressure by the extraction of primary combustion air from the building space, in doing so, avoid odour escape from the buildings. During forced outage of the ERF, an air extraction system on the roof of the waste bunker / tipping building will provide a predetermined number of air exchanges to prevent the build-up of odours inside the buildings.	Low

Risk description	Impact	Likelihood	Initial Risk	Mitigation	Mitigated Risk
				For planned outage, the waste bunker volume will be run down empty or as low as possible to minimise material causing odour during this period.	
Capacity of any non-ERF facility undersized.	Moderate	Possible	Moderate	Processing capacities have been sized to the maximum level of approved waste during the life of the Project.	Low
Breakdown of the entry or exit main weighbridges will disrupt waste deliveries to all ISWMS facilities.	High	Possible	High	If either entry or exit main weighbridge is out of action, the other main weighbridge can, with minimum intervention, function as both entry and exit weighbridge. The secondary weighbridge can be used as alternative to either entry or exit main weight bridge or function as both entry and exit weighbridge.	Low
Nuisance complaints concerning noise generated in green waste facility.	Moderate	Possible	Moderate	Project Site is located within a designated industrial area. Green waste processing operations have been sited in a central location on the Project Site to maximise distance to nearby receptors and reduce auditable noise. Green waste reception area layout developed to distance high noise-emitting equipment from potential nearby receptors with Legio-type blocks providing additional noise absorption. Equipment will be regularly serviced and well-maintained to minimise noise emissions. Noise levels from the green waste processing operations will further be considered as part of the EIA for the ISWMS Site, with additional noise mitigations measures being provided as necessary.	Low
Nuisance complaints concerning odours from green waste, mulch and compost storage and leachate storage lagoon.	Moderate	Possible	Moderate	Green Waste Facility sited in a central location on the Project Site to maximise the distance to nearby receptors. Odour (and bioaerosol) management will be considered as part of the EIA for the ISWMS Site, with additional mitigations measures being provided in addition to general good management and housekeeping practices management as necessary. Good industry management practices to be adopted in EMP including: Locate 'problem' areas and prioritise actions to address any complaints. Regularly check for further odours and develop an appropriate corrective action programme. Manage material deliveries and processing rates. Increase the frequency of cleaning.	Low
Green waste operations generate large quantities of dust	Moderate	Possible	Moderate	Regular inspection of facility and implementing good housekeeping action per EMP when required; Shredding and grinding operations will be undertaken in the open air. On-Site speed of vehicles to be restricted. Street sweeper to be used at Green Waste Facility if required.	Low

Risk description	Impact	Likelihood	Initial Risk	Mitigation	Mitigated Risk
				Wheel washing facility located close to Green Waste Facility.	
Risk of fire due to combustible nature of green waste.	Moderate	Possible	Moderate	Inclusion of fire breaks in storage area. Green Waste Facility fire protection to be provided (ring main and hose reels).	Moderate
Nuisance complaints concerning noise generated in C&D waste facility.	Moderate	Possible	Moderate	C&D process operations that have a high noise level (shredder and crusher) will only be activated intermittently which will reduce noise emission duration. The layout of the C&D reception area has been developed to distance these pieces of equipment from nearby receptors, with the BA Processing Facility building and George Town Landfill Facility providing additional noise absorption. Equipment will be regularly serviced and well-maintained to minimise noise emissions. Noise levels from the C&D Processing operations will further be considered as part of the EIA for the ISWMS Site, with additional noise mitigations measures being provided as necessary.	Low
Risk of fire due to combustible components of the C&D waste.	Moderate	Possible	Moderate	C&D Facility fire protection to be provided (ring main and hose reels).	Moderate
C&D process generate large quantities of dust.	Moderate	Possible	Moderate	Regular inspection of facility and implementing good housekeeping action when required. The C&D processing operations will be undertaken in the open air and crushing and screening equipment will be fitted with water misters to reduce dust emissions. On-Site speed of vehicles to be restricted. Wheel wash facility located on the Project Site.	Low
Nuisance complaints concerning noise generated in BA Waste Facility.	Moderate	Possible	Moderate	The BA process operations that have a high noise level (trommel) will only be activated intermittently which will minimise noise emissions duration. The layout of the BA Processing Facility has been developed to distance these pieces of equipment as possible from adjacent receptors, with the BA Processing Facility building providing additional noise absorption. Equipment will be regularly serviced and well-maintained to minimise noise emissions. Noise levels from the BA Processing operations will further be considered as part of the EIA for the ISWMS Site, with additional noise mitigations measures being provided as necessary.	Low
Transfer of APCR into the mixer trucks can generate dust of a hazardous nature which can contaminate the immediate area and expose personnel.	High	Likely	High	Detail design shall consider including dedusting (suction to filter) in order to avoid dust emissions during the residues discharge from silo the truck. A system of humidification of the APCR will be provided for the flue gas residue discharge process.	Low

Risk description	Impact	Likelihood	Initial Risk	Mitigation	Mitigated Risk
APCR dosing insufficient to provide stabilised material, suitable for disposal in non-hazardous landfill.	High	Possible	Moderate	Dosing mix to be developed based on indicative and then actual samples of ISWMS APCR, comprising a combination of APCR, water, cement and / or pozzolan. Dosing to be undertaken in pan mixed adjacent to APCR storage silo, providing reasonable quality control of dosing process. Additional mixing provided by cement mixer *en route* to Landfill Facility. Samples of dosed materials tested annually for compliance with TCLP standard.	Low
Elevated fire risk due to presence of flammable and combustible liquids (petrol, diesel) that are extracted from ELVs as well as other combustible components (e.g., tyres).	High	Likely	High	Fire strategy document to be developed for the ISWMS Project. Fire protection system to be developed in accordance with outcome of fire risk assessment. Detail design of ELV Facility layout to incorporate process separation distances to reduce fire spread risks. ELV procedures to be developed with a specific focus on safety and risk mitigation. Fire management system to include both detection and protection measures appropriate for the specific risks at the ELV.	Moderate
Nuisance complaints concerning noise from the ELV Facility.	Moderate	High	Moderate	High noise emitting equipment (baler and shear in particular) will only be used intermittently to minimise noise exposure time. The layout of the reception area has been developed to distance these pieces of equipment as far as possible from nearby receptors, with the adjacent (raised) car storage area providing additional noise absorption. Depollution activities will be undertaken within a covered building which will help noise absorption. Equipment will be regularly serviced and well-maintained to minimise noise emissions. Noise levels from the ELV and scrap metal processing operations will be considered further as part of the EIA for the ISWMS Site, with additional noise mitigations measures being provided as necessary.	Low
Leachate / waste oils release into the environment	High	Possible	High	Depolluting (including oil removal) to be undertaken inside ELV roofed area fitted with fully sealed concreate floor slab, sloped to drain all surface runoff to central drain point from where waste stream is forwarded to oily water separator(s). Liquid storage areas provided with bunded storage capacity, spill trays, etc. RWL will be fully sealed. Leachable contaminants t in RWL locked in by mixing APCR with cement and pozzolan. Leachate from RWL treated via on-Site Leachate Treatment Plant.	Moderate

Risk description	Impact	Likelihood	Initial Risk	Mitigation	Mitigated Risk
Nuisance complaints concerning odours from the Medical Waste Facility.	Moderate	Possible	Moderate	Location of the Medical Waste Facility selected to be maximum distance from off-Site receptors and from on-Site receptors (ERF and non-ERF facilities). Low volumes of incoming medical waste materials and batched incineration result in minimum on-Site storage and retention time for medical waste. No odour from medical waste once combusted.	Low
Personnel exposure to sharps, broken glass, infectious and other unsafe items	Moderate	Likely	High	Incoming medical waste arrives in enclosed containers or transferred into enclosed containers directly on arrival. Automated bin-lift eliminates manual handling required and exposure of personnel to waste.	Low
Medical waste incinerator does not comply with the requirements of Cayman environmental requirements.	High	Possible	High	Preliminary information indicates that emission from the incinerator will comply with Cayman environmental requirements. Provision has been made for the addition of a wet scrubber in the event that this will become a requirement.	Moderate
Operational security and safety risk to Site personnel from possible attacks and theft (by third parties) of contraband drugs destined for incineration at the Medical Waste Facility.	Moderate	Possible	Moderate	Agreement to be sort from CIG/local law enforcement to obtain additional security for the transportation, delivery and attendance of incineration process of contraband drugs. Incinerator batch process result in untreated waste being on-Site for short time periods. Very low anticipated process rate reduces risk likelihood.	Low
Nuisance complaints concerning noise from MRF process and equipment.	Moderate	Possible	Moderate	High noise emitting equipment (baler and glass crusher) will only be used intermittently to minimise noise exposure time. The MRF processing operations will involve the intermittent use of several pieces of noisy equipment, particularly the baler and glass crusher. The concept layout of the MRF has been designed to distance these pieces of equipment from potential receptors. Enclosed MRF building and process rooms will provide a level of noise absorption. Equipment will be regularly serviced and well-maintained to minimise noise emissions. Noise levels from the MRF operations will further be considered as part of the EIA for the ISWMS Site, with additional noise mitigations measures being provided as necessary.	Low
Personnel safety risk from contact with broken glass in MRF.	Moderate	Possible	Moderate	Glass to be managed as a separate collection and process stream (containers, feed hoppers, conveyors, pulveriser, bulk bagging) involving no manual handling of glass and no personnel contact with glass. Glass spillage clean-up to be managed by safe procedures and PPE.	Low
Fire risk at MRF due to large quantities of combustible paper and plastic material	Moderate	Possible	Moderate	Fire strategy document to be developed for the ISWMS Project. Fire protection system to be developed in accordance with outcome of fire risk assessment.	Low

Risk description	Impact	Likelihood	Initial Risk	Mitigation	Mitigated Risk
				Detail design of MRF Facility layout to incorporate process separation distances to reduce impact of a potential fire; Fire management system to include both detection and protection measures appropriate for the specific risks at the ELV. Concept design includes fire ring main and hose reels at MRF building.	
Leachate discharge from new RWL is released into environment, potentially contaminating ground water.	High	Possible	High	New RWL will be fully lined to prevent leachate release to the surrounding environment. Leachate contaminant concentration will be minimised by APCR stabilisation prior to deposition in RWL. Leachate collection pipework will be installed inside the lined RWL. Collected leachate will be treated via an adjacent Leachate Treatment Facility prior to discharge/release from Site.	Low
The required Facilities on the Sister Island and associated logistics between Grand Cayman, Cayman Brac and Little Cayman are currently under discussion with CIG.	High	Possible	High	Specific Sister Island Facility requirements to be agreed between CIG and ReGen. O&M structure to be defined with CIG. Logistics arrangements to be agreed with CIG.	Moderate

5. Stakeholder Engagement and Public Consultation

A consultation program has been developed and implemented as part of the Environmental Impact Assessment (EIA) Process for the ISWMS Project. Consultation or public involvement is recommended for projects that require regulatory review and approval by governing agencies, and where project components may affect members of the public and/or raise environmental concerns. As such, successful implementation of the ISWMS requires a commitment to open dialogue and a mutually inclusive communications campaign with multiple stakeholders (public, public agencies, etc.). This chapter describes the stakeholder engagement and public consultation carried out for the ISWMS EIA.

5.1 Consultation requirements for EIA

As per the EIA Directive[1], there are two mandatory points of public consultation that occur during an EIA:

– Draft Terms of Reference (ToR) review and comment
– Draft Environmental Statement (ES) review and comment

Per the EIA Directive, pending initial review and comment by the Environmental Assessment Board (EAB), the Draft ToR is released to the public to ensure that it addresses the likely significant issues of importance. Prior to such review, the following procedures are required:

– Publication of the Draft ToR or a link thereto on the Department of Environment's (DoE's) website for a period of 21 consecutive days.
– Notification of the publication and public meeting in the local press on two separate occasions, within 10 days prior to the publication of the Draft ToR.
– Public meetings at venues to be agreed with the EAB to present the Draft ToR. The meetings will be held at least 7 days prior to the end of the consultation period.

Comments on the published Draft ToR are to be submitted in writing to the EAB care of the DoE via email post or hand delivery to offices of the DoE. Comments from the National Conservation Council on the Draft ToR are also to be received at this time. The EAB works with the Proponent to ensure that all relevant comments are reflected in the Final ToR, and the Proponent shall provide a written response to the consultation comments. All responses will be appended to the Final ToR. Once the ToR has been finalized by the EAB and the Proponent, inclusive of the relevant concerns of the public and National Conservation Council, the EIA may commence. A summary of the public meetings carried out in support of the Draft ToR is provided in Section 5.5.

Consultation on the ES will be undertaken when the Draft ES is completed in order to consider representations, valid views, and concerns from the public and key stakeholder groups. This consultation will include, at a minimum:

– The publication of the Draft ES or a link to the statement on the DoE website for a period of 21 consecutive days.
– Notification of the publication of the Draft ES, and a public meeting in the local press on two separate occasions within 10 days before the statement's publication.
– Public meetings at venues to be agreed with EAB to present the Draft ES. Meetings will be held at least seven days prior to the end of the consultation period.

[1] Directive for Environmental Impact Assessments Section 43, National Conservation Act (Extraordinary Gazette No. 50/2016, June 29, 2016) issued in accordance with Sections 3(12)(j) and 43(2)(c) of The National Conservation Act (Supplement No. 1, Extraordinary Gazette, February 5, 2014)

The Proponent will respond to, and address, representations received during consultation on the Draft ES. These representations and responses will be appended to the Final ES.

5.2 Consultation framework

A formal consultation framework for the ISWMS has been developed in collaboration with ReGen and the Cayman Islands Government (CIG) and its respective consultants to satisfy the public consultation requirements of the EIA as well as engage and educate the public and key stakeholders about the ISWMS Project, including 'Energy from Waste' (EfW) technology and address concerns around environmental and human health impacts from emissions. Developing a framework for consultation and its implementation ensures that project information is provided to the general public and public agencies at an early stage and throughout the project at various milestones during the regulatory review. The framework provides a schedule for engagement opportunities and chronology, creating transparency with the public throughout the Project.

The main goals of the consultation framework include the following:

– Satisfy public consultation requirements per the EIA Directive
– Improve efficiency of communication with the public and stakeholders
– Maintain and improve relationships with stakeholders, including neighbors, and the broader community
– Demonstrate willingness to listen and consider input from stakeholders
– Enhance the reputation of ReGen as a responsible entity for managing waste

It is important to facilitate conversations with the public and stakeholders so that they are meaningfully involved in the Project, their comments are considered early, concerns are noted, and feedback is provided about how such input influenced Project decisions. This is done through formal comment periods, including a sign-in sheet, comment forms, and comment drop-off box. Special considerations may be given to any concerns raised by stakeholders that contribute to Project planning. Ultimately, an effective consultation process results in a more refined and clearer ES.

5.3 Stakeholder communications

As part of its communications strategy, the Proponent has developed a public-facing website, (regen.ky) that outlines a description of the project, associated visuals, facilities, local impacts, energy recovery and recycling processes, and frequently asked questions. Users and interested parties can subscribe to an e-newsletter to receive project updates as they occur and follow ReGen's social media accounts, including:

– Facebook: https://www.facebook.com/regencayman
– Instagram: https://www.instagram.com/regen_cayman/
– Twitter: https://twitter.com/regencayman
– LinkedIn: https://www.linkedin.com/company/regencayman/
– YouTube: https://www.youtube.com/@regencayman9032

The goal of the communication strategy is to provide effective communication channels, enable information to be circulated, allow for informal and formal discussion, and to provide a mechanism for service improvement, dispute resolution, communication, and education.

The following table outlines the informal stakeholder communication meetings and events that have taken place during and in support of the ISWMS EIA:

Table 5.1 Stakeholder communication meetings and events

Date	Event	Description
May 2021	Presentation to Cayman Chamber of Commerce and CIG Overseas Ambassadors	Presentation on ReGen Project hosted in chamber of Commerce Board Room
June 2021	ToR Public Consultation Meeting	West Bay – Presentation to public of ToR for ISWMS EIA. Q&A
June 2021	ToR Public Consultation Meeting	George Town – Presentation to public of ToR for ISWMS EIA. Q&A
June 2021	ToR Public Consultation Meeting	Bodden Town – Presentation to public of ToR for ISWMS EIA. Q&A
July 2021	Presentation to Camana Bay and Olea Residents and Businesses	Presentation hosted in Camana Bay Cinema on ReGen Project
October 2021	Presentation to Healthcare Conference	Presentation on ReGen Project, waste management and its potential impact on human health
November 2021	Presentation to Parkway Residents	Teams Presentation to Parkway (Neighbouring community) on ReGen project
April 2022	Presentation to Cayman Prep Year 12 Students to support graded project	Annual presentation to students on ReGen project and GTLF remediation
April 2022	Presentation to CIS Year 10 students	Presentation on ReGen Project and sustainable development
April 2022	Presentation at Royal Institute of Chartered Surveyors Conference (RICS)	ReGen and sustainability in construction presentation at the RICS conference held at Ritz Carlton
August 2022	Presentation to Cayman Society of Architects, Surveyors and Engineers (CASE) Members	Presentation in Camana Bay Cinema presenting the ReGen project and exploring educational and employment opportunities
March 2023	Presentation to Cayman Prep Year 12 Students to support graded project	Annual presentation to students on ReGen project and GTLF remediation
April 2023	Protecting Paradise Podcast	Audio and Video podcast hosted by Bella Rooney of Plastic Free Cayman focused on the ReGen Project and sustainability in the Cayman Islands.
July 2023	Teams presentation to Cayman Connection (UK)	Presentation focused on updating Caymanians living overseas on the ReGen project
Ongoing	Social Media	ReGen posts on LinkedIn, Facebook, Instagram and Twitter
Ongoing	Camana Bay Times	ReGen / Waste & Environment related articles published intermittently

5.4 EIA coordination and meetings

Meetings between the Proponent, EAB, and other agencies are held throughout the EIA to introduce the Project, conduct Site visits, source data from the agencies, and coordinate design and technical components. The EAB is a subcommittee of the National Conservation Council.

The following table documents the EAB coordination meetings that have taken place as part of the EIA:

Table 5.2 EIA coordination meetings

Date	Participants	Purpose
02-Sep-22	EAB, DART, GHD	EIA phase launch
02-Feb-23	EAB, DART, GHD	Schedule and Scope Review
10-Mar-23	EAB, DoE, DART, GHD	Chapter 2 (Project Need & Policy Context) & 3 (Project Site, Existing Facilities & Key Constraints) review meeting

Date	Participants	Purpose
14-Mar-23	DoE, DART, GHD	Chapter 4 (Proposed Project) review meeting
18-Apr-23	EAB, DART, GHD	Chapter 6 (Marine Ecology) & 7 (Terrestrial Ecology) review meeting
27-Apr-23	EAB, DART, GHD	Chapter 12 (Noise and Vibration) review meeting
10-May-23	DoE, DART, GHD	Chapter 6 (Marine Ecology) & 7 (Terrestrial Ecology) follow up discussion
24-May-23	EAB, DART, GHD, APEC	Chapter 13 (Traffic &Transport) review meeting
13-Jun-23	EAB, DART, GHD	Chapter 11 (Air Quality & Greenhouse Gases Emissions), 1 (Introduction) & 4 (Proposed Project) review meeting
27-Jun-23	EAB, DART, GHD	Chapter 9 (Land Quality) review meeting
18-Jul-23	EAB, DART, GHD	Chapter 10 (Landscape & Visual) & 14 (Socio-Economics) review meeting
25-Jul-23	EAB, DART, GHD	Chapter 5 (Stakeholder Engagement & Public Consultation), 8 (Hydrology & Hydrogeology) & 15 (Summary of Impact Assessment)

Consultation was also carried out with relevant members of EAB to prepare the Methods Statements that guided the EIA workplans for hydrology and hydrogeology, air quality and greenhouse gas emissions, and traffic and transport.

5.5 Public Sessions for the Draft ToR

Mandatory public consultation on the Draft ToR was carried out in June 2021 via three public meetings held on separate dates in different areas of Grand Cayman following release of the Draft ToR for public comment. The public comment period was open for 21 days during which a total of nine comment submissions were received by members of the public. Following the comment period, the comments received on the Draft ToR were incorporated into the finalized ToR. On October 8, 2021, the ToR was finalized and accepted by the EAB and uploaded to ReGen and DoE websites for public access.

5.6 Public Sessions for the Draft ES

As noted above, consultation on the ES will be undertaken upon completion of the Draft ES to consider input on the EIA from members of the public. This process represents the final stage of refinement of the scope of the EIA. At this time it is crucial to inform members of the public the factual information about the project and encourage transparent communication so that different perspectives are heard and discussed.

There will be a public session at each of the three following locations: West Bay – John Gray Memorial Hall, George Town – Harquail Theatre, and George Town (east) – Mary Miller Hall. The public sessions will be held on consecutive days between the hours of 7:00 pm – 9:00 pm and at least one meeting will be live-streamed via the Cayman Islands Government online streaming services, CIGTV.

Information at public meetings will be displayed on poster boards for public view with representatives from Dart, CIG, and EAB available to answer or direct questions. A joint PowerPoint presentation shared between GHD and APEC (as technical consultants), Dart, CIG, and DoE will also be included. The following outlines the proposed content for each public meeting:

Project information poster boards:

– EIA process
– EAB and Dart
– EIA chapters and list consultants
– Site location, existing site and surroundings and zoning
– Proposed infrastructure
– EfW generic and energy recovery facility (ERF) technology flow diagram and explanation

- Waste hierarchy and power production
- EIA summary

Presentation:

- EIA process
- Project history
- Strategic solutions
- Summary of EIA

The proposed representatives from each organization are shown in the following Table 5.3.

Table 5.3 Staff attendance at public meetings

Staff Member	Organization
Richard McAree (Project Manager)	Dart
Sai Nidval	Dart
Ben Meade	Dart
Bethany-Ebanks-Pacheco	Dart
Erin Bodden	Dart
Andrew Small	Dart
Martin Edelenbos	Dart
Naomi Law	Dart
Blair Shoniker (Consultant Project Manager)	GHD
Erika Brown	GHD
Laura Lawlor	GHD
Gord Reusing	GHD
Denis Murphy	APEC
Ali Sabti	APEC
Gina Ebanks-Petrie	Director – DoE (EAB)
Lauren Dombowsky	DoE
Jennifer Ahearn (or representative)	CO Ministry of Sustainability and Climate Resiliency
Hannah Reid	Ministry of Sustainability and Climate Resiliency
Richard Simms	DEH
Tim Austin	DoE (EAB)
(Moderator)	TBC

There will also be a Virtual Engagement Room (VER) option for those that cannot attend public sessions in person. This style of session will contain the same material presented at in-person public meetings but in a virtual setting.

5.6.1 Materials Presented at the Draft ES Public Sessions

The materials and presentations will be summarized and provided as an appendix to the Final ES.

6. Marine Ecology

6.1 Purpose

GHD Limited (GHD) was retained by ReGen and the Cayman Islands Government (CIG) as approved by the Environmental Assessment Board (EAB) to determine the existing conditions and impact assessment of the marine environment in the vicinity of the proposed Integrated Solid Waste Management System (ISWMS) Site. GHD's ecologists have completed background information reviews to characterize the associated marine environment, with a focus on marine and coastal habitats, wildlife, protected species, and significant natural areas. The purpose of this chapter is to document:

- Environmental policy potentially applicable to the proposed works
- Methodology for the background review
- Existing marine environmental conditions[1]
- Impact of the proposed project
- Monitoring measures

6.2 Study Area

A Study Area was developed as part of the Terms of Reference (ToR) to determine if any nationally designated sites, significant natural areas, habitats, or protected species could occur within or near the proposed ISWMS Site. This Marine Ecology Study Area included the North Sound as well as wider coastal waters from the mean high-water mark on Grand Cayman out to 12 nautical miles (22.2 kilometres [km]) (Figure 6.1).

[1] Existing conditions are based on the time of EAB acceptance of the ISWMS Environmental Impact Assessment Terms of Reference in September 2021.

Figure 6.1 Marine Ecology Study Area

6.3 Applicable standards and guidelines

This section identifies Territory and other regulatory legislation and policies that are applicable and relevant to the Study Area and the immediate vicinity. This includes policies that triggered the study. These documents may identify natural features, protected species, and other habitat, as well as other features relevant to this Study Area.

6.3.1 Cayman Island National Trust Act

The *Cayman Island National Trust Act*[2] establishes the National Trust for the Cayman Islands as a corporate body. It shall manage and conserve natural and cultural beauty and wealth of Cayman Islands including submarine areas.

The purpose of the Trust is:

– The preservation of the historic, natural, and maritime heritage of the Islands through the preservation of areas, sites, buildings, structures, and objects of historic or cultural significance.
– The conservation of lands, natural features, and submarine areas of beauty, historic or environmental importance which the Trust may have acquired through gift, bequest, purchase, lease, or other means.
– The protection of native flora and fauna.

6.3.2 Cayman Islands (Territorial Sea) Order

This 1989 Order extends the boundaries of the Colony of the Cayman Islands so as to include, as territorial sea, the sea within 12 nautical miles (22.2 kilometres) of the baselines of the Cayman Islands, together with its seabed and subsoil, and makes other provisions in this connection. This includes the coast of all islands comprised in the territory. In particular, the Order defines the baseline from which the breadth of the territorial sea is measured as generally the low-water line, except where there are fringing reefs or bays.

6.3.3 National Conservation Act

The *National Conservation Act* (NCL)[3] makes provision for the conservation of wildlife and the environment in the Cayman Islands and provides for enforcement and penalties. The NCL incorporated the Species Conservation Plan for Mangroves which came into effect on 26 April 2020, which lists Species at Risk under Part 1 or Part 2 of Schedule I. Species listed under Part 1 are protected at all times, while those listed under Part 2 may be hunted or collected in accordance with regulations or a conservation plan (if any). The Department of Environment (DoE) is the lead body for legal protection of listed species.

The purpose of the NCL is to:

– Promote and secure biological diversity and the sustainable use of natural resources in the Cayman Islands.
– Protect and conserve endangered, threatened, and endemic wildlife and their habitats.
– Provide for protected terrestrial, wetland, and marine areas.
– Give effect to the provisions of the protocol concerning specially protected areas and wildlife to the convention for the protection and development of the marine environment of the wider Caribbean region.
– Give effect to related provisions of the *Convention on Wetlands of International Importance especially as Waterfowl Habitat*, the *Convention on the Conservation of Migratory Species of Wild Animals*, the *Global Convention on Biological Diversity* and the *United Nations Framework Convention on Climate Change.*
– Repeal the Marine Conservation Act[4]; and for incidental and connected purposes.

[2] Department of Environment (DoE). *Cayman Island National Trust Law*. 2010.URL: National Trust Law (2010 Revision) (gov.ky)
[3] Department of Environment (DoE). *The National Conservation Law*. 2013.URL: https://doe.ky/wp-content/uploads/2015/01/NationalConservationLaw-Es052014_web.pdf
[4] Department of Environment (DoE). *The National Conservation Law*. 2013.URL: https://doe.ky/wp-content/uploads/2015/01/NationalConservationLaw-Es052014_web.pdf

All of the mangrove species covered by the Special Conservation Plan for Mangroves are protected under Part 2 of Schedule 1 of the NCL. Mangrove loss has been extensive in recent decades. In 2008, the IUCN (International Union for Conservation of Nature and Natural Resources) Red List listed black mangrove as endangered, white mangrove and buttonwood as vulnerable and red mangrove as near-threatened. The Development and Planning Act[5] allows for some protection and preservation of mangrove habitat through buffers. Section 26 of the Development and Planning Act provides guidance to maintain mangrove buffers.

6.3.4 National Conservation (Marine Parks) Regulations

The National Conservation (Marine Parks) Regulations (NCMPR)[6]) was gazetted on March 12, 2021. It defines regulations specific in determining restrictions on specified areas and designates marine protected as:

- Schedule 1 - Marine Reserve Zone: which prohibits the removal of any specimen and the anchoring of any vessel unless the requirements under Section 5(2) and 5(3) can be met,
- Schedule 2 - Environmental Zone: in which prohibited activities include the removal of any form of marine life, the use of anchors, entry into the water and exceeding a speed of five knots,
- Schedule 3 - Wildlife Interaction Zone: in which engagement of wildlife interaction in accordance with any orders, guidance notes or directives issued by the Council is allowed but the anchoring of vessels is forbidden, except in certain circumstances,
- Schedule 4 - Line Fishing Zone: in which the removal of fry and sprat are permitted but anchoring is forbidden, except in certain circumstances,
- Schedule 5 - Shoreline Fishing Zone: in which the removal of certain species of fish are permitted,
- Schedule 6 - No-Diving Overlay Zone: in which scuba diving is not permitted unless authorized by the Council to do so or under other circumstances listed in the regulation, and
- Schedule 7 - Spawning Aggregation Overlay Zone: in which the removal of any specimen, anchoring of vehicles and entering the water is prohibited during the period beginning 1st December and ending 30th April.

6.3.5 Wastewater Collection and Treatment Act

The *Wastewater Collection and Treatment Act*[7] was amended in 2017 in conjunction with the establishment of the Utility Regulation and Competition Office (OfReg). The OfReg was established to accept the licensing responsibilities of the Water Authority, and for incidental and connected purposes.

6.3.6 Water Authority Act

If the discharge of cooling water into the marine environment is required a permit under the *Water Authority Act*[8] will need to be obtained. At this point in time no direct discharge of cooling water into the marine environment will occur.

6.3.7 International agreements

Cayman Islands are included in the United Kingdom's (UK) ratification of the following international agreements relevant to the marine environment and the proposed development:

5 Department of Development and Planning. *Development and Planning Act (2021 Revision)*. 2021.URL: https://legislation.gov.ky/cms/images/LEGISLATION/PRINCIPAL/1971/1971-0028/DevelopmentandPlanningAct_2021%20Revision.pdf

6 Department of Environment (DoE). *National Conservation (Marine Parks) Regulations*, *The National Conservation Act (2013)*. 2021.URL: National Conservation (Marine Parks) Regulations, 2021 (gov.ky)

7 Water Authority of the Cayman Islands. *Wastewater Collection and Treatment Law*. 2019. URL: https://www.waterauthority.ky/upimages/documents/WastewaterCollectionandTreatmentLaw2019Revision_1630097634.PDF

8 Water Authority of the Cayman Islands. *Water Authority Act*. 2022. URL: https://legislation.gov.ky/cms/images/LEGISLATION/PRINCIPAL/1982/1982-0018/WaterAuthorityAct_2022%20Revision.pdf?zoom_highlight=water+authority+act#search=%22water%20authority%20act%22

Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention)
The mission of the Ramsar Convention is the wise use of all wetlands through local and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world. There is no hunting, no collecting of any species, and no littering permitted within Ramsar sites.

Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (Cartagena Convention) – Protocol on Specially Protected Areas and Wildlife
Regional legal agreement for the protection of the Caribbean Sea and supported by three technical agreements on Oil Spills, Specially Protected Areas and Wildlife (SPAW) and Land Based Sources of Marine Pollution (LBS).

Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)
Provides a global platform for the conservation and sustainable use of migratory animals and their habitats.

Convention on Biological Diversity (CBD)
This convention was set in place to provide direction to achieve goals to enhance global diversity, conserve nature and that the benefits from genetic diversity are shared fairly with the population.

6.3.8 Local guidance

The National Biodiversity Action Plan (NBAP)[9] was developed by the DoE of the Cayman Islands to help guide and inform design and planning agencies to formulate sustainable and functional uses of the resources of the islands. The NBAP is planned to evolve with the changes and needs constantly addressed through revisions.

The NBAP attempts to address the concern for loss of biodiversity as outlined under the CBD and it identifies goals in order to strive to maintain biodiversity. The plan gathers available information on the ecosystems and environment that are present within the Cayman Islands. The baseline information that is gathered and applied in a multi branched approach by developing Habitat Action Plans (HAPs) and Species Action Plans (SAPs). These plans set a number of targets and proposed actions that are aimed at supporting and maintaining biodiversity.

The ultimate goal of the NBAP is zero extinction in the Cayman Islands.

6.3.9 Chartered Institute of Ecology and Environmental Management

The Chartered Institute of Ecology and Environmental Management (CIEEM) is a registered charity based in the United Kingdom (UK) that established a set of guidelines for Ecological Impact Assessment (EcIS) in the UK and Ireland. These guidelines promote good practices when conducting EcIS relating to terrestrial, freshwater, and coastal marine environments in the UK and Ireland10. These guidelines were relied upon to advise the preparation of the Environmental Statement (ES). As stated in the guidelines, where an ES is required the EcIS will be presented in a way that fits the overall structure and style of the ES while utilizing best practices within the CIEEM guidelines.

The CIEEM is also a resource to obtain an ecologist or environmental manager during project construction and operation. The members and practitioners of CIEEM are professionally trained individuals who manage, protect, and improve the natural environment. While the CIEEM was recommended in the ToR it is currently limited to the UK and Europe. Therefore, the ISWMS Site will implement the oversight of ecologists or experienced environmental managers to ensure best practices are utilized on Site to maintain the integrity of the environment.

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9 DaCosta-Cottam, M., J. Olynik, J. Blumenthal, K. D. Godbeer, J. Gibb, J. Bothwell, F. J. Burton, P. E. Bradley, A. Band, T. Austin, P. Bush, B. J. Johnson, L. Hurlston, L. Bishop, C. McCoy, G. Parsons, J. Kirkconnell, S. Halford, and G. Ebanks-Petrie. *Cayman Islands National Biodiversity Action Plan 2009, Cayman Islands Government, Department of Environment*. 2009

10 Chartered Institute of Ecology and Environmental Management (CIEEM). 2018. Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine, Version 1.2. CIEEM, Winchester.

6.4 Methodology

Available secondary sources of information were collected and reviewed to characterize the marine environment existing conditions within the Study Area. The following sources of secondary information were reviewed:

– Cayman Islands Department of Environment (DoE)
  - National Biodiversity Action Plan (NBAP)[11,12]
  - National Conservation Act[13] – Part 1 & 2, Schedule 1
  - National Conservation (Marine Parks) Regulations[14]
  - Species Conservation Plan for Mangroves[15] (National Conservation Act, section 17)
– Google Earth – web-based aerial imagery (select availability representing 2004 – 2023)
– UK Overseas Territories and Crown Dependencies - 2011 Biodiversity Snapshot
– Cayman Island National Trust – 2018-2019 Annual Report
– iNaturalist - plant and animal observations in vicinity of Study Area

Relevant information has been considered herein regarding project impacts on hydrology (Chapter 8 – Hydrology and Hydrogeology).

To present the baseline conditions of the marine environment a Study Area of the North Sound as well as wider coastal waters, from mean high-water mark on Grand Cayman out to 12 nautical miles (22.2 km), was established (Figure 6.1).

6.4.1 Consultation

To establish a comprehensive baseline condition of the Study Area's marine environment, the DoE, the National Trust for the Cayman Islands, the Central Caribbean Marine Institute, and Shark Conservation Cayman were contacted for records of protected species, species habitat mapping and additional natural features information including designated areas within the Study Area.

6.4.2 Feature value at a project scale

Marine ecological features (i.e., habitats, protected species) within the Study Area that could be affected by the development are assigned a value at a project scale in accordance with the ToR. These values are assigned based on the conservation status or the species or habitat and their ecological importance as outlined in Table 6.1(adapted from Table 5.1 of the ToR). Where numerous species of wildlife are discussed (e.g., marine mammals, marine reptiles) the highest value across the species is assigned to the group.

Table 6.1 Importance of the proposed ISWMS development for marine ecological features

Geographic context of importance	Value	Description
International	I-1	Sites of international importance (e.g., Ramsar Conservation Wetland of International importance)

11 DaCosta-Cottam, M., J. Olynik, J. Blumenthal, K. D. Godbeer, J. Gibb, J. Bothwell, F. J. Burton, P. E. Bradley, A. Band, T. Austin, P. Bush, B. J. Johnson, L. Hurlston, L. Bishop, C. McCoy, G. Parsons, J. Kirkconnell, S. Halford, and G. Ebanks-Petrie. *Cayman Islands National Biodiversity Action Plan 2009, Cayman Islands Government, Department of Environment*. 2009.

12 While the NBAP (DaCosta-Cottam et al. 2009) text was reviewed, maps associated with the report were not available for review.

13 Department of Environment (DoE). *The National Conservation Law*. 2013.URL: https://doe.ky/wp-content/uploads/2015/01/NationalConservationLaw-Es052014_web.pdf

14 Department of Environment (DoE). *National Conservation (Marine Parks) Regulations*, *The National Conservation Act (2013)*. 2021.URL: National Conservation (Marine Parks) Regulations, 2021 (gov.ky)

15 National Conservation Council (NCC). *Species Conservation Plan for Mangroves*. 2021. URL: Species-Conservation-Plan-for-Mangroves-FINAL.pdf

Geographic context of importance	Value	Description
	I-2	Internationally endangered species (e.g., Species under the Endangered Species Act, Marine Mammal Protection Act, International Union for Conservation of Nature’s Red List of Threatened Species (IUCN Red List))
National	N-1	A nationally designated site including marine parks, environmental zones, and replenishment zones
	N-2	Species protected under Schedule 1 Part 1 and 2 of the NCL
	N-3	Species and habitats listed in the NBAP
Local	L-1	Protected species that based on their extent, population size, quality, etc. are determined to be at a lesser level of importance than the geographic contexts above
	L-2	Common and widespread semi-natural habitats occurring within the Study Area in proportions greater than may be expected in the local context
	L-3	Common and widespread native species occurring within the Study Area in numbers greater than may be expected in the local context
Negligible	Ne-1	Common and widespread semi-natural habitats and species that do not occur in levels elevated above those of the surrounding area
	Ne-2	Areas of heavily modified or managed land uses (e.g., hard standing used for car parking, as roads, etc.)

6.5 Baseline conditions

6.5.1 Existing environment

The three Cayman Islands are flat, low-lying limestone islands with extensive offshore reef systems and mostly surrounded by fringing reefs and mangroves enclosing shallow, sand and seagrass filled lagoons. Associated with these habitats is a high diversity of marine species, including several molluscs and crustaceans providing commercially significant species. Baseline studies of the oceanography and biology of the shallow marine environments of Grand Cayman have been carried out by the Cayman Island Government's DoE.

6.5.2 Consultation results

The DoE was consulted on November 18, 2022, with response received on November 29, 2022. Marine habitat mapping within a 1.2 mile (2 kilometre) radius of the Site was shared and incorporated into the baseline conditions.

Shark Conservation Cayman was contacted on April 27, 2023, with a response received on May 11, 2023. Species information has been incorporated into the baseline conditions.

The National Trust for the Cayman Islands and the Central Caribbean Marine Institute were contacted on November 23, 2022, and on April 27, 2023. No responses have been received to date.

There are no anticipated impacts to the marine environment as part of the proposed development. As such, it was determined that marine surveys were not warranted in order to carry out the Marine Ecology impact assessment. Therefore, there was no further need for consultation with the EAB to scope out further surveys.

Agency correspondence is presented in **Appendix 6.A (Marine Ecology Report – Appendix A)**.

6.5.3 Zone of influence

The Zone of Influence (ZoI), as defined in the ToR, is likely to comprise the receiving waters, and contained marine habitat and species, of the North Sound in addition to the marine transportation routes between the Islands. As marine transportation between the islands is already occurring regularly, activities associated with the proposed development are not anticipated to lead to environmental change.

6.5.4 Designated / policy areas

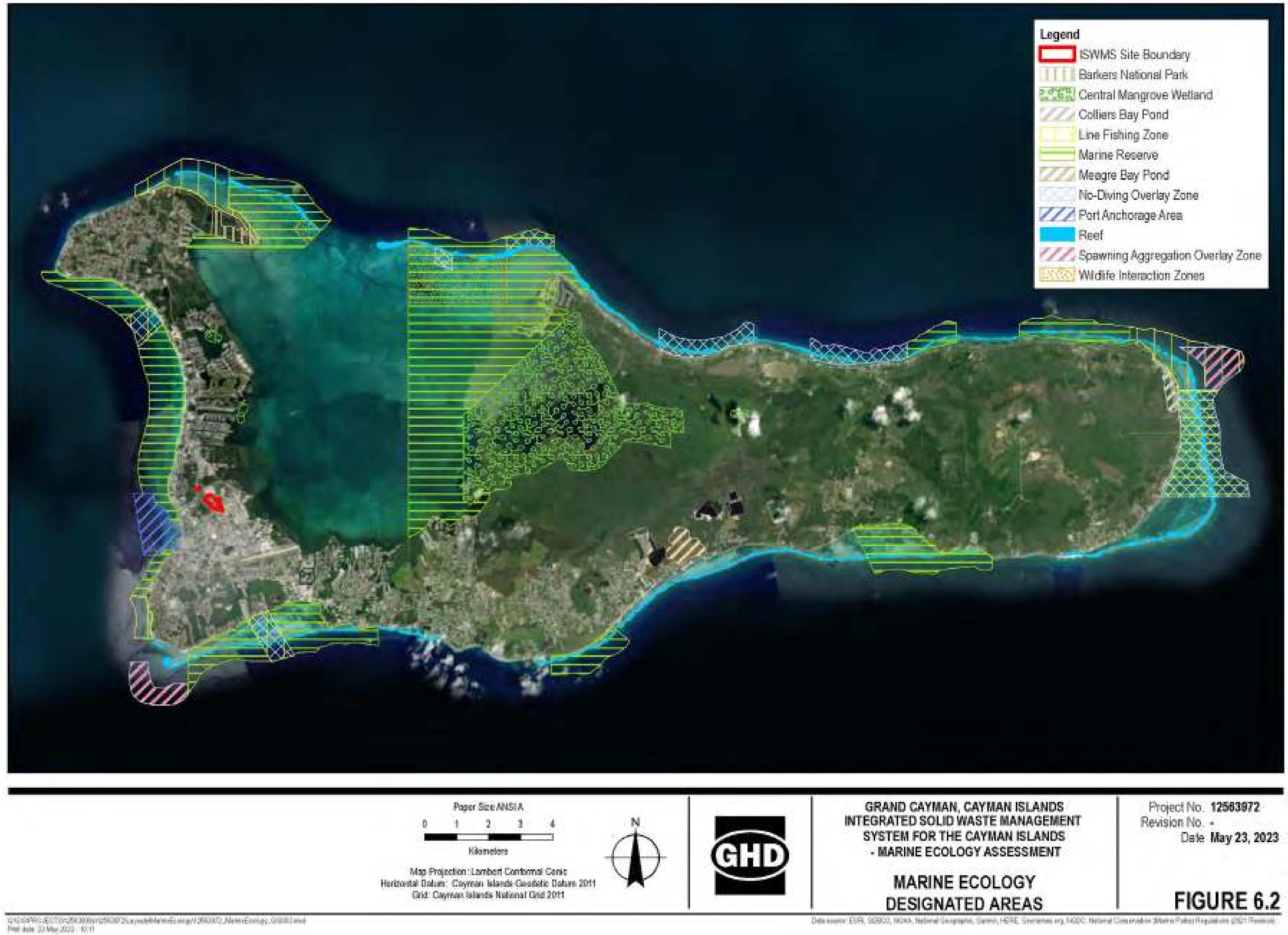
*Two proposed Ramsar sites (Central Mangrove Wetland and Barkers Wetland) have been identified within the Marine Ecology Study Area (*Figure 6.2*), these sites are discussed in* ***Chapter 7 – Terrestrial Ecology*** *(Section 7.5.3) in accordance with the ToR.*

The Cayman Islands has a network of marine protected areas as shown on Figure 6.2 for Grand Cayman, with the following zones occurring within a 3.1 mile (5 kilometre) radius of the Site:

- Marine Reserve Zones: George Town and Seven Mile Beach are approximately 0.9 mile (1.5 kilometres) west of the Site. South Sound West and South Sound East are approximately 3.1 miles (5 kilometres) south of the Site
- Line Fishing Zone: Jackson Point is approximately 2.8 miles (4.5 kilometres) south of the Site
- Shore Line Fishing Zone: George Town approximately 0.6 mile (1 kilometres) west of the Site
- No-Diving Overlay Zone: South Sound is approximately 3.1 miles (5 kilometres) south of the Site
- Spawning Aggregation Overlay Zone: Southwest zone is approximately 3.1 miles (5 kilometres) southwest of the Site off the shore of South Sound Beach

Marine protected environments have the potential to be affected. The Marine habitats listed above are assigned a value at a project scale for direct discharge as a N-1 due to these sites being a nationally designated protected site.

Figure 6.2 Marine Ecology designated areas[16]



[16] Data source: Cayman Island Department of Environment

6.5.5 Marine and coastal habitats

The DoE provided marine habitat mapping within a 1.2 mile (2 kilometre) radius of the Site with the following habitats[17,18,19,20] delineated on Figure 6.3.

- Shelf benthic classification:
  - Aggregated patch reef: coral formations that are isolated from other coral reef formations by sand or other habitats and that have no organized structural axis relative to the shore or shelf edge.
  - Beach rock: formations on shorelines of carbonate-cemented sandstone. It can form rapidly and occurs on tropical and warm temperate beaches.
  - Colonized hardbottom: hard bottom habitats that are more than 10 percent live coral cover.
  - Rubble: cylindrical or irregular shaped loose fragments of bedrock, or coral, bivalves, and coralline algae. Often occurring landward from well developed reef environments.
  - Sand: soft bottom reef areas that are dominated by fine sediments (finer than rubble larger particles than mud).
  - Spur and groove: a structure of a coral reef that consists of alternating elongated channels (grooves) and ridges (spurs). More developed on the windward side of coral reefs. Grooves often consist of coral rubble or carbonate sand. The spur features are covered with living corals.
  - Uncolonized hardbottom: exposed hard bottom area without visible coral structures. Occurring in areas of high energy. Having less than 10 percent live coral cover.
- Lagoon benthic classification:
  - Hardbottom: hard habitats that lack coral diversity and reef development.
  - Seagrass beds: soft bottomed habitat that is dominated by seagrass species. Occurring in shallow lagoon habitats and back reef slopes.
  - Silt: soft bottomed habitat that occur in shallow calm environments, dominated by fine particles.
  - Vegetated sand: soft bottomed habitat occurring where the bottom is dominated by vegetation other than seagrass species.

A detailed habitat assessment of the Cayman Islands was conducted as part of the NBAP[21]. Marine habitats were divided into the open sea, coral reef, lagoons, seagrass beds, dredged seabeds, and artificial installations. Coastal habitats were classified according to vegetation, and were divided into maritime cliffs, sandy beach and cobble, mangroves, invasive coastal plants and coastal shrubland. The proposed development on Grand Cayman is located within 0.5 miles (750 metres (m)) of the North Sound which in this location comprises fringing red mangroves (*Rhyzophora mangle*), which in parts are within the Mangrove Buffer Zone, and seagrass beds. Coral reefs have been scoped out of this assessment as they are located to the west of the development approximately 0.8 mile (1.2 kilometre) away with no pathway to effects through drainage.

Marine environments have the potential to be affected by two elements: direct discharge into the marine environment and intersecting with shipping routes. The Marine habitats listed above are assigned a value at a project scale for

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17 Allen Coral Atlas. *Benthic Map Classes*. 2013. URL: https://storage.googleapis.com/coral-atlas-field-data/training materials/AllenCoralAtlas_BenthicClasses_v3.pdf

18 Cooper, J. A. G. *Encyclopedia of Quaternary Science (Second Edition), Sea Level Studies, | Sedimentary Indicators of Relative Sea-Level Changes – High Energy*. 2012. URL: https://www.sciencedirect.com/science/article/pii/B9780444536433001345

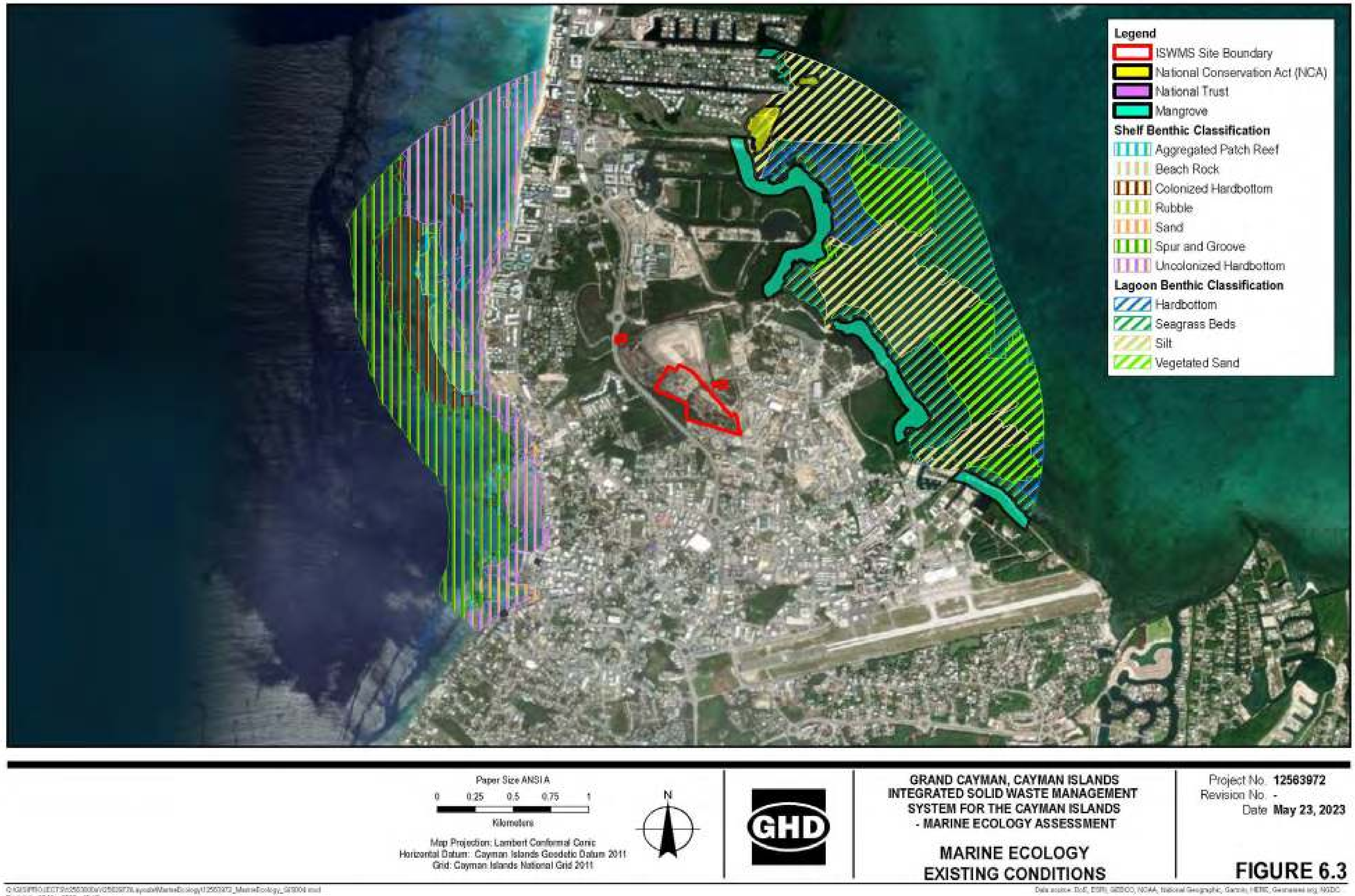
19 Shinn, E. A. *Encyclopedia of Modern Coral Reefs – Spurs and Grooves*. 2011.URL: https://link.springer.com/referenceworkentry/10.1007/978-90-481-2639-2_255

20 Swanson, D., H. Bailey, B. Schumacher, M. Ferguson, and B. Vargas-Angel. *Ecosystem Sciences Division Standard Operating Procedures: Data Collection for Rapid Ecological Assessment Benthic Surveys Ecosystem Sciences Division Standard Operating Procedures: Data Collection for Rapid Ecological Assessment Benthic Surveys*. 2018. URL: https://repository.library.noaa.gov/view/noaa/18267

21 DaCosta-Cottam, M., J. Olynik, J. Blumenthal, K. D. Godbeer, J. Gibb, J. Bothwell, F. J. Burton, P. E. Bradley, A. Band, T. Austin, P. Bush, B. J. Johnson, L. Hurlston, L. Bishop, C. McCoy, G. Parsons, J. Kirkconnell, S. Halford, and G. Ebanks-Petrie. *Cayman Islands National Biodiversity Action Plan 2009, Cayman Islands Government, Department of Environment*. 2009.

direct discharge as a N-3. Additionally, the intersection of the shipping route to the Port of George Town with mapped spur and groove, sand, and hardbottom habitat leads to the marine habitats being assigned a value of N-3 at a project scale due to these habitats being listed in the NBAP.

Figure 6.3 Marine Ecology existing conditions[22]



[22] Data source: Cayman Island Department of Environment

6.5.5.1 Seagrass beds

Seagrass beds (dominated by turtle grass [*Thalassia testudinum*]) develop in shallow subtidal areas on sand and mud. Seagrasses are flowering plants that reproduce by setting seed and gain nutrients by photosynthesising light from the water column and through absorbing nutrients through their roots and vascular tissue[23]. Along with coral reefs and mangroves, seagrass beds are one of the three major coastal interface communities. They are highly productive habitats and provide a nursery for the larval and juvenile stages of many marine species.

Seagrasses are highly sensitive to changes in water quality, including clarity and salinity. Since the late 1960s, local seagrass beds have been severely impacted by extensive dredging of shallow lagoons to facilitate access, and dredging for fill, using (often unscreened) cutter-head hydraulic and mechanical dredges. In 2001, the DoE resurveyed the original 1976 Wickstead Report sites and found local seagrass beds to be significantly impacted by dredging activity, both directly, through the removal of substrate and physical modification of the environment, and indirectly, through the introduction of particulate matter into the water column[24]. Seagrass beds within the off-site Study Area are mapped on Figure 6.3**.** Seagrass beds are assigned a value of N-2 at a project scale due to seagrass beds being protected under Schedule 1 Part 2 of the NCL.

6.5.5.2 Mangroves

"Mangrove" habitats are a generic term describing the plant assemblages that inhabit saline coastal habitats. These habitats are also named for the dominant species associated with this habitat. In the Cayman Islands, there are four mangrove species: black mangrove (*Avicennia germinans*), white mangrove (*Laguncularia racemosa*), red mangrove, and buttonwood (*Conocarpus erectus*). All species are protected and have a tolerance for wet, salty conditions. Red mangrove is a pioneering species typically comprising the seaward fringe of a mangrove forest, while buttonwood is typically found in the driest, least-saline environments of all mangroves[25].

Coastal mangroves within the off-Site Study Area are mapped on Figure 6.2 and Figure 6.3. Coastal mangroves are assigned a value of N-2 at a project scale due to species being protected under Schedule 1 Part 1 of the NCL.

6.5.6 Wildlife

6.5.6.1 Marine mammals

Marine mammal species occurring within the Cayman Islands are often found offshore, rarely coming close to shore[26]. Exceptions may include species of beaked whales whose local range may be restricted to deep foraging water such as the Cayman Trench. Marine mammal sighting schemes in the Cayman Islands have led to the reporting of the presence of a number of marine mammals, for example the bottlenose dolphin (*Tursiops truncates*) and spotted dolphin (*Stenella frontalis*). According to the Volunteer Observer Sighting Scheme, two small species of whale, short-finned pilot (*Globicephala macrorhynchus*) and beaked whales (*Mesoplodon* spp.), are more regularly seen further offshore, around various submarine banks, as reported in the ToR. Further the sperm whale (*Physeter catadon*), Blainville's beaked whale (*Mesoplodon densirostris*), and killer whale (*Orcinus orca*) have been recorded and it is probable that other marine mammal species, such as American manatees (*Trichechus manatus*), occur in Cayman waters[27].

[23] DaCosta-Cottam, M., J. Olynik, J. Blumenthal, K. D. Godbeer, J. Gibb, J. Bothwell, F. J. Burton, P. E. Bradley, A. Band, T. Austin, P. Bush, B. J. Johnson, L. Hurlston, L. Bishop, C. McCoy, G. Parsons, J. Kirkconnell, S. Halford, and G. Ebanks-Petrie. *Cayman Islands National Biodiversity Action Plan 2009, Cayman Islands Government, Department of Environment*. 2009.

[24] Ibid.

[25] Ibid.

[26] Department of Environment (DoE). *Dangerous Animals*. 2021. URL: https://doe.ky/terrestrial/dangerous-animals/

[27] DaCosta-Cottam, M., J. Olynik, J. Blumenthal, K. D. Godbeer, J. Gibb, J. Bothwell, F. J. Burton, P. E. Bradley, A. Band, T. Austin, P. Bush, B. J. Johnson, L. Hurlston, L. Bishop, C. McCoy, G. Parsons, J. Kirkconnell, S. Halford, and G. Ebanks-Petrie. *Cayman Islands National Biodiversity Action Plan 2009, Cayman Islands Government, Department of Environment*. 2009.

Marine mammals as a group are assigned a value of I-2 at a project scale due to all species being internationally protected under the United States (US) *Marine Mammal Protection Act*[28] (MMPA). Sperm and killer whales are listed as endangered under the US *Endangered Species Act*[29] (ESA). All marine mammal species are protected under Schedule 1 Part 1 of the NCL.

6.5.6.2 Marine reptiles

Four sea turtle species have been reported to occur in the waters of the Cayman Islands, namely the green turtle (*Chelonia mydas*), loggerhead (*Caretta caretta*), leatherback (*Dermochelys coriacea*), and hawksbill sea turtle (*Eretmochelys imbricata*). Although leatherback turtles are primarily oceanic, most hard-shell marine turtles recruit to nearshore feeding grounds such as seagrass beds and coral reefs. The Cayman Islands once supported extensive green turtle nesting grounds, and abundant loggerhead and hawksbill turtle nesting grounds. By the early 20th century nesting grounds of all three species were considered extinct due to massive exploitation. However, surveys conducted in the early 2000's found critically low levels of nesting by green and loggerhead turtles. In recent years there has been an increase in the number of nests found on the islands. Between 2014 and 2018 there has been 217 green nests, 237 loggerhead nests, and eight hawksbill nest documents annually. [30].

Two species of crocodiles are native to the Cayman Islands: the American crocodile (*Crocodylus acutus*) and the Cuban crocodile (*Crocodylus rhombifer*). Both species were extirpated in historic times, however, individuals occasionally visit the islands, likely swimming from Cuba or Jamaica[31].

Marine reptiles as a group are assigned a value of I-2 at a project scale due to all species being internationally listed as either endangered or threatened under the ESA, listed as critically endangered, endangered, or vulnerable on the IUCN Red List, and being protected under Schedule 1 Part 1 of the NCL.

6.5.6.3 Sharks

Sharks represent keystone species in the marine environment and are often observed in the waters of the Cayman Islands as a result of its deep and shallow water environments. Pelagic species include tiger shark (*Galeocerdo cuvier*), great hammerhead shark (*Sphyrna mokarran*), oceanic white tip shark (*Carcharhinus longimanus*), and silky shark (*Carcharhinus falciformis*). In addition, some shark species reside in Cayman all year round and inhabit coastal waters, these include the nurse shark (*Ginglymostoma cirratum*), lemon shark (*Negaprion brevirostris*), Caribbean reef shark (*Carcharhinus per*ezi), blacktip shark (*Carcharhinus limbatus*)[32]. Surveys conducted by Shark Conservation Cayman recorded seven species occurring within the upper 30 m of near coastal waters: Caribbean reef shark, nurse shark, lemon shark, blacktip shark, great hammerhead, scalloped hammerhead (*Sphyrna lewini*), and tiger shark[33].

Sharks as a group are assigned a value of I-2 at a project scale due to several species being listed as critically endangered (great hammerhead, oceanic white tip, scalloped hammerhead) or endangered (Caribbean reef) on the IUCN Red List. Scalloped hammerheads are listed as threatened under the US ESA, and all shark species are protected under Schedule 1 Part 1 of the NCL.

6.5.6.4 Nassau grouper

The Cayman Islands is home to a number of Nassau grouper (*Epinephelus striatus*) spawning sites. Two of these sites are within Grand Cayman waters: one off the eastern side of the island, and a second off the southwestern point. All Nassau grouper spawning sites are protected under the NCL as Spawning Aggregation Overlay Zones (Figure 6.2).

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28 Marine Mammal Commission and NOAA's National Marine Fisheries Service. 2019. The Marine Mammal Protection Act of 1972, as amended through 2018. URL: https://www.fisheries.noaa.gov/s3/2023-05/mmpa-2018-revised-march-2019-508.pdf

29 United States Fish and Wildlife Service. 2023. Environmental Conservation Online System. Listed Animals. URL: https://ecos.fws.gov/

30 . *Cayman Islands National Conservation Council. Conservation Plan for Sea Turtles., Cayman Islands Government, Department of Environment*. 2019.

31 Department of Environment (DoE). *Dangerous Animals*. 2021. URL: https://doe.ky/terrestrial/dangerous-animals/

32 Department of Environment (DoE). *Sharks*. 2021.URL: https://doe.ky/marine/sharks/

33 Shark Conservation Cayman. Email correspondence. Received May 11, 2023.

Nassau grouper are assigned a value of I-2 at a project scale due to being listed as critically endangered under the IUCN Red List, protected under the US ESA, and protected under Schedule 1 Part 1 of the NCL.

6.5.7 Protected species

According to the NBAP[34], numerous protected species have been reported to use the seagrass bed and mangrove habitats of the Study Area (Table 6.2). Species listed under Part 1 of the NCL (Schedule I) are protected at all times, while those listed under Part 2 may be hunted or collected in accordance with regulations or a conservation plan (if any). All species listed in Table 6.2, excluding those previously discussed in Section 6.5.6 are assigned a value of N-2 at a project scale due to being protected under Schedule 1 Part 1 or 2 of the NCL.

Bats and birds are included in Table 6.2 as mangroves provide suitable habitat for their life processes. They are discussed further in **Chapter 7 - Terrestrial Ecology**.

Table 6.2 Protected species associated with the seagrass bed and mangrove habitats of the Study Area

Species	Habitat use within Study Area[1]	Legal protection under Schedule I of the National Conservation Act[35]
Birds		
All birds (Aves all species)*	Mangroves	All birds are protected under Part 1 of the NCL, except those listed in Part 2
Mammals		
Bats (Chiroptera all species)*^	Mangroves	Protected under Part 1 of the NCL
Manatees (Sirenia all species)*	Seagrass beds	Protected under Part 1 of the NCL
Whales and dolphins (Cetacea all species)	Seagrass beds	Protected under Part 1 of the NCL
Reptiles		
Turtles: Green (*Chelonia mydas*)*^, Loggerhead (*Caretta caretta*)^, Leatherback (*Dermochelys coriacea*)^, Hawksbill (*Eretmochelys imbricata*)^	Seagrass beds, mangroves	Protected under Part 1 of the NCL
American crocodile (*Crocodylus acutus*)* Cuban crocodile (*Crocodylus rhombifer*)	Mangroves	Protected under Part 1 of the NCL
Hickatee (*Trachemys decussata angusta*)*	Mangroves	Regulated under Part 2 of the NCL
Fish		
Sharks and rays (Elasmobranchii all species)*	Seagrass beds	All sharks and rays are protected under Part 1 of the NCL, except those specifically listed in Part 2
All bony fish (Teleostei all species)*	Seagrass beds, mangroves	All bony fish are protected under Part 2 of the NCL, except those specifically listed in Part 1
Nassau grouper (*Epinephelus striatus*)*^	Seagrass beds, mangroves	Regulated under the NCMPR Schedule 7 (Spawning Aggregation Overlay Zones) and regulated under Part 2 of the NCL
Mosquito fish (*Limia caymanensis* and *Gambusia xanthosoma*)*^	Mangroves	Regulated under Part 2 of the NCL
Tilefish (*Malacanthus plumieri*)*	Seagrass beds	Protected under Part 1 of the NCL
Filefish (Monacanthidae all species)*	Seagrass beds	Protected under Part 1 of the NCL

[34] DaCosta-Cottam, M., J. Olynik, J. Blumenthal, K. D. Godbeer, J. Gibb, J. Bothwell, F. J. Burton, P. E. Bradley, A. Band, T. Austin, P. Bush, B. J. Johnson, L. Hurlston, L. Bishop, C. McCoy, G. Parsons, J. Kirkconnell, S. Halford, and G. Ebanks-Petrie. *Cayman Islands National Biodiversity Action Plan 2009, Cayman Islands Government, Department of Environment*. 2009.

[35] Department of Environment (DoE). *The National Conservation Law*. 2013.URL: https://doe.ky/wp-content/uploads/2015/01/NationalConservationLaw-Es052014_web.pdf

Species	Habitat use within Study Area[1]	Legal protection under Schedule I of the National Conservation Act[35]
Invertebrates		
All soft corals (including Gorgonians & Telestaceans) (Anthozoa all species)*	Mangroves	Protected under Part 1 of the NCL
Sponges (Porifera all species)*	Mangroves	Protected under Part 1 of the NCL
Echinoderms (Echinodermata all species)*	Seagrass beds, mangroves	Protected under Part 1 of the NCL
Conch (Strombidae all species)*	Seagrass beds	Protected under Part 1 of the NCL, except those listed in Part 2
Queen conch (*Strombus gigas*)*^	Seagrass beds, mangroves	Regulated under Part 2 of the NCL
Cassidae (*Cassis tuberosa, C. madagascariensis, C. flammea, Phalium granulatum, Cypraeacassis testiculus*)*	Seagrass beds	Protected under Part 1 of the NCL
Tulip mussel (*Cosa caribbaea*)*	Seagrass beds	Regulated under Part 2 of the NCL
Commissioner Gerrard's clam (*Transenella gerrardi*)*	Seagrass beds	Regulated under Part 2 of the NCL
Alfred's turbonille (*Turbonilla alfredi*)*	Seagrass beds	Regulated under Part 2 of the NCL
Crustaceans		
Lobsters (*Palinura* sp., *Achelata* sp.)*	Mangroves	Protected under Part 1 of the NCL, except those listed in Part 2
Spiny lobster (*Panulirus argus*)*^	Seagrass beds, mangroves	Regulated under Part 2 of the NCL
White Land crab (*Cardisoma guanhumi*)*^	Mangroves	Regulated under Part 2 of the NCL
Plants		
Black mangrove (*Avicennia germinans* [= *nitida*])*~	Mangroves	Regulated under Part 2 of the NCL
Buttonwood (*Conocarpus erectus*)*	Mangroves	Regulated under Part 2 of the NCL
White mangrove (*Laguncularia racemosa*)*	Mangroves	Regulated under Part 2 of the NCL
Red mangrove (*Rhizophora mangle*)*	Mangroves	Regulated under Part 2 of the NCL
Eel grass (*Halodule wrightii* [= *ciliate / bermudensis / beaudettei*])*	Seagrass beds	Regulated under Part 2 of the NCL
Manatee grass (*Syringodium filiforme* [= *Cymodocea manitorum*])*	Seagrass beds	Regulated under Part 2 of the NCL
Turtle grass (*Thalassia testudinum*)*	Seagrass beds	Regulated under Part 2 of the NCL

Species	Habitat use within Study Area[1]	Legal protection under Schedule I of the National Conservation Act[35]
Algae		
Green algae (*Chlorophyta* sp.)*	Seagrass beds, mangroves	Regulated under Part 2 of the NCL
Brown algae (*Phaeophyta* sp.)*	Seagrass beds, mangroves	Regulated under Part 2 of the NCL
Red algae (*Rhodophyta* sp.)*	Seagrass beds, mangroves	Regulated under Part 2 of the NCL
Notes		
[1] Habitats identified in the Cayman Islands National Biodiversity Action Plan (NBAP)[36] * Denotes species listed within a Habitat Action Plan of the NBAP ^ Denotes species with own Species Action Plan detailed in the NBAP ~ Denotes species that were detected on Site		

6.5.8 Invasive species

An alien species is one that has been deliberately or accidentally introduced by humans to an environment it would not naturally occur in. An alien species becomes an invasive species once it starts to reproduce and proliferate in that environment. Invasive species are incredibly problematic as they take over habitat and resources once utilised by native species and cause an imbalance of the ecosystem[37]. There are numerous invasive species present in the Cayman Islands, with the majority being terrestrial species (detailed information on terrestrial invasive species is provided in **Chapter 7 – Terrestrial Ecology**). Invasive species are not assigned a value at a project scale.

6.5.8.1 Red lionfish

Red lionfish (*Pterois volitans*) were first recorded in Little Cayman in February 2008, and in Cayman Brac in October 2008. Native to the Indo-Pacific, it is thought red lionfish became established in the Atlantic as a result of Hurricane Andrew, when several fish were introduced into marine waters at Biscayne Bay, Florida. Red lionfish are invasive in Cayman waters and require active control to prevent its spread. They are associated with seagrass beds and mangroves and can inflict painful stings with their dorsal spines. Envenomation can cause swelling, redness, bleeding, nausea, numbness, joint pain, anxiety, headache, disorientation, paralysis, and convulsions; however, the severity of the symptoms varies depending on how much venom was injected. A current Species Action Plan is available for this invasive species[38].

6.5.8.2 Stony coral tissue loss disease

Stony coral tissue loss disease (SCTLD) is a threat on coral populations in Grand Cayman. SCTLD was first detected in Florida's reefs in 2014 and has now spread to several Caribbean countries. There is no known cause and method of transmission of this virus however it is expected to be transmitted by touch and water circulation[39].

36 DaCosta-Cottam, M., J. Olynik, J. Blumenthal, K. D. Godbeer, J. Gibb, J. Bothwell, F. J. Burton, P. E. Bradley, A. Band, T. Austin, P. Bush, B. J. Johnson, L. Hurlston, L. Bishop, C. McCoy, G. Parsons, J. Kirkconnell, S. Halford, and G. Ebanks-Petrie. *Cayman Islands National Biodiversity Action Plan 2009, Cayman Islands Government, Department of Environment*. 2009.
37 Department of Environment (DoE). *Invasive Species*. 2021.URL: https://doe.ky/terrestrial/invasive-species/
38 DaCosta-Cottam, M., J. Olynik, J. Blumenthal, K. D. Godbeer, J. Gibb, J. Bothwell, F. J. Burton, P. E. Bradley, A. Band, T. Austin, P. Bush, B. J. Johnson, L. Hurlston, L. Bishop, C. McCoy, G. Parsons, J. Kirkconnell, S. Halford, and G. Ebanks-Petrie. *Cayman Islands National Biodiversity Action Plan 2009, Cayman Islands Government, Department of Environment*. 2009.
39 Department of Environment (DoE). *SCTLD Frequently Asked Questions*. 2021.URL: https://doe.ky/marine/sctld/faq/

6.5.9 Summary of marine baseline conditions

CIEEM guidelines were used in the assessment of ecological receptors. The importance of the ecological features were first assessed with reference to Cayman Island legislation and then the impact to the species or habitat that would be impacted with the proposed ISWMS Site was taken into account.

Although, all the species listed have the potential to occur on-Site and potential to be impacted, it is not anticipated that any species will be greatly impacted from the development at the ISWMS Site.

The ecological receptors of concern for the marine environment include, marine and costal habitats including spur and groove, sand, and hardbottom habitats, inland mangroves, marine mammals, marine reptiles, sharks, Nassau grouper, and additional protected species not previously listed. See Table 6.3 for value listed.

Table 6.3 Summary of marine ecological features values at a project scale

Marine ecological features	Value at project scale for receptors of concern
Marine protected areas (Section 6.5.4)	N-1: due to being a nationally designated site including marine parks, environmental zones, and replenishment zones
Marine and coastal habitats (Section 6.5.5) Spur and groove, sand, and hardbottom habitats	For direct discharge: N-3: due to these habitats being listed in the NBAP For shipping routes: N-3: due to these habitats being listed in the NBAP
Seagrass beds (Section 6.5.5.1)	N-2: due to seagrass beds being protected under Schedule 1 Part 2 of the NCL
Coastal mangroves (Section 6.5.5.2)	N-2: due to mangrove species being protected under Schedule 1 Part 2 of the NCL
Marine mammals (Section 6.5.6.1)	I-2: due to all species being internationally protected under the US MMPA and/or ESA, listed on the IUCN Red List, and protected under Schedule 1 Part 1 of the NCL
Marine reptiles (Section 6.5.6.2)	I-2: due to all species being internationally listed as either endangered or threatened under the ESA, listed as critically endangered, endangered, or vulnerable on the IUCN Red List, and being protected under Schedule 1 Part 1 of the NCL
Sharks (Section 6.5.6.3)	I-2: due to several species being listed as critically or endangered on the IUCN Red List. Scalloped hammerheads are listed as threatened under the US ESA, and all shark species are protected under Schedule 1 Part 1 of the NCL
Nassau grouper (Section 6.5.6.4)	I-2: due to being listed as critically endangered under the IUCN Red List, protected under the US ESA, and protected under Schedule 1 Part 1 of the NCL
Protected species not previously listed (Section 6.5.7)	N-2: due to being protected under Schedule 1 Part 1 or 2 of the NCL

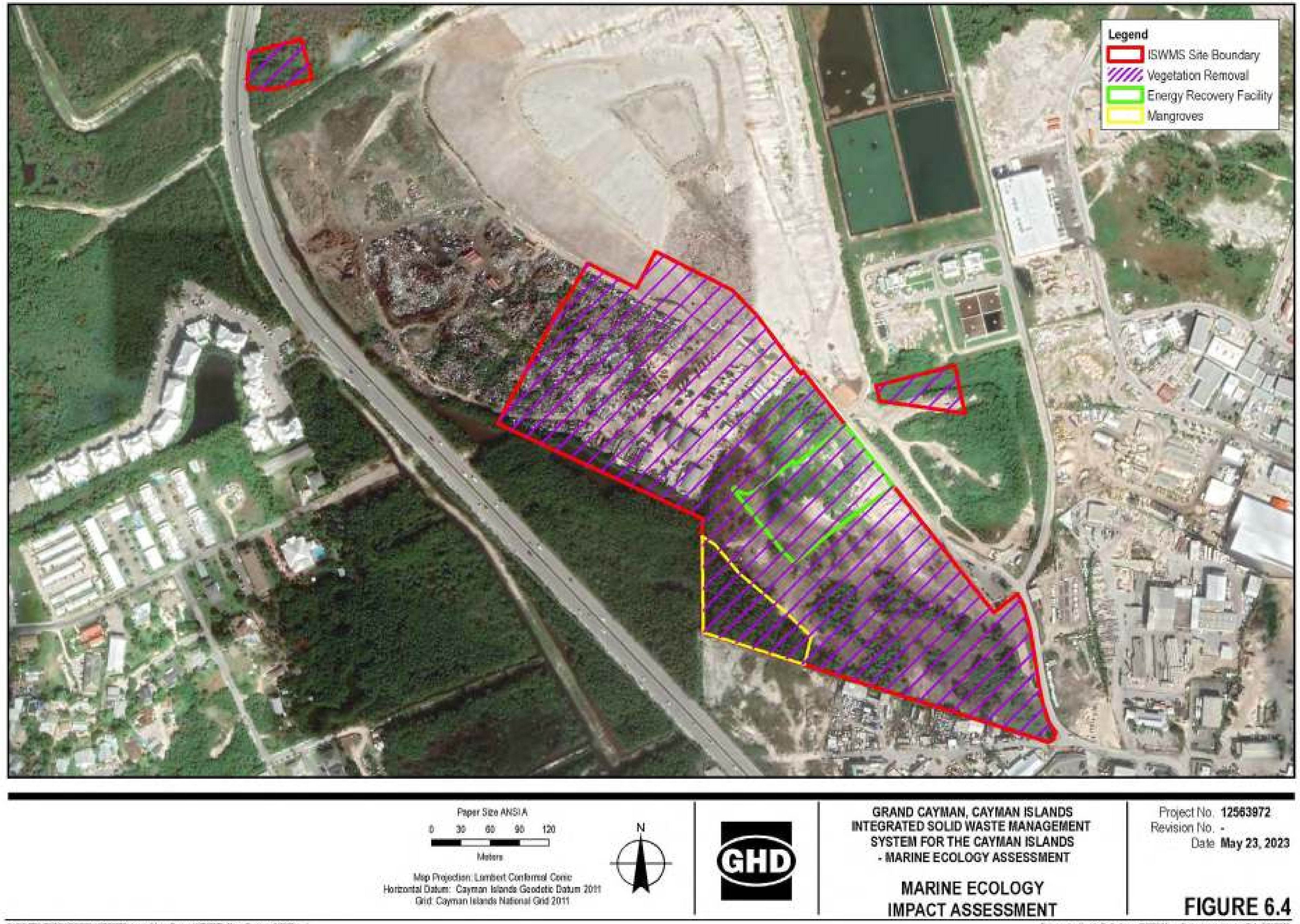
6.6 Impact Assessment and Mitigation

The proposed Site development is delineated on Figure 6.4. The proposed development will result in the removal of an estimated 1.7 acres (0.7 hectares (ha)) of inland mangrove habitat and 33 acres (13.35 ha) of terrestrial habitat (see **Chapter 7 – Terrestrial Ecology** for detailed information on terrestrial habitat). There is no direct discharge to the marine environment anticipated as part of the proposed development. An impact analysis was conducted based on secondary sources and it was found that, based on the absence of direct discharge during the construction phase, there are no anticipated impacts to the marine environment. However, as the facility design is not yet finalized, there is a possibility of direct marine discharge of cooling water to the North Sound if the anticipated discharge alternatives prove to be infeasible. For transparency on this possible but unlikely design outcome, the assessment of potential impact to North Sound seagrass beds is included herein.

Operational impacts of the importation of waste via vessel from the Sister Islands (Cayman Brac and Little Cayman) were also examined through secondary sources. Cayman Brac and Little Cayman are approximately 95 miles

(152 kilometres [km]) and 80 miles (129 km) respectively from Grand Cayman. As with the construction phase, with the incorporation of best management practices (BMPs) and mitigation measures, and absence of direct discharge to the marine environment, there are no significant impacts anticipated during operation. General mitigation measures are detailed below to maintain the integrity of the natural environment throughout construction and operation of the ISWMS.

Figure 6.4 Marine Ecology impact assessment



6.6.1 Pathways of potential effects

Potentially significant marine ecology effects identified in the ToR and through the assessment of the marine environment baseline conditions are validated in Table 6.4 to confirm pathways of potential effects.

Table 6.4 Pathway validity of potential effects by activity

Activity (leading to environmental change)	Effect	Feature	Pathway Validity	Potential Effect Before Mitigation
Land preparation e.g., earthworks, excavation (during construction)	Migration of contaminates through surface water/storm water and groundwater movements	North Sound habitats and species including fringing mangroves and seagrass beds	Direct pathways for the migration of contaminants through surface water/storm water and groundwater	Spills of oil, gasoline, and other fluids into North Sound habitats and species including fringing mangroves and seagrass beds
Waste processing (during operation)	Migration of contaminates through surface water/storm water and groundwater movements	North Sound habitats and species including fringing mangroves and seagrass beds	Direct pathway for the migration of contaminants into North Sound habitats	Spills of oil, gasoline, and other fluids into natural communities affecting the North Sound Habitats and species
Vessel movements (during operation)	Increased vessel strikes	Migratory and highly mobile marine wildlife (e.g., hawksbill, green and loggerhead turtle, groupers, marine mammals, and sharks)	Direct pathway for increased vessel strikes to marine wildlife by vessel movements	Increased vessel strikes on marine wildlife (e.g., hawksbill, green and loggerhead turtle, groupers, marine mammals, and sharks)
	Disturbance	Migratory and highly mobile marine wildlife (e.g., hawksbill, green and loggerhead turtle, groupers, marine mammals, and sharks)	Direct pathway for the disturbance of marine wildlife by vessel movements	Increased sound and vibration in the marine environment affecting migratory and highly mobile marine wildlife (e.g., hawksbill, green and loggerhead turtle, groupers, marine mammals, and sharks)

6.6.2 Significance evaluation

The significance of a residual effect is a determination following evaluation of the identified "potential effect" with the implementation of mitigation measures. A significance evaluation of the potential effects associated with the construction and operation of the ISWMS has involved:

– Identifying those effects that could likely be significant.
– Assessing the effects of the proposed construction works against the baseline (current or future, as appropriate).
– Concluding whether or not these resultant effects are likely to be significant.

The significance of effects determination has been completed for the marine environment based on professional judgment and the following:

– Predicting adverse effects from proposed construction activities and evaluating the scope and scale of those effects.
– Detailing mitigation measures triggered through regulatory requirements and/or BMPs to eliminate, reduce, or control the effect the construction activities have on environmental components.
– Determining the significance of the residual effects.

Significance evaluation is assessed using the criteria detailed in Table 6.5 (adapted from Table 5.3 of the ToR).

Table 6.5 Significance evaluation criteria

Characterisation	Description	Quantitative Measure or Definition of Qualitative Categories
Magnitude	The size or degree of the effects compared against baseline conditions or reference levels, and other applicable measurement parameters (i.e., standards, guidelines, objectives)	**Negligible (N) |** Differing from the average baseline conditions to a small degree, but within the range of the natural variation **Very Low (VL) |** Differing from the average baseline conditions to a small degree, but very minimally out of the range of the natural variation **Low (L) |** Differing from the average baseline and outside the range of natural variation but less than or equal to appropriate guideline or threshold value **Medium (M) |** Differing from the average baseline and outside the range of natural variation and marginally exceeding a guideline or threshold value **High (H) |** Differing from the average baseline and outside the range of natural variation and exceeding a guideline or threshold value
Geographic Extent	The geographic area over which the effects are likely to be measurable	**Site Study Area (SSA) |** Occurs within the ISWMS Site boundary **Outside Study Area (OSA) |** Occurs outside of the ISWMS Site boundary
Timing	Considers when the residual environmental effect is expected to occur. Timing considerations are noted in the evaluation of the residual environmental effect, where applicable or relevant.	**Not Applicable (NA) |** Seasonal variations are not likely to change the effect **Applicable (A) |** Seasonal aspects may affect the outcome of the effect
Duration	The time period over which the effects are likely to last	**Short-Term (ST) |** The effect is reversible at the end of construction works **Medium-Term (MT) |** The effect is reversible within a defined length of time (e.g. during operation) **Long-Term (LT) |** The effect is reversible over an extended length of time (including at the end of operation)
Frequency	The rate of recurrence of the effects (or conditions causing the effect)	**Once (O) |** Effects occur once **Regular (R) |** Effects can occur at regular intervals through construction and/or operation **Continuous (C) |** Effects are continuous throughout construction and operation

Characterisation	Description	Quantitative Measure or Definition of Qualitative Categories
Reversibility	The degree to which the effects can or will be reversed (typically measured by the time it will take to restore the environmental attribute or feature)	**Reversible (R) |** The baseline conditions will recover to their standard after the construction works are completed **Partially Reversible (PR) |** Mitigation can return the baseline conditions **Not Reversible (NR) |** Mitigation cannot guarantee a return to baseline conditions

6.6.3 Potential effects and mitigation measures

The potential residual effects identified in Table 6.4 are further evaluated here as the potential effects, associated mitigation and resultant significance. A potential effect to the marine environment during construction and operation is the increase of sedimentation due to vegetation clearing causing increased sediment run-off. Most of the vegetation has already been cleared; however, erosion and sedimentation measures will be established within the ISWMS Site boundary to prevent sediment migration and dust emissions. Additional potential effects to the marine environment are habitat and wildlife interference or strikes as a result of vessel movements during operation. The effects assessment of significance is presented in Table 6.6.

Table 6.6 Marine Ecology assessment of significance

Potential Effect	Mitigation Measures and Best Management Practices Proposed	Residual Environmental Effect Characterisation and Rationale						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Flooding / change in water quality affecting the North Sound habitats and species including fringing mangroves and seagrass beds	During construction and operation: – Implement engineering controls to isolate any flood-prone areas from construction soil/sand/cement stockpiles, and operations materials stockpiles – Employ discharge design which does not include direct discharge to the North Sound as hydrologic and geologic feasibility allows (e.g. deep injection of cooling water). If direct discharge is the solution employed, mitigate sedimentation and contamination of the seagrass beds by including on-site cooling ponds and piping the discharge to the North Sound or lining the surface water conveyance and including sediment control structures within the conveyance. – Construct conveyance/connection to North Sound (if required), following stabilization of site soils post-construction disturbance, while risk of sediment release to the North Sound is lowest.	VL	OSA	A	LT	R	R	Minimal increased flooding/ change in water quality to North Sound habitats and species	Not significant as there is no anticipated change in water quality to the North South Habitat.
		There will be very minimal change in water quality or increased flooding to North Sound habitats and species outside of natural variation based on professional judgement of evaluating the effectiveness of the engineering design and controls. Potential sedimentation and thermal impacts on seagrass beds can be mitigated through design. Seasonal variations are likely to change the potential for impact of flooding to the North Sound habitat. The effect from flooding may occur during construction and operation of the ISWMS Site. The duration is listed as long term as there is the potential for this effect to occur throughout operation. It is anticipated that mitigation measures are sufficient to negate potential effect for the duration. The effect has the potential to occur at regular intervals throughout construction and operation. The effect from flooding can be mitigated and return the environment to baseline conditions, therefore the effect is reversible.							

Potential Effect	Mitigation Measures and Best Management Practices Proposed	Residual Environmental Effect Characterisation and Rationale						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Spills of oil, gasoline, and other fluids into natural communities affecting the North Sound habitats and species including fringing mangroves and seagrass beds	During construction and operation: – Implement a stormwater management plan to maintain pre-construction drainage patterns and flows during all project phases – Implement appropriate erosion and sediment controls to mitigate Site runoff of water or mud – All machinery should be inspected for fluid leaks or other potential pollutants. The Contractor should evaluate each piece of equipment to ensure risks of spills or sediment release due to its use is mitigated prior to putting it into service – Proper machinery inspections and maintenance, as well as establishing areas away from natural features that are dedicated to re-fuelling and storing machinery – Proper vessel inspections to reduce likelihood of a spill occurring – Implement an emergency and response management plan to address the potential for spills – Include a landfill cap within construction design to reduce the levels of contaminants within stormwater runoff and groundwater – Preparation and implementation of a detailed wastewater and sewerage plan, including suitable treatment options for wastewater prior to discharge	VL	OSA	NA	ST	R	PR	No residual effect to North Sound habitats and species including fringing mangroves and seagrass beds	Not significant as mitigation in place will ensure there is no impacts to natural communities impacting the North Sound
		There is a very low magnitude of potential impact due to spills of oil, gasoline, and other fluids to the fringing mangroves and seagrass beds. With low likelihood of adverse impacts anticipated to the North Sound habitat as mitigations will reduce potential for contamination. The impact caused by fluid spills is the same during all times of year due to use of equipment during construction and operation. A short-term duration of the effect is anticipated as the Site will return to baseline operation conditions after construction. As construction activities will be completed, the amount of construction machinery would decrease, and regular activities would occur on Site, resulting in less opportunity for spills to occur. The potential for spills is to occur at regular intervals throughout construction and operation due to regular refuelling required on equipment. The effects due to spills are partially reversible as mitigation measures can return the environment to baseline conditions. All spills are to be addressed immediately with the emergency response management plan that is put into place before construction begins.							

Potential Effect	Mitigation Measures and Best Management Practices Proposed	Residual Environmental Effect Characterisation and Rationale						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Increased vessel strikes on marine wildlife (e.g., hawksbill, green and loggerhead turtle, groupers, marine mammals, and sharks)	During operation: – Travel at slow and safe speeds, in accordance with the Cayman Islands Port Regulations (2022 Revision), to avoid collisions with marine wildlife – Work with coast guards to utilize recommended routes to avoid species during known migration time periods – Ensure vessel operators are knowledgeable of marine wildlife seasonality and speed limits	VL	OSA	A	LT	C	PR	No net change of risk of vessel strikes on marine wildlife, therefore no residual effect	Not significant as there are no additional impacts expected beyond current operations. Additionally, mitigation will help to ensure there is no increase in vessel strikes
		There is a very low magnitude of the effect against baseline conditions as there is already shipping of wastes occurring between the islands with current operations. There is a distance from Grand Cayman of approximately 95 miles (152 kilometres (km)) and 80 miles (129 km) to Cayman Brac and Little Cayman respectively. Throughout this distance there is a potential for vessel strikes to occur with marine species. Species involved could include those of I-2 value. Seasonal aspects may impact the outcome of event as there are times of the year when species are more active in certain areas or migrating. Any effect from increased vessel strikes would occur during operation of the ISWMS Site. The duration is listed as long term as the effect will occur so long as there is operation and shipping between the islands. It is anticipated that mitigation measures are sufficient to negate potential effects long term while shipping occurs. The effect of vessel strikes is partially reversible as the implementation of mitigation measures can reverse the environment to baseline conditions. Working with the coast guard to utilize recommended routes during known migration times can help to avoid species when they are most active.							

Potential Effect	Mitigation Measures and Best Management Practices Proposed	Residual Environmental Effect Characterisation and Rationale						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Increased sound and vibration in the marine environment affecting migratory and highly mobile marine wildlife (e.g., hawksbill, green and loggerhead turtle, groupers, marine mammals, and sharks)	During operation: – Work with coast guard and DoE to identify and utilize recommended routes which avoid densely populated areas and high migration times	VL	OSA	NA	LT	R	PR	No net change with respect to increased sound and vibration in the marine environment, therefore no residual effect	Not significant as there are no additional impacts expected beyond current operations. Additionally, mitigation will help to ensure there are no impacts from sound and vibration affecting species.
		There is a very low degree to which sound and vibration from vessels during operations will deviate outside of the baseline conditions within the marine environment affecting migratory and highly mobile marine wildlife. Seasonal variations are not likely to change the effect as there is continued regular shipping between the islands throughout the year, creating opportunities for marine species to be exposed to sound and vibration. The effect from increased sound and vibration would occur during operation of the ISWMS Site. The duration is listed as long term as the potential for the effect to occur within the marine environment is present as long as there is shipping operations between the islands. It is anticipated that mitigation measures are sufficient to negate the potential effect for the duration of shipping operations. The effects of increased vibration and sound have the potential to be seen at a regular frequency as there is continuous shipping between the islands. Ensuring mitigation measures are fully implemented helps to avoid the species that would be impacted by sound and vibrations in the marine environment. The increased sound and vibrations in the marine environment is partially reversible as mitigations can return the marine environment to the baseline conditions.							

6.6.4 Summary of effects

The predicted environmental effects on the marine environment were assessed to be adverse but not significant. However, with the implementation of mitigation measures and BMPs that will be outlined in the Environmental Management Plan (EMP) in the Environmental Statement (ES), the residual effect on the marine environment is minimal and not significant.

The effects anticipated are as summarized below:

– No offsite impacts from an erosion and sedimentation perspective
– No increased flooding/change in water quality
– No increase in water pollution
– No change of vessel strike risk on marine wildlife
– No change with respect to increased sound and vibration in the marine environment

It should be noted that a number of the potential effects are related to ongoing/ existing activities (i.e., vessel movements between islands) and therefore no change is anticipated beyond the status quo.

6.6.5 Residual effects

There are no anticipated residual effect remaining after the implementation of mitigation measures during construction and operations identified for the marine environment.

6.7 Monitoring

For the purposes of construction works, limited monitoring requirements have been identified. As previously noted in Section 6.6 the potential effects are limited. The following monitoring requirements are recommended based on the residual effects identified:

During construction and operation:

– Erosion and sediment control monitoring: silt fencing will be established around the ISWMS Site to limit sediment run-off into the surrounding environment. Regular inspections (i.e., weekly, before and following 0.98 inches (25 millimetres [mm]) or more rainfall) should be conducted to identify any damage to the fencing. Prompt repairs should follow.
– Erosion and sediment control monitoring: Regular inspections (i.e., weekly, before and following 0.98 inches (25 mm) or more rainfall) should be conducted to identify any damage to the fencing. Prompt repairs should follow.
– Monitoring for marine wildlife is to occur for the duration of each journey when barges are travelling between islands.

6.8 Conclusions

Natural heritage information from secondary sources and associated reports were collated to provide the basis for this evaluation of potential impacts to the marine environment as a result of the proposed ISWMs facility. Although the majority of project components are outside of marine natural areas, there is some potential for protected species occurrence in select areas throughout the ISWMS Site (mainly of highly mobile, mangrove-dwelling wildlife species, such as birds and bats) and when importing waste from the Sister Islands, Cayman Brac and Little Cayman (mainly of marine wildlife). As such, general mitigation measures have been provided as recommendations to be implemented throughout construction and operation to satisfy the identified assessment and significance evaluation. Further evaluation of terrestrial wildlife species (i.e., protected birds and bats) and mitigation measures are provided in **Chapter 7 – Terrestrial Ecology**.

Many potential impacts typical to land development have been avoided or minimized due to the anticipated avoidance of direct discharge to the marine environment and mitigation of impacts should direct discharge be the only feasible alternative. With the implementation of the recommended mitigation efforts outlined in this chapter, it is anticipated that the construction of the proposed development will result in no significant residual effects to the marine environment.

7. Terrestrial Ecology

7.1 Purpose

GHD Limited (GHD) was retained by ReGen and the Cayman Islands Government (CIG) as approved by the Environmental Assessment Board (EAB) to determine the existing conditions and impact assessment of the terrestrial environment in the vicinity of the proposed Integrated Solid Waste Management System (ISWMS) Site. GHD's ecologists have completed background information reviews to characterize the associated terrestrial environment, with a focus on the terrestrial habitats, wildlife, protected species, and significant natural areas. The purpose of this chapter is to document:

– Environmental policy potentially applicable to proposed works
– Methodology for the background review
– Methodology for completing targeted surveys
– Existing terrestrial environmental conditions[1]
– Impact of the proposed project
– Monitoring measures

7.2 Study Area

A Study Area was developed as part of the Terms of Reference (ToR) to determine if any nationally designated sites, significant natural areas, habitats, or protected species could occur within or near the proposed ISWMS Site. This Terrestrial Ecology Study Area included the ISWMS Site and a 1.2 mile (2 kilometre [km]) buffer (Figure 7.1).

1 Existing conditions are based on the time of EAB acceptance of the ISWMS Environmental Impact Assessment Terms of Reference in September 2021.

Figure 7.1 Terrestrial Ecology Study Area

7.3 Applicable standards and guidelines

This Section identifies Territory and other regulatory legislation and policies that are applicable and relevant to the Study Area and the immediate vicinity. This includes policies that triggered the study. These documents may identify natural features, protected species, and other habitats as well as other features relevant to this Study Area.

7.3.1 Cayman Island National Trust Act

The *Cayman Island National Trust Act*[2] establishes the National Trust for the Cayman Islands as a corporate body. It shall manage and conserve natural and cultural beauty and wealth of Cayman Islands including submarine areas.

The purpose of the Trust is:

– The preservation of the historic, natural, and maritime heritage of the Islands through the preservation of areas, sites, buildings, structures, and objects of historic or cultural significance.
– The conservation of lands, natural features, and submarine areas of beauty, historic or environmental importance which the Trust may have acquired through gift, bequest, purchase, lease, or other means.
– The protection of native flora and fauna.

7.3.2 National Conservation Act

The *National Conservation Act* (NCL)[3] makes provision for the conservation of wildlife and the environment in the Cayman Islands and provides for enforcement and penalties. The NCL incorporated the Species Conservation Plan for Mangroves which came into effect on 26 April 2020, which lists species under Part 1 are protected at all times, While those listed under Part 2 may be hunted or collected in accordance with regulations or a conservation plan (if any). The Department of Environment (DoE) is the lead body for legal protection of listed species.

The purpose of the NCL is to:

– Promote and secure biological diversity and the sustainable use of natural resources in the Cayman Islands.
– Protect and conserve endangered, threatened, and endemic wildlife and their habitats.
– Provide for protected terrestrial, wetland, and marine areas.
– Give effect to the provisions of the protocol concerning specially protected areas and wildlife to the convention for the protection and development of the marine environment of the wider Caribbean region.
– Give effect to related provisions of the *Convention on Wetlands of International Importance especially as Waterfowl Habitat*, the *Convention on the Conservation of Migratory Species of Wild Animals*, the *Global Convention on Biological Diversity* and the *United Nations Framework Convention on Climate Change*.
– Repeal the Marine Conservation Act[4]; and for incidental and connected purposes.

The NCL establishes the hierarchy to develop conservation plans as Part of Protected Species under Part 1 & 2. Section 25 of the Development and Planning Act[5] (2021) provides conditions in order to preserve trees and woodlands.

All of the mangrove species covered by the Special Conservation Plan for Mangroves are protected under Part 2 of Schedule 1 of the NCL. Mangrove loss has been extensive in recent decades. In 2008, the IUCN (International Union for Conservation of Nature and Natural Resources) Red List listed black mangrove (*Avicennia germanans*) as endangered, white mangrove (*Laguncularia racemosa*) and buttonwood (*Conocarpus erectus*) as vulnerable, and red

2 Department of Environment (DoE). *Cayman Island National Trust Law*. 2010.URL: National Trust Law (2010 Revision) (gov.ky) f
3 Department of Environment (DoE). *The National Conservation Law*. 2013.URL: https://doe.ky/wp-content/uploads/2015/01/NationalConservationLaw-Es052014_web.pdf
4 Ibid
5 Department of Development and Planning. *Development and Planning Act (2021 Revision)*. 2021.URL: https://legislation.gov.ky/cms/images/LEGISLATION/PRINCIPAL/1971/1971-0028/DevelopmentandPlanningAct_2021%20Revision.pdf

mangrove (*Rhizophora mangle*) as near-threatened. The *Development and Planning Act*[6] allows for some protection and preservation of mangrove habitat through buffers. Section 26 of the *Development and Planning Act* provides guidance to maintain mangrove buffers.

The NCL also provides grounds to establish the Animals Act[7] in which makes provisions for the protection of animals against diseases and cruel treatment, goals for developing livestock areas for breeding and control of animals and the protection of wildlife.

7.3.3 Wastewater Collection and Treatment Act

The *Wastewater Collection and Treatment Act*[8] was amended in conjunction with the establishment of the Utility Regulation and Competition Office (OfReg). The OfReg was established to accept the licensing responsibilities of the Water Authority, and for incidental and connected purposes.

7.3.4 Water Authority Act

If any sewage effluent, trade effluent, or other wastes are proposed to be discharged into or onto the ground, a permit under the *Water Authority Act*[9] will need to be obtained.

7.3.5 International agreements

Cayman Islands are included in the United Kingdom's (UK) ratification of the following international agreements relevant to the marine environment and the Proposed Development:

Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention)
The mission of the Ramsar Convention is the wise use of all wetlands through local and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world. There is no hunting, no collecting of any species, and no littering permitted within Ramsar sites.

Convention on Biological Diversity (CBD)
This convention was set in place to provide direction to achieve goals to enhance global diversity, conserve nature and that benefits from genetic diversity are shared fairly with the population.

Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)
Provides a global platform for the conservation and sustainable use of migratory animals and their habitats.

Convention on Biological Diversity (CBD)
This convention was set in place to provide direction to achieve goals to enhance global diversity, conserve nature and that benefits from genetic diversity are shared fairly with the population.

7.3.6 Local guidance

The National Biodiversity Action Plan (NBAP)[10] was developed by the DoE of the Cayman Islands to help guide and inform design and planning agencies to formulate sustainable and functional uses of the resources of the Islands. The NBAP is planned to evolve with the changes and needs constantly addressed through revisions.

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6 Department of Development and Planning. *Development and Planning Act (2021 Revision)*. 2021.URL: https://legislation.gov.ky/cms/images/LEGISLATION/PRINCIPAL/1971/1971-0028/DevelopmentandPlanningAct_2021%20Revision.pdf

7 Department of Environment (DoE). *The National Conservation Law*. 2013.URL: https://doe.ky/wp-content/uploads/2015/01/NationalConservationLaw-Es052014_web.pdf

8 Water Authority of the Cayman Islands. *Wastewater Collection and Treatment Law*. 2019. URL: https://www.waterauthority.ky/upimages/documents/WastewaterCollectionandTreatmentLaw2019Revision_1630097634.PDF

9 Water Authority of the Cayman Islands. *Water Authority Act*. 2022. URL: https://legislation.gov.ky/cms/images/LEGISLATION/PRINCIPAL/1982/1982-0018/WaterAuthorityAct_2022%20Revision.pdf?zoom_highlight=water+authority+act#search=%22water%20authority%20act%22

10 DaCosta-Cottam, M., J. Olynik, J. Blumenthal, K. D. Godbeer, J. Gibb, J. Bothwell, F. J. Burton, P. E. Bradley, A. Band, T. Austin, P. Bush, B. J. Johnson, L. Hurlston, L. Bishop, C. McCoy, G. Parsons, J. Kirkconnell, S. Halford, and G. Ebanks-Petrie. *Cayman Islands National Biodiversity Action Plan 2009, Cayman Islands Government, Department of Environment*. 2009

The NBAP attempts to address the concern for loss of biodiversity as outlined under the CBD and it identifies goals in order to strive to maintain biodiversity. The plan gathers available information on the ecosystems and environment that are present within the Cayman Islands. The baseline information that is gathered and applied in a multi branched approach by developing Habitat Action Plans (HAPs) and Species Action Plans (SAPs). These plans a set number of targets and proposed actions that are aimed at supporting and maintaining biodiversity.

The ultimate goal of the NBAP is zero extinction in the Cayman Islands.

7.3.7 Chartered Institute of Ecology and Environmental Management

The Chartered Institute of Ecology and Environmental Management (CIEEM) is a registered charity based in the United Kingdom (UK) that established a set of guidelines for Ecological Impact Assessment (EcIS) in the UK and Ireland[11]. These guidelines promote good practices when conducting EcIS relating to terrestrial, freshwater, and coastal marine environments in the UK and Ireland. These guidelines were relied upon to advise the preparation of the Environmental Statement (ES). As stated in the guidelines where an ES is required the EcIS will be presented in a way that fits the overall structure and style of the ES while utilizing best practices within the CIEEM guidelines.

The CIEEM is also a resource to obtain an ecologist or environmental manager during Project construction and operation. The members and practitioners of CIEEM are professionally trained individuals who manage, protect, and improve the natural environment. While the CIEEM was recommended in the ToR it is currently limited to the UK and Europe. Therefore, the ISWMS Site will implement the oversight of ecologists or experienced environmental managers to ensure best practices are utilized on Site to maintain the integrity of the environment.

7.4 Methodology

Available secondary sources of information were collected and reviewed to characterize the terrestrial environment existing conditions within the Study Area. The following sources of secondary information were reviewed:

- Cayman Islands Department of Environment:
  - NBAP[12,13]
  - National Conservation Act[14] – Part 1 & 2, Schedule 1
  - Species Conservation Plan for Mangroves[15] (National Conservation Act, section 17)
- Google Earth - web-based aerial imagery (select availability representing 2004 – 2023)
- UK Overseas Territories and Crown Dependencies- 2011 Biodiversity Snapshot
- Cayman Island National Trust - 2018-2019 Annual Report
- iNaturalist - plant and animal observations in vicinity of Study Area

7.4.1 Consultation

To establish a comprehensive baseline condition of the Study Area's terrestrial environment, the DoE, the National Trust for the Cayman Islands, the National Conservation Council, and BirdLife International were contacted for records of protected species, species habitat mapping and additional natural features information including designated areas within the Study Area.

11 Chartered Institute of Ecology and Environmental Management (CIEEM). 2018. Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine, Version 1.2. CIEEM, Winchester.

12 DaCosta-Cottam, M., J. Olynik, J. Blumenthal, K. D. Godbeer, J. Gibb, J. Bothwell, F. J. Burton, P. E. Bradley, A. Band, T. Austin, P. Bush, B. J. Johnson, L. Hurlston, L. Bishop, C. McCoy, G. Parsons, J. Kirkconnell, S. Halford, and G. Ebanks-Petrie. *Cayman Islands National Biodiversity Action Plan 2009, Cayman Islands Government, Department of Environment*. 2009

13 While the NBAP (DaCosta-Cottam et al. 2009) text was reviewed, maps associated with the report were not available for review.

14 Department of Environment (DoE). *The National Conservation Law*. 2013.URL: https://doe.ky/wp-content/uploads/2015/01/NationalConservationLaw-Es052014_web.pdf

15 National Conservation Council (NCC). *Species Conservation Plan for Mangroves*. 2021. URL: Species-Conservation-Plan-for-Mangroves-FINAL.pdf.

7.4.2 Feature value at a project scale

Terrestrial ecological features (i.e., habitats, protected species) within the Study Area that could be affected by the development are assigned a value at a project scale in accordance with the ToR. These values are assigned based on the conservation status or the species or habitat and their ecological importance as outlined in Table 7.1 (adapted from Table 5.5 of the ToR). Where numerous species of wildlife are discussed (e.g., bats, birds) the highest value across the species is assigned to the group.

Table 7.1 Importance of the proposed ISWMS Development for terrestrial ecological features

Geographic context of importance	Value*	Description
International	I-3	Sites of international importance (e.g., Ramsar Conservation Wetland of International importance)
	I-4	Internationally endangered species (e.g., Species on the International Union for Conservation of Nature's Red List of Threatened Species (IUCN Red List)
	I-5	Species endemic to the Cayman Islands
National	N-4	A nationally designated site including National Trust parks
	N-5	Species protected under Schedule 1 Part 1 and 2 of the NCL
	N-6	Species and habitats listed in the NBAP
Local	L-4	Protected species that based on their extent, population size, quality, etc. are determined to be at a lesser level of importance than the geographic contexts above
	L-5	Common and widespread semi-natural habitats occurring within the Study Area in proportions greater than may be expected in the local context
	L-6	Common and widespread native species occurring within the Study Area in numbers greater than may be expected in the local context
Negligible	Ne-3	Common and widespread semi-natural habitats and species that do not occur in levels elevated above those of the surrounding area
	Ne-4	Areas of heavily modified or managed land uses (e.g., hard standing used for car parking, as roads, etc.)
Notes		
* Value numbering continues from **Chapter 6 - Marine Ecology Table 6.1**		

7.4.3 Terrestrial habitat assessment

The following tasks were completed to collect primary information from the Study Area:

– Field reconnaissance assessment of existing conditions and sensitivities that may be affected by the proposed project, including Site photographs.

– Installation of stationary equipment within the Site to complete targeted surveys to determine presence or absence of any wildlife.

Additional terrestrial habitat assessment was conducted using the pre-existing mapped data of the Site. A botanical inventory was completed using photos collected by others, from areas where access permitted. Vegetation mapping was refined using Vegetation Classification for the Cayman Islands scheme through analysis of the deployed cameras.

7.4.4 Wildlife surveys

7.4.4.1 Bat acoustic surveys

Bat acoustic survey devices (i.e., bat detectors) were installed at two locations (Figure 7.2) (an example of a bat acoustic survey equipment set-up is shown on Figure 7.3). The detectors were placed within potentially suitable roosting habitat and left to record during the maternity roosting period. Potentially suitable habitat was identified as mixed, deciduous, or coniferous forests, or any wooded areas with less than 60 percent canopy cover, but where large potentially suitable roost trees were present. These locations aimed to capture the variety of treed habitats that may be impacted within the Site, and to detect which high intensity echolocating bat species are present. No systematic cavity or roost tree surveys were carried out; however, observations of potentially suitable habitat were made during background review, aerial imagery analysis, and detector installation. Observations during detector set up did not reveal a high abundance of suitable forested/wooded areas within the Site. Wooded potential habitat along the northeast perimeter of the Site was targeted with the location of Bat Detector 1 (Bat 1), while mangrove potential habitat along the south-central perimeter of the Site was targeted with the location of Bat Detector 2 (Bat 2; Figure 7.2).

The bat detectors (Wildlife Acoustics SM4BAT+ model[16]) were deployed on October 28, 2021. Bat 1 was deployed through to December 10, 2021, while Bat 2 deployed through to February 15, 2022. Each detector was set to record nightly from 30 minutes before sunset to 30 minutes after sunrise, and to record files of up to 15 seconds in duration any time they detected a sound in the frequencies typically used by bats.

Call files were subsequently downloaded and processed in Kaleidoscope Pro using the Bats of the Neotropics v5.4.0 with a +1 conservative classifier option to aide in assigning species identifications to each file. Manual review of recorded bat calls followed the hierarchical steps below:

– Evaluation of the Maximum Likelihood Estimator[17] (MLE) output by Kaleidoscope for each species and the total numbers of calls, calls identified as bat calls by the software but not identified as specific species, and noise files.
– Visual signature confirmation of the presence of species with an MLE value of 0 (to confirm presence) by manual review of selected calls.
– Manual review of all calls identified to species level for species which were given an MLE of 1 (i.e., considered false positives by the software).
– Review of five percent of the calls for which no auto-identification was possible, biased towards calls with the highest number of call pulses, with a focus on identifying any species calls not already recorded.

7.4.4.1.1 Limitations

Bat acoustic surveying only records bat species that echolocate at a high intensity (i.e., those bolded in Table 7.2). The Cayman Islands is also home to two low intensity echolocating species and three species that are non-echolocating. While it is possible for these species to be present on Site, acoustic survey devices are not sensitive enough to pick up low intensity calls, and species that are non-echolocating need to be assessed using other methods (i.e., mist netting, roost exit/entry surveys).

16 Wildlife Acoustics. *Wildlife Acoustics - Wildlife Audio Recording Equipment*. 2021. URL: https://www.wildlifeacoustics.com/
17 The maximum likelihood estimator determines what the most likely distribution of different species are that would result in the observed classifications given the classifier error rate (Wildlife Acoustics 2021).

Table 7.2 Potential bat species by echolocation type

Bat species	Echolocating/Non-echolocating
Antillean nectar bat, *Brachyphylla nana nana*	Non-echolocating
Big brown bat, *Eptesicus fuscus minor*	**Echolocating – high intensity**
Brazilian free-tailed bat, *Tadarida brasiliensis muscala*	**Echolocating – high intensity**
Buffy flower bat, *Erophylla sezekorni*	Non-echolocating
Eastern red bat, *Lasiurus borealis*	**Echolocating – high intensity**
Jamaican fruit bat, *Artibeus jamaicensis parvipes*	Echolocating – low intensity
Pallas's mastiff bat, *Molossus molossus*	**Echolocating – high intensity**
Waterhouse's leaf-nosed bat, *Macrotus waterhousii minor*	Echolocating – low intensity
White-shouldered bat, *Phyllops falcatus*	Non-echolocating
Notes	
Acoustic survey devices will only detect species in bold (i.e., high intensity echolocating species).	

7.4.4.2 Audiofauna surveys

One Wildlife Acoustics Songmeter SM4 acoustic recorder with omnidirectional microphones was deployed in a mapped Urban and Man-Modified area with occasional shrubs. This area was identified to have suitable habitat for resident and migratory bird species (Figure 7.2). The device was installed 4.9 feet (1.5 metres [m]) above ground level and recorded calls at an interval of 5 minutes on/15 minutes off for a total of 1 hour during dawn and dusk periods (an example of an audiofauna survey equipment set-up is shown on Figure 7.3). The device was actively recording from October 28, 2021, to February 1, 2022. Data was processed using Kaleidoscope Pro Analysis Software to sort, label, and identify bird songs. A manual auditory review was conducted by an experienced GHD ecologist to verify the species identified by the software and to identify other distinguishing faunal sound recordings.

7.4.4.3 Wildlife camera surveys

Five wildlife cameras were deployed from October 28, 2021, to January 17, 2022, to detect incidental wildlife on the Site (Figure 7.2) (an example of a wildlife camera survey equipment set-up is shown on Figure 7.3). These cameras were orientated towards potential high traffic wildlife areas to photograph incidental wildlife that may traverse the Site. The cameras were set to trigger following motion detection 24-hours per day. Photos were downloaded bi-weekly by a Site staff member and were analysed by GHD ecologists. Camera 5 was moved to the location indicated on Figure 7.2 on November 18, 2021.

Figure 7.2 Terrestrial Ecology survey locations

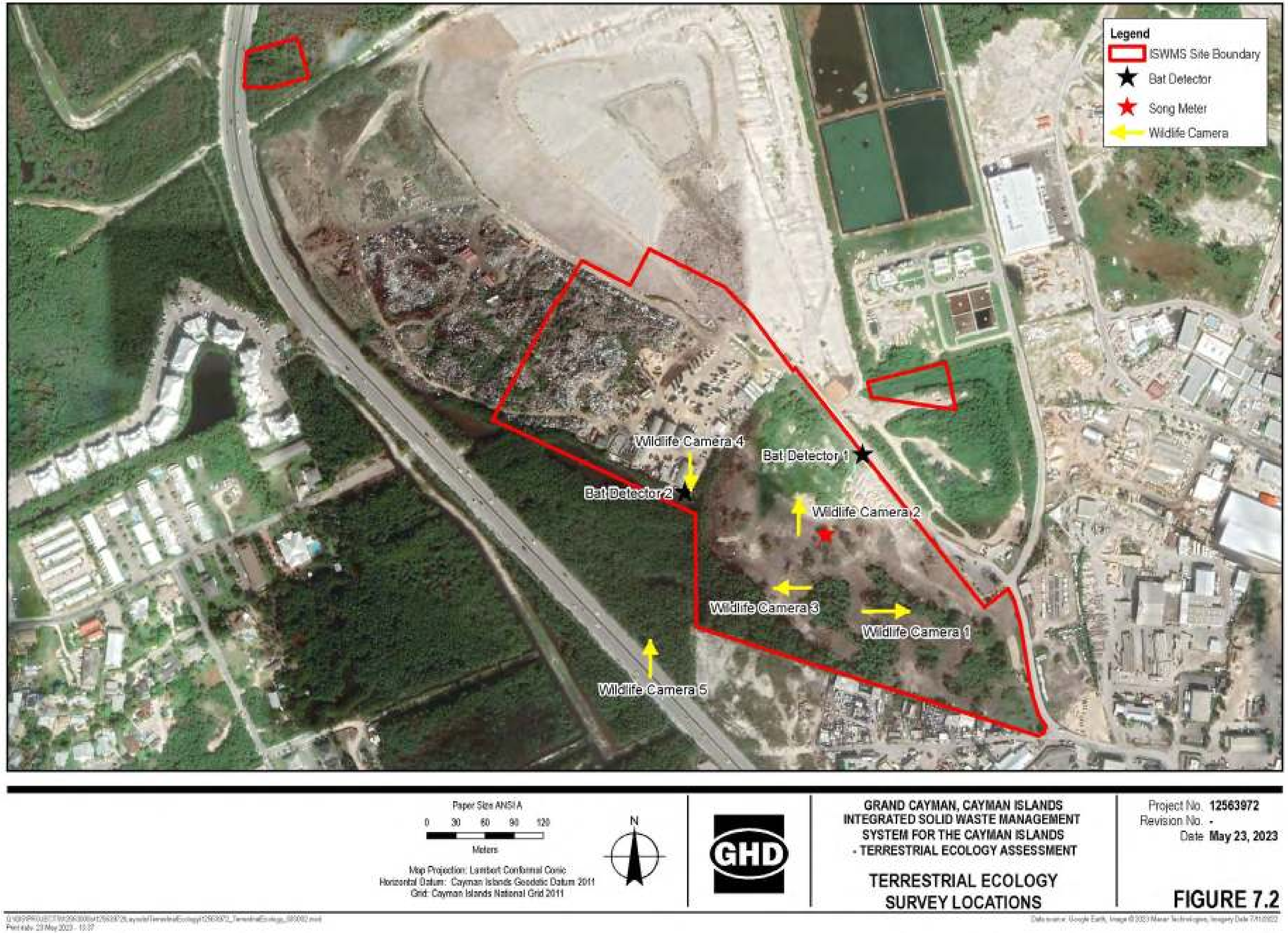


Figure 7.3 Terrestrial Ecology wildlife survey equipment set-ups: (1) bat acoustic survey, (2) audiofauna survey, and (3) wildlife camera survey

7.5 Baseline conditions

7.5.1 Existing environment

The Site consists of areas of filled land, mangrove, poorly vegetated land, and bare ground. The southwest part of the Site comprises a mangrove community. The remainder of the Site is a combination of bare ground, landfilled ground, and a few small operations buildings with little or no vegetative cover. Vegetation removal has been on-going in the southeast part of the Study Area since the ToR was in development as part of Site operations associated with the GTLF.

The Site lies within a landscape which is mostly heavily developed, and construction has occurred on all sides. Immediately north of the Site lies the GTLF – the northwestern part of the proposed ISWMS Site is formed of part of the landfilled area. An inland remnant mangrove and the Esterly Tibbetts Highway are to the west, and to the northeast is the Cayman Islands wastewater treatment plant. Immediately south and east of the Site is an industrial area comprising bare land, open air storage of plant and equipment, and a series of (generally) low rise industrial buildings.

This current characterization of the Site as filled land, mangrove, poorly vegetated land, and bare ground is the baseline used for the impact assessment for the proposed ISWMS as it is surrounded by developed or developing lands.

7.5.2 Consultation results

The DoE was consulted on November 18, 2022, with response received on November 29, 2022. Terrestrial mapping within a 1.2 mile (2 km) radius of the Site was shared and incorporated into the baseline conditions. This mapping delineated mangroves, wetlands, bat house and colony locations, lands protected by the National Conservation Act and by the National Trust for the Cayman Islands (Figure 7.4), habitat mapping (discussed further in Section 7.5.4; Figure 7.5), and historical vegetation mapping (discussed further in Section 7.5.4.3; Figure 7.6).

The National Trust for the Cayman Islands, the National Conservation Council, and BirdLife International were contacted on November 23, 2022, and on April 27, 2023. No responses have been received to date.

All agency correspondence is presented in **Appendix 7.A (Terrestrial Ecology Report – Appendix A).**

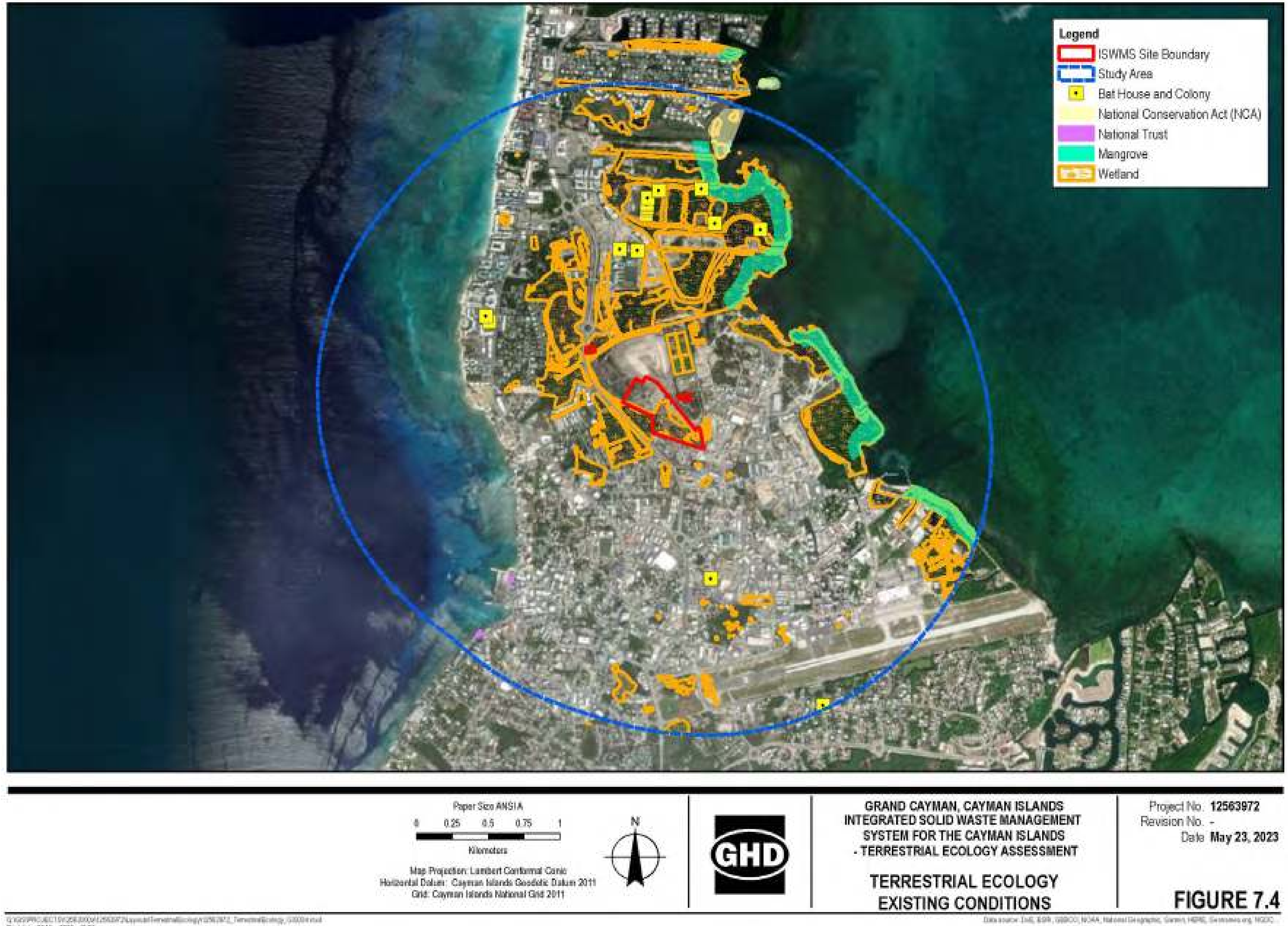
7.5.3 Designated / policy areas

Within the defined desktop study radius there are two proposed Ramsar sites, details of which are provided in Table 7.3. These features are located outside the Study Area; however, data was collected within the ToR which included a 7.46-mile (12 kilometre) radius from Site for the purposes of this evaluation.

On February 27, 2023, the CIG issued an Interim Directive for the Protection of the Grand Cayman Blue Iguana (*Cyclura lewisi*) in accordance with Section 17 (7) of the National Conservation Act[18]. This interim directive focuses on the immediate protection of the portion of the Cayman Island blue iguana population residing in the east end of Grand Cayman (greater than 15.5 miles [25 kilometres]) east of the proposed ISWMS Site.

[18] Department of Environment (DoE). *The National Conservation Law*. 2013.URL: https://doe.ky/wp-content/uploads/2015/01/NationalConservationLaw-Es052014_web.pdf

Figure 7.4 Terrestrial Ecology existing conditions[19]



[19] Data source: Cayman Island Department of Environment

Table 7.3 Designated / policy areas in and near the Study Area

Name	Status	Approximate distance and direction from proposed development	Description	Feature value at a project scale
Central Mangrove Wetland, Little Sound, Ponds and associated Marine Zones	Proposed Ramsar site	2.8 miles (4.5 km) east	A 98 percent pristine mangrove wetland covering approximately 30 percent of the area of Grand Cayman. It supports important habitats, marine invertebrates, and internationally important populations of migratory birds.	I-3: as a proposed site of international importance (i.e., Ramsar Conservation Wetland of International importance)
Barkers Wetland	Proposed Ramsar site	4.7 miles (7.5 km) north	One of the largest areas of undeveloped land on the western peninsula of Grand Cayman, it is a continuum from coral reef to coastal forest and mangrove. The wetland supports breeding and migratory birds as well as important invertebrates and endemic fish.	I-3: as a proposed site of international importance (i.e., Ramsar Conservation Wetland of International importance)
DoE Primary habitat and Land use "Wetland" (Figure 7.5)	Mapped under CBD and NCL	On Site. Adjacent the west Site boundary and the further west Esterly Tibbetts Highway; along the north edge of the property line.	Primary habitat is mature habitat in its natural state, otherwise uninfluenced by human activity where ecological processes are not significantly disturbed. This is the preferred habitat where species can persist. These locations are areas where important ecological processes and vital interface interactions between ecosystems occur.	Discussed in Section 7.5.4.1.1 and 7.5.4.2
DoE Land use "Man-Modified" (Figure 7.5)	Mapped under NCL	On Site. South end of study Site, east of Seymour Road.	Defined as the populated areas of the Cayman Island, and those areas of land subject to direct modification by humans.	Discussed in Section 7.5.4.1.2

7.5.4 Terrestrial habitat assessment

Site primary source data collection was limited to the acoustic and camera methodologies outlined in Section 7.4 and supplemented with secondary source information.

A key reference of secondary source information relied upon was the detailed terrestrial habitat assessment of the Cayman Islands conducted as part of the NBAP[20]. Terrestrial habitats were divided into salt-tolerant succulents, pools, ponds, and mangrove lagoons, dry shrubland forest and woodland, caves, farms and grassland, urban and man-modified areas, and roads.

7.5.4.1 Land use

DoE habitat mapping (Figure 7.5) shows that the proposed development on the Grand Cayman is primarily located on Wetland and Urban and Man-Modified Areas on Site.

7.5.4.1.1 Wetland

Wetland is a vegetation community that contain any amount marsh, swamp, mangrove, or other non-marine water areas, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish, or salt, and includes any terrestrial or marine area forming part of the same ecological system[21]. Figure 7.5 presents a large area in the southeast portion of the ISWMS Site as wetland; however, Site investigations have confirmed the majority of these lands have been previously disturbed and used for waste disposal activities dating back 18 years or more.

The NBAP defines the habitat of 'pools, ponds and mangrove lagoons' as "natural and man-modified areas of standing permanent and temporary water and associated vegetation, including pools, ponds, ditches and flooded marl pits"[22]. Given their similarity by definition, wetlands are assigned a value of N-6 at a project scale due to pools, ponds and mangrove habitat being listed in the NBAP.

7.5.4.1.2 Urban and man-modified areas

Urban and Man-Modified areas of the Caymans Islands are defined as the populated areas that have been subject to direct modification by humans. This may include residential areas, commercial areas, public and private green-space, land cleared for development, active farmland, or historically cleared areas. Roads are a component of this feature but can also be classified under their own habitat[23]. Within the Site, the majority of the western section and the perimeter of the eastern section are mapped as Man-Modified areas. While not mapped as such, Site investigations have confirmed that the majority of the southeast portion of the ISWMS Site has been previously disturbed and should be considered "Man-Modified" areas.

Urban and Man-Modified areas are assigned a value of N-6 at a project scale due to the habitat being listed in the NBAP.

7.5.4.2 Primary habitat

Primary Habitat is defined as mature habitat in its natural state, otherwise uninfluenced by human activity where ecological processes are not significantly disturbed[24]. As part of international agreements that were set for the CBD, Ramsar and Bonn Agreements, Primary Habitat has been mapped in the Cayman Islands. Figure 7.5 demonstrates

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20 DaCosta-Cottam, M., J. Olynik, J. Blumenthal, K. D. Godbeer, J. Gibb, J. Bothwell, F. J. Burton, P. E. Bradley, A. Band, T. Austin, P. Bush, B. J. Johnson, L. Hurlston, L. Bishop, C. McCoy, G. Parsons, J. Kirkconnell, S. Halford, and G. Ebanks-Petrie. *Cayman Islands National Biodiversity Action Plan 2009, Cayman Islands Government, Department of Environment*. 2009

21 Ramsar Convention. *An Introduction to the Ramsar Convention on Wetlands, 7th ed. (previously The Ramsar Convention Manual). Ramsar Convention Secretariat, Gland, Switzerland*. 2016.

22 DaCosta-Cottam, M., J. Olynik, J. Blumenthal, K. D. Godbeer, J. Gibb, J. Bothwell, F. J. Burton, P. E. Bradley, A. Band, T. Austin, P. Bush, B. J. Johnson, L. Hurlston, L. Bishop, C. McCoy, G. Parsons, J. Kirkconnell, S. Halford, and G. Ebanks-Petrie. *Cayman Islands National Biodiversity Action Plan 2009, Cayman Islands Government, Department of Environment*. 2009

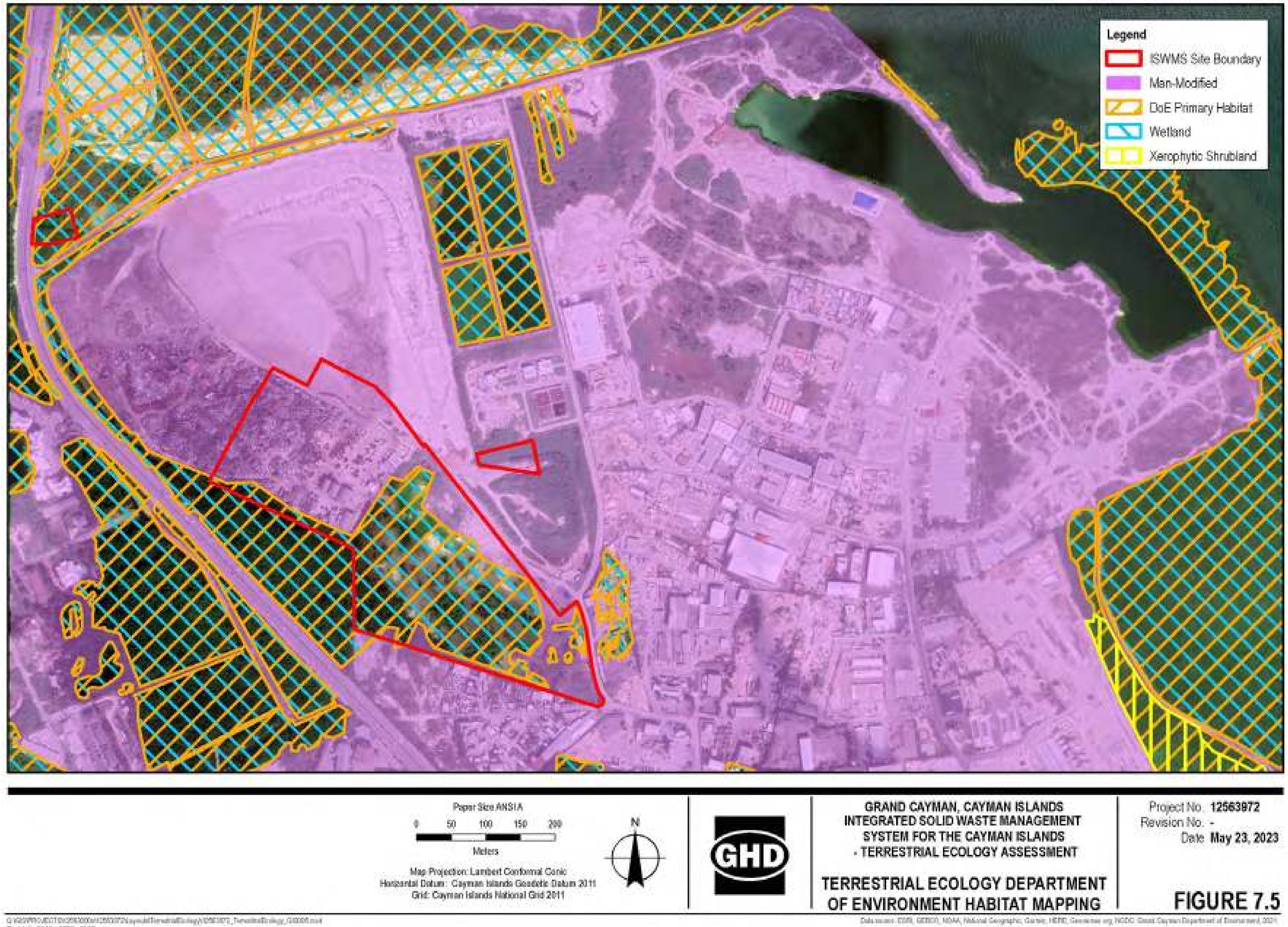
23 Ibid.

24 Department of Environment (DoE). *Submission to the Central Planning Authority, published by Cayman News Service: After-fact primary habitat removal to be approved.* 2020.URL: https://caymannewsservice.com/2020/09/after-fact-primary-habitat-removal-to-be-approved/

the areas on and surrounding the Site that have been mapped as Primary Habitat. Within the Site, Primary Habitat represents the same areas as defined previously as wetland.

Site investigations have confirmed that the terrestrial habitat within the southeast portion of the ISWMS Site, while mapped previously as Primary Habitat, is no longer consistent with the definition. Prior to acquisition by DART in November 2020, these lands were cleared and used for waste disposal activities. As such, this habitat is assigned a value of Ne-3 at a project scale due to common and widespread semi-natural habitats that do not occur in levels elevated above those of the surrounding area.

Figure 7.5 Terrestrial Ecology DoE habitat mapping[25]



[25] Data source: Cayman Island Department of Environment

7.5.4.3 Vegetation reconnaissance

The lands within the Site are predominantly industrial, occasional shrubland, and thickets inundated with water. Vegetation communities that were mapped as part of historical data, are shown on Figure 7.6. The composition of shrub communities was variable, ranging from deciduous lowland shrublands, frequently containing red mangrove or black mangrove. There are numerous culturally disturbed areas within the limits of the Site to the operations of the Site. Many of the areas noted as wetland vegetation communities have been historically cleared.

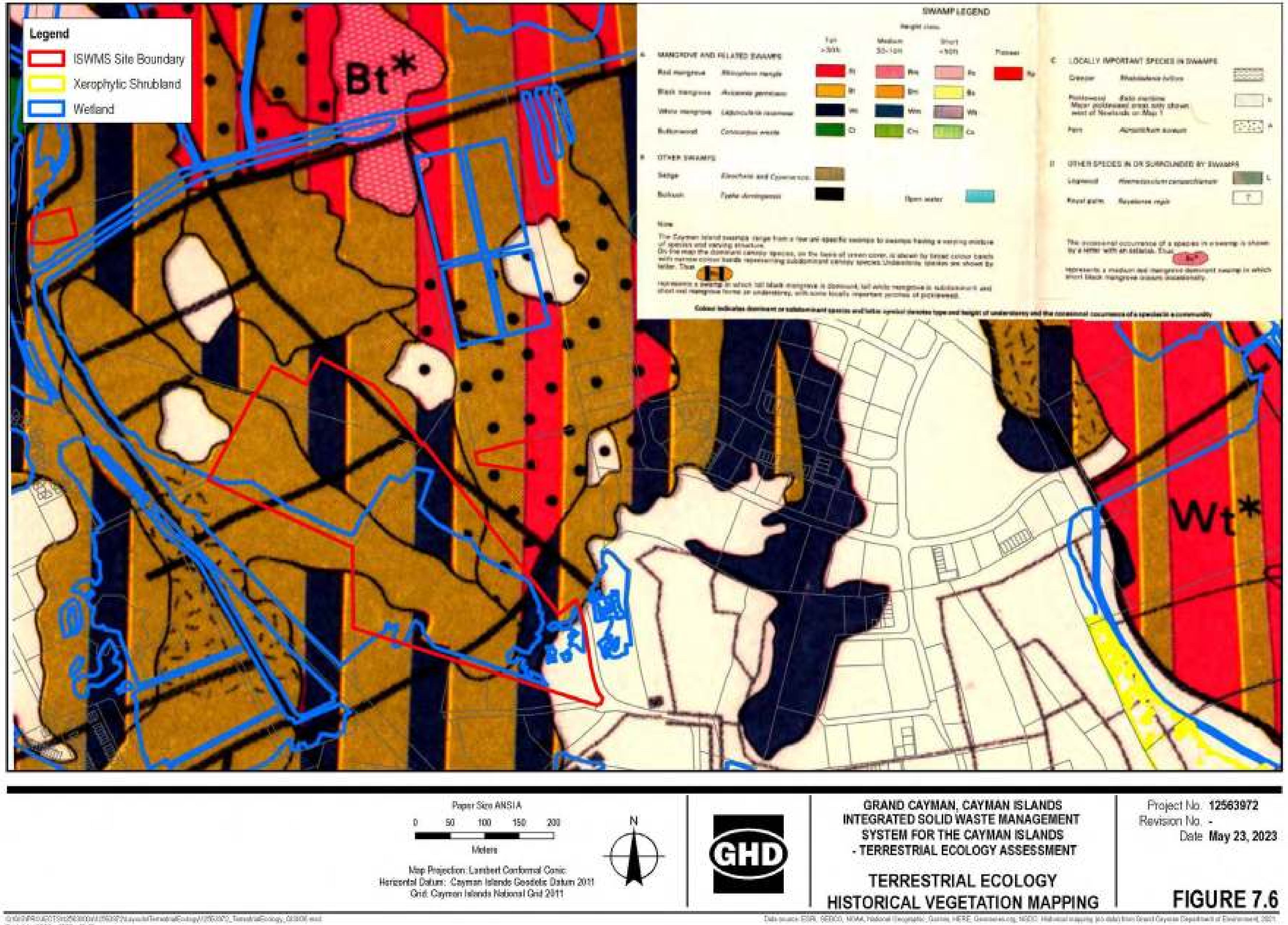
The historical vegetation mapping (Figure 7.6) identifies the western side of the property abutting Esterly Tibbetts Highway as being dominated by medium height black mangrove (10 – 30 feet (3 – 9 m)) and sub-dominated by medium height white mangrove (10 – 30 feet (3 – 9 m)). This same community is identified on Figure 7.6 as being present in the Caribbean Utility Company (CUC) substation Study Area to the northwest, north of Esterly Tibbitts Highway.

A swamp dominated by red mangrove in which tall black mangrove occurs occasionally is found along the northeastern portion of the property, beyond the Site boundaries, but within the Study Area. A portion of the Study Area in the south, east of Seymour Road is identified as being dominated by tall black mangrove, sub dominated by tall red mangrove, with patches of golden leather fern (*Acrostichum aureum*). The DoE habitat mapping (Figure 7.5) identifies this area as Man-Modified and falls outside the Primary Habitat areas.

Certain areas of vegetation were dominated primarily by unidentified mangrove. While other areas were observed with other tree species present, which include Florida thatch palm (*Thrinax radiata*) and river tamarind (*Leucaena leucocephala*). One shrub species, golden leather fern, was identified. Other plants included tridax daisy (*Tridax procumbens*) and chamberbitter (*Phyllanthus urinaria*). A preliminary list of vascular plant species can be found in **Appendix 7.A (Terrestrial Ecology – Appendix B).**

Given that these lands were cleared and used for waste disposal activities prior to acquisition by DART in November 2020, these on-Site vegetation communities are assigned a value of Ne-3 at a project scale due to being common and widespread semi-natural habitats not occurring in levels elevated above those of the surrounding area.

Figure 7.6 Terrestrial Ecology historical vegetation mapping



7.5.5 Wildlife

Several species of wildlife were recorded on Site during Site investigations and through the deployed survey devices. These included green iguana (*Iguana iguana*), red junglefowl (*Gallus gallus*), and stray animals such as feral dogs (*Canis familiaris*), and cats (*Felis catus*). These species are all common to Grand Cayman. Additional wildlife observations are presented below.

7.5.5.1 Bat acoustic survey results

Given the abundance of bat houses and colonies within the Study Area (delineated on the DoE existing conditions mapping, Figure 7.4), bat detectors were installed at two locations (Figure 7.2). The estimated bat passes recorded during the survey are presented in Table 7.4 by species and location. Complete bat acoustic survey results are presented in **Appendix 7.A (Terrestrial Ecology – Appendix C)**.

Of the four species of bats with a reasonable likelihood of detection through acoustic surveys (i.e., high intensity echolocating species), Pallas's mastiff bat and Brazilian free-tailed bat were confirmed on Site. Eastern red bat and big brown bat calls could not be positively confirmed upon manual review of the call data. Overall, the auto-identified eastern red bat calls (18 at Bat 1, 53 at Bat 2) were generally Pallas's mastiff bat search phase calls and feeding buzzes where the higher frequency pulses of this species confused the auto-classifier, or calls misidentified due to poor call quality for auto analysis (typical Pallas's call characteristics evident on manual review were not picked up by the software). Auto-identified big brown bat calls (four at Bat 1, 14 at Bat 2) were generally of insufficient call quality to determine species, but many were deemed likely to be Brazilian free-tailed based on the visible call characteristics. The majority of the sampled "no ID" call files were Pallas's mastiff bat, or either non-bat or small fragments of bat calls that could not be identified. The species could not be identified due to too few call pulses and/or poor quality to confirm species identity.

Bats as a group are assigned a value of N-5 at a project scale due to all species being protected under Schedule 1 Part 1 of the NCL, and species and their habitats being listed in the NBAP.

Table 7.4 Bat acoustic survey results summary

Detector	Pallas's Mastiff Bat Calls*	Brazilian Free-tailed Bat Calls*	Noise Files (Auto-ID)
Bat 1	1,896	114	30,962
Bat 2	11,173	1,200	3,046
Notes			
* Call totals reported include all auto-identified calls for the species, vetted/manually corrected calls auto-identified as an alternative species (eastern red bat or big brown bat), and 5 percent of the calls noted as "no ID" by the Kaleidoscope auto-classifier. Refer to Section 7.4.4.1 for methodology on call analysis details.			

Bats, as protected species, are further discussed in Section 7.5.6.1.

7.5.5.2 Audiofauna survey results

Audiofauna surveys identified the presence of 20 birds, three amphibians (Cuban treefrog [*Osteopilus septentrionalis*], eastern narrowmouth toad [*Gastrophryne carolinensis*], and greenhouse frog [*Eleutherodactylus planirostris*]) and one mammal (agouti [*Dasyprocta punctata*]) species.

Amphibians and mammals are assigned a value of Ne-3 at a project scale due to common and widespread semi-natural species that do not occur in levels elevated above those of the surrounding area.

Of the 20 bird species identified through audiofauna surveys, 19 species are protected under Schedule 1 Part 1 of the NCL. Birds as a group are assigned a value of N-5 due to most species being protected under Schedule 1 Part 1 of the NCL. Protected bird species are further discussed in Section 7.5.6.3.

Complete results of audiofauna surveys are presented in **Appendix 7.A (Terrestrial Ecology – Appendix D)**.

7.5.5.3 Wildlife camera survey results

Wildlife camera surveys identified the presence of four arthropods, 15 birds, three reptiles, and one mammal species. Limitations with survey equipment led to the inability to accurately identify arthropods and reptiles captured on camera to a genus or species level due to poor camera imagery. Critical identification features were not visible due to the nature of the survey and are documented in our results table accordingly. For that reason, these unidentified arthropods and reptiles are not assigned a value at a project scale.

The one mammal identified through wildlife camera surveys was feral dogs. Given their feral status, they are not assigned a value at a project scale.

Of the 15 bird species identified, 14 species are protected under Schedule 1 Part 1 of the NCL. As previously stated in Section 7.5.5.2, birds as a group are assigned a value of N-5 due to most species being protected under Schedule 1 Part 1 of the NCL. Protected species are further discussed in Section 7.5.5.

Complete results of wildlife camera surveys are presented in **Appendix 7.A (Terrestrial Ecology – Appendix E)**.

7.5.6 Protected species

According to the NBAP[26], numerous protected species have been reported to use the terrestrial habitats of the Study Area. Species listed under Schedule 1 Part 1 of the NCL are protected at all times, while those listed under Part 2 may be hunted or collected in accordance with regulations or a conservation plan (if any). A complete list of these species is included in **Appendix 7.A (Terrestrial Ecology – Appendix F)**. Those species confirmed on Site or with potential to occur within the Site are discussed further below.

7.5.6.1 Bats

There are no endemic bat species in the Cayman Islands, however, all bat species on the Cayman Islands are protected under Part 1 of Schedule 1 of the NCL and are therefore protected at all times. The breeding season for bats in the Cayman Islands occurs from June 1 to November 15. Threats to bat species are primarily due to loss and disturbance of natural habitats and roosts. Clearance of vegetation and in-filling of caves for development, anthropogenic disturbances (humans, powerlines, wind turbines, etc.), non-native landscaping, and predation from non-native species negatively impacts roosting and feeding habitat[27].

Acoustic surveying confirmed two species of bats to be present within the proposed ISWMS Site; however, all nine bat species listed below have the potential to occur within the Site based on the available habitat. Since the acoustic survey equipment does not pick up those species that are non-echolocating or are low-intensity echolocating there is a limitation to the data set for this Site in determining if those species are not present, and are therefore discussed here based on available habitat.

Antillean nectar bat is distributed only in Cuba, Isla de Pinos, Grand Cayman, Hispaniola and Middle Caicos[28]. Antillean nectar bat are primarily a cave dwelling species and prefer habitat consisting of deep hot caves. Where no deep caves exist, Antillean nectar bat have a more opportunistic habitat selection and have been documented to live in cooler, less humid caves[29]. Antillean nectar bat has a *low potential* to occur within the Site as no caves are present. Antillean nectar bats are nectarivore and rely on pollen, but their diet also includes fruit and insects[30]. This species of bat relies on non-echolocating foraging strategies to forage for food.

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[26] DaCosta-Cottam, M., J. Olynik, J. Blumenthal, K. D. Godbeer, J. Gibb, J. Bothwell, F. J. Burton, P. E. Bradley, A. Band, T. Austin, P. Bush, B. J. Johnson, L. Hurlston, L. Bishop, C. McCoy, G. Parsons, J. Kirkconnell, S. Halford, and G. Ebanks-Petrie. *Cayman Islands National Biodiversity Action Plan 2009, Cayman Islands Government, Department of Environment*. 2009

[27] Ibid.

[28] Nowak, R. M. *Walker's Bats of the World. Johns Hopkins University Press, Baltimore*. 1994.

[29] Swanepoel, P. and H. H. Genoways. *Revision of the Antellean Bats of the Genus Brachyphylla (Mammalia: Phyllostomatidae). Bulletin of Carnegie Museum of Natural History 12: 1-53*. 1978.

[30] Silva-Taboada, G., and R. H. Pine. *Morphological and behavioral evidence for the relationship between the bat genus Brachyphlla and Phyllonycterinae. Biotropica. 1:10-19*. 1969.

Big brown bat ranges from southern Canada to the very northern edge of South America, and includes islands of the Greater Antilles, The Bahamas, Grand Cayman, Barbuda, and Dominica[31]. *Eptesicus fuscus minor* is the smallest known representative of the *E. fuscus* genus and is a subspecies endemic to Grand Cayman. Big brown bat is known to roost in a range of habitats such as tree hollows, natural caves, rock ledges, and anthropogenic structures such as buildings, roofs, etc. This species roosts in large colonies in well ventilated, open areas of caves, or in smaller groups in other cavities[32]. Big brown bat is an aerial insectivore with a diet consisting primarily of beetles and occasionally other insects such as moths, flies, wasps, flying ants, lacewing flies, and dragonflies. Foraging occurs throughout the night, beginning soon after sunset and ending just before sunrise[33]. In the tropics, there is no evidence of hibernation, but these bats may become torpid if temperatures drop below 20˚C rather than leaving the roost to hunt[34]. Big brown bat *has the potential* to occur within the Site and may utilize treed vegetation and anthropogenic structures as roosting habitat.

Brazilian free-tailed bat is widely distributed across the southern United States, Mexico and Central America, portions of South America, and the Greater and Lesser Antilles, making it one of the most widely distributed species of bat in the Americas. Brazilian free-tailed bat is known to utilize a range of habitats including caves, mine tunnels, old wells, tree hollows, and anthropogenic habitats such as bridges, buildings, and residences. Solitary individuals or small groups are found in fissures or on walls and ceilings of caves and manmade structures, whereas larger groups of tens of bats occupy bell holes, and groups of hundreds or thousands roost in large places on the ceiling of caves. Brazilian free-tailed bats are an insectivorous species and foraging is mainly at dusk and dawn during peak insect activity[35]. Brazilian free-tailed *bat has the potential* to occur within the Site given the presence of treed vegetation and anthropogenic habitats that are present.

Buffy flower bats live in subtropical and tropical forests, including pine woodlands. Roosts have been found to contain a few hundred to a few thousand individuals. These bats hang alone or bunched from cave walls and ceilings. Buffy flower bats have been found both in the inside portions of the hot caves where it is dark, as well as exterior. Buffy flower bats tend to choose hot caves with only slight climate changes. It is thought that buffy flower bats may visit numerous caves throughout their home range[36]. These animals have been detected from low to medium levels of elevation; they have been captured in dry washes from sea level to 100 m elevation. In The Bahamas and Caymans, colonies range in size from a few individuals to a few hundred[37,38]. No caves are present within the Site and therefore buffy flower bat has a *low potential* of occurring. This species of bat relies on non-echolocating foraging strategies to forage for food. The diet of buffy flower bat consists of insects, fruit, and nectar, but are known to specialize in nectar and pollen feeding[39].

Eastern red bat is known to prefer habitat that is sparsely to moderately populated by humans and are rarely seen in urbanized areas. Eastern red bats primarily choose roosting sites in dense foliage within areas that range from 0.5 - 12 m off the ground. They are an aerial insectivore that uses echolocation at a high intensity interval. The diet of eastern red bats consists of beetles, flies, moths, leafhoppers, and termites, therefore, can likely be found foraging in open areas above tree canopy or along forest edges[40]. Eastern red bats have also been observed foraging around streetlights due to the high concentration of insects[41]. Eastern red bat *has the potential* to occur within the Site due to the presence of preferred roosting and foraging habitat such as treed vegetation and forest edge habitat.

31 Gannon, M. R., A. Kurta, A. Rodriguez-Duran, and M. R. Willig. *Bats of Puerto Rico*. 2005. Lubbock, TX: Texas Tech University Press.
32 Silva Taboada, G. *Los murciélagos de Cuba. Editorial Academia, Havana*. 1979.
33 Ibid.
34 Ibid.
35 Ibid.
36 Goodwin, R. E. *The ecology of Jamaican bats. Journal of Mammalogy, 51:571–579*. 1970.
37 Hall, J. S., C. W. Stihler, and P. L. Dougherty. *Bat populations on San Salvador and New Providence Islands. Bahamas Journal of Science 6:22-27*. 1998.
38 Murray, K.L., & Fleming, T.H. *Social structure and mating system of the buffy flower bat, Erophylla sezekorni (Chiroptera, Phyllostomidae)*. 2008.
39 Soto-Centeno, J. A., and A. Kurta. *Diet of two nectarivorous bats, Erophylla sezekorni and Monophyllus redmani (Phyllostomidae), on Puerto Rico. Journal of Mammalogy, 887:19–26*. 2006.
40 Rodriguez-Duran, A. *Nonrandom aggregations and distribution of cave-dwelling bats in Puerto Rico. Journal of Mammalogy, 19: 141–146*. 1998.
41 Hickey, M. b. C., and M. B. Fenton. *Foraging by red bats (Lasiurus borealis) do intraspecific chases mean territoriality? Canadian Journal of Zoology, 68(12): 2477–2482*. 1990.

Jamaican fruit bat distributed from Mexico and Central America to northwest South America and is found throughout the Greater and Lesser Antilles[42]. Jamaican fruit bat is known to occur throughout many habitat types including evergreen forests, cloud forests, and arid habitats[43]. They have been found in trunks and foliage trees, caves, and manmade structures. Jamaican fruit bat *has the potential* to occur within the Site and may utilize forest habitat and anthropogenic structures as roosting and foraging habitat. Jamaican fruit bat is a generalist frugivore but has been known to feed on plant materials such as pollen, nectar, flowers, and leaves as well[44]. In some areas of their range, Jamaican fruit bats have been observed to visit the same fruiting plant on consecutive nights[45].

Pallas's mastiff bat prefers habitat in subtropical and tropical moist lowlands. Pallas's mastiff bats are known to roost in cavities found in tree hollows or utility poles, in leaves, as well as buildings and roofs. Pallas's mastiff bat is one of the most abundant insectivorous species of bats in urban areas. Pallas's mastiff bat is also known to forage in very open areas and usually at higher altitudes[46]. Pallas's mastiff bat *has the potential* to occur within the Site given the presence of preferred roosting habitat of treed vegetation and anthropogenic structures.

Waterhouse's leaf-nosed bat occurs on the mainland from the southwestern United States, through western Mexico to Guatemala, and in the West Indies in Cuba, Hispaniola, Jamaica, Turks and Caicos, The Bahamas, and the Cayman Islands[47]. In Grand Cayman, abandoned roosts of Waterhouse's leaf-nosed bat have been identified at Old Man Bay, Spotts Bat Cave, the Agriculture Pavilion Cave, and Pirate's Cave side tunnel. Waterhouse's leaf-nosed bat is found primarily in dry areas and rarely in evergreen lowland forests[48]. This species prefers roosting in humid, dark, sheltered caves but when roosting in buildings will tolerate more light[49]. Waterhouse's leaf-nosed bat prefers foraging in densely foliated habitats and is considered a gleaning insectivore as it captures insects from a surface rather than in the air[50]. Waterhouse's leaf-nosed bat has a *low potential* to occur within the Site due to the absence of caves; however, these bats have been observed roosting in anthropogenic structures and may still occur within the Site.

White-shouldered bat is a foliage-roosting bat and prefers forested habitats at low elevations (below 680 m) such as lowlands and low mountains[51]. Forested habitat such as evergreen, submontane, pine, and semideciduous forests, and urban parks have had documented observations of white-shouldered bat. Very little is known about the diet of white-shouldered bat, but a few observations and fecal samples have documented the fruit of *Syzygium jambos* and seeds of *Cecropia scheberiana* to be present in their digestive tract[52]. White-shouldered bat *has the potential* to occur within the Site and may utilize edge forest habitat present.

Of the nine bat species with the potential to occur within the Site, five species (buffy flower bat, Antillean nectar bat, white-shouldered bat, Waterhouse's leaf-nose bat, and Jamaican fruit bat) would not have been able to be detected through acoustic surveys as they either do not use echolocation as a means of foraging for food or use echolocation at too low of a frequency to accurately detect through acoustic monitoring. Of the non-echolocating species though, only white-shouldered bat and Jamaican fruit bat have more than a low potential of occurrence on Site based on an assessment of habitat. Of the four bat species with the potential to occur within the Site and able to be detected via acoustic monitoring, two bat species were identified on Site including: Pallas's mastiff bat and Brazilian free-tailed bat.

Pallas's mastiff bat is listed as Least Concern on the IUCN red list[53]. Currently there is no critical concern for the status of the local population of *Molossus molossus minor*, which is known only from the Cayman Islands and Cuba. This

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42 Larsen, R., K. A. Boegler, H. H. Genoways, W. P. Masefield, R. A. Kirsch, and S. C. Pedersen. *Mist netting bias, species accumulation curves, and the rediscovery of two bats on Montserrat (Lesser Antilles). Acta Chiroptera, 9(2): 423–435.* 2007.

43 Ortega, J. and I. Castro-Arellano. *Artibeus jamaicensis. American Society of Mammalogists, 622: 1–9.* 2001.

44 Gannon, M. R., A. Kurta, A. Rodriguez-Duran, and M. R. Willig. *Bats of Puerto Rico.* 2005. Lubbock, TX: Texas Tech University Press.

45 Ibid.

46 Holland, R. A., C. F. Meyer, E. K. Kalko, R. Kays, and M. Wikelski. *Emergence time and foraging activity in Pallas' mastiff bat, Molossus molossus (Chiroptera: Molossidae) in relation to sunset/sunrise and phase of the moon. Acta Chiropterologica, 13(2), pp.399-404.* 2011.

47 Anderson, S. and Nelson, C.E. *A systematic revision of Macrotus (Chiroptera). American Museum novitates; no. 2212.* 1965.

48 Ibid.

49 Silva Taboada, G. *Los murciélagos de Cuba. Editorial Academia, Havana.* 1979.

50 Emrich, M.A., E. L. Clare, W. O. Symondson, S. E. Koenig, and M. B. Fenton. *Resource partitioning by insectivorous bats in Jamaica. Molecular Ecology, 23(15), 3648-3656.* 2014.

51 Taveras, V. D. C. and C. A. Mancina. *Phyllops falcatus (Chiroptera: Phyllostomidae). Mammalian Species 811: 1-7.* 2008.

52 Mancina, C. A., and L. Garcia-Rivera. *Notes on the natural history of Phyllops falcatus (Gray, 1839) (Phyllostomidae: Sterodermatinae) in Cuba. Chiroptera Neotropical 6(1–2): 123–125.* 2000.

53 Barquez, R., B. Rodriguez, B. Miller and M. Diaz. *Molossus molossus. The IUCN Red List of Threatened Species 2015: e.T13648A22106602.* 2015. https://dx.doi.org/10.2305/IUCN.UK.2015-4.RLTS.T13648A22106602.en. Accessed on 23 November 2022.

species of bats is not known to be migratory, however little information exists for their movement patterns. Pallas's mastiff bat is known to utilize mangrove, pools, ponds, mangrove lagoons, forest, woodland, caves, farmland, grassland, and urban habitat for either roosting or foraging activity, some of which can be found on-Site[54].

Brazilian free-tailed bat is listed as Least Concern on the IUCN red list[55]. The status of the Cayman Islands' population is currently unknown, though calls have been documented via Anabat and a D-20 Petterson bat detector[56,57]. A colony of an estimated 8,000-30,000 bats appears to have abandoned the large cave in Old Man Bay[58]. Previously, sixteen individuals were observed in the Salina Cave, pre-hurricane Ivan[59]. Brazilian free-tailed bat is known to utilize pools, ponds, mangrove lagoons, forest, woodland, caves, farmland, grassland, and urban habitat for either roosting or foraging activities[60], some of which can be found on Site. This species has the variety of migration strategies known throughout its range, including some long-distance seasonal migrations and some residents that do not migrate due to appropriate temperatures and food availability.

Bats as a group are assigned a value of N-5 at a project scale due to all species and their habitats being listed in the NBAP. The four species assessed as potentially or confirmed to be associated with the Site are white-shouldered bat, Jamaican fruit bat, Palla's mastiff bat and Brazilian free-tailed bat.

7.5.6.2 Inland mangroves

"Mangrove" habitats are a generic term describing the plant assemblages that inhabit saline coastal habitats. These habitats are also named for the dominant species associated with this habitat. In the Cayman Islands, there are four mangrove species: black mangrove, white mangrove, red mangrove, and buttonwood. All species are listed under Part 2 of Schedule 1 of the NCL and have a tolerance for wet, salty conditions. Red mangrove is a pioneering species typically comprising the seaward fringe of a mangrove forest, while buttonwood is typically found in the driest, least-saline environments of all mangroves[61].

The inland mangrove wetland located east of Esterly Tibbetts Highway and in the western portion of the Site is understood to be isolated from an active marine connection as a result of surrounding development in the last 20 years. Black mangrove was the only species identified to be present on Site during the preliminary surveys of vascular plants. This species is often observed growing up to 9 m tall with a large diameter of a trunk. Black mangrove can tolerate more saline conditions then other mangroves species present in the Cayman Islands and tend to grow landward. Threats to this species are primarily related to unsustainable removal, over development, and climate change[62]. The inland mangrove wetland is assigned a value of N-5 at a project scale due to mangrove species being protected under Schedule 1 Part 2 of the NCL.

7.5.6.3 Birds

Twenty-seven bird species identified on-Site through audiofauna and wildlife camera surveys are protected under Schedule 1 Part 1 of the NCL on the Cayman Islands. Swamp and mangrove habitat located within the southeast portion of the Site may provide breeding and feeding habitat for 16 of these protected bird species (Table 7.5). The

54 DaCosta-Cottam, M., J. Olynik, J. Blumenthal, K. D. Godbeer, J. Gibb, J. Bothwell, F. J. Burton, P. E. Bradley, A. Band, T. Austin, P. Bush, B. J. Johnson, L. Hurlston, L. Bishop, C. McCoy, G. Parsons, J. Kirkconnell, S. Halford, and G. Ebanks-Petrie. *Cayman Islands National Biodiversity Action Plan 2009, Cayman Islands Government, Department of Environment*. 2009

55 Barquez, R., Diaz, M., E. Gonzalez, A. Rodriguez, S. Incháustegui, and J. Arroyo-Cabrales. *Tadarida brasiliensis. The IUCN Red List of Threatened Species 2015: e.T21314A22121621*. 2015. https://dx.doi.org/10.2305/IUCN.UK.2015-4.RLTS.T21314A22121621.en. Accessed on 23 November 2022.

56 Freeman, P.W. *Specialized insectivory: beetle eating and moth eating molossid bats.. Journal of Mammalogy, 60(3):467-479*. 1979.

57 Simmons, J.A., W. A. Lavender, B. A. Lavender, J. E. Childs, K. Hulebak, M. R. Rigden, J. Sherman, B. Woolman, and M. J. O'Farrell. *Echolocation by Free-tailed bats (Tadarida). Journal of Comparative Physiology, 125: 291–299*. 1978.

58 Department of Environment (DoE). *Terrestrial Mammals*. 2021. URL: https://doe.ky/terrestrial/animals/mammals/

59 Ibid.

60 DaCosta-Cottam, M., J. Olynik, J. Blumenthal, K. D. Godbeer, J. Gibb, J. Bothwell, F. J. Burton, P. E. Bradley, A. Band, T. Austin, P. Bush, B. J. Johnson, L. Hurlston, L. Bishop, C. McCoy, G. Parsons, J. Kirkconnell, S. Halford, and G. Ebanks-Petrie. *Cayman Islands National Biodiversity Action Plan 2009, Cayman Islands Government, Department of Environment*. 2009

61 Ibid.

62 Department of Environment (DoE). *The National Conservation Law*. 2013.URL: https://doe.ky/wp-content/uploads/2015/01/NationalConservationLaw-Es052014_web.pdf

primary threats related to these bird species are loss of habitat and habitat fragmentation due to development and urbanization.

Birds as a group are assigned a value of N-5 due to most species being protected under Schedule 1 Part 1 of the NCL.

Table 7.5 Protected bird species utilizing habitat on/immediately adjacent the Site

Species	Habitat
Black and white warbler, *Mniotilta varia*	Woods; trunks, limbs of trees. Breeds in mature or second-growth forests, deciduous and mixed. Often in woods on dry, rocky hillsides and ravines. Also nests in dry portions of **wooded swamps**. In migration, seen most often on trunks and low branches of trees within woodlands and thickets. In winter in the tropics, found in trees from sea level to high in the mountains.
Black-crowned night heron, *Nycticorax nycticorax*	**Marshes**, shores; roosts in trees. Found in a wide variety of aquatic habitats, around both fresh and salt water, including marshes, rivers, ponds, mangrove swamps, tidal flats, canals, rice fields. Nests in groves of trees, in thickets, or on ground, usually on islands or above water, perhaps to avoid predators.
Cayman parrot, *Amazona leucocephala*	Endemic to Cayman Island, utilizes mature **mangrove** and dry forest as breeding habitat. Nest in cavities of dead and live black mangrove (*Avicennia germinans*), and in dry forest in mango (*Mangifera indica*), strangler fig (*Ficus aurea*), royal palm (*Roystonea regia*), and red birch (*Bursera simaruba*).
Common gallinule, *Gallinula galeata*	**Fresh marshes**, reedy ponds. May be on still or slow-moving waters. Favors fresh marshes with some open water, ideally with some open ground and some dense cover along margins. Sometimes on more open ponds with only small amount of marsh cover.
Common yellowthroat, *Geothlypis trichas*	**Swamps, marshes**, wet thickets, edges. Breeds most abundantly in marshes and other very wet habitats with dense low growth. Also nests in briars, moist brushy places, tangles of rank weeds and shrubbery along streams, and overgrown fields, but is generally scarce in drier places. In migration and winter, still most common in marshes, but also occurs in any kind of brushy or wooded area.
Gray catbird, *Dumetella carolinensis*	Undergrowth, brush, thorn scrub, suburban gardens. At all seasons, favors dense low growth. Most common in leafy thickets along the edges of woods and streams, **shrubby swamps**, overgrown brushy fields, and hedges in gardens. Avoids unbroken forest and coniferous woods.
Great blue heron, *Ardea herodias*	**Marshes, swamps**, shores, tide flats. Very adaptable. Forages in any kind of calm fresh waters or slow-moving rivers, also in shallow coastal bays. Nests in trees or shrubs near water, sometimes on ground in areas free of predators. "Great White" form is mostly in saltwater habitats.
Great egret, *Ardea alba*	**Marshes**, ponds, shores, mud flats. Usually forages in rather open situations, as along edges of lakes, large marshes, shallow coastal lagoons, and estuaries, also along rivers in wooded country. Usually nests in trees or shrubs near water, sometimes in thickets some distance from water, sometimes low in marsh.
Greater Antillean grackle, *Quiscalus niger*	Greater Antillean Grackle frequents the open areas with trees and the urban areas. It is often seen along water on beaches, lakeshores, and other aquatic areas. It also frequents **mangroves** and **marshes**. It is very common in lowlands.
Greater yellowlegs, *Tringa melanoleuca*	Open marshes, mudflats, streams, ponds; in summer, wooded muskeg, spruce bogs. During migration and winter, found in wide variety of settings, including tidal flats, estuaries, open beaches, **salt and fresh marshes**, shores of lakes and ponds, riverbanks. Breeds in boggy and marshes places within northern coniferous forest.
Green heron, *Butorides virescens*	Lakes, ponds, **marshes, swamps**, stream sides. May be found foraging in practically any aquatic habitat, but most common around small bodies of fresh water, especially those lined with trees, shrubs, tall marsh vegetation. Nests in a wide variety of situations, including willow thickets, mangroves, dry woods, open marsh.
Northern parula, *Setophaga americana*	Breeds mainly in humid woods where either Usnea or Spanish Moss hangs from the trees (but also in some woods where neither is found.) Nests mainly in humid coniferous and deciduous forests, especially those with abundant tree lichens, in **swamps** or along edges of ponds, lakes, or slow-moving streams. In migration and winter, frequents almost any kind of trees.

Species	Habitat
Snowy egret, *Egretta thula*	**Marshes, swamps**, ponds, shores. Widespread in many types of aquatic habitats, including fresh and salt water; in coastal areas, may seek sheltered bays. Inland, favors extensive marshes and other large wetlands. Sometimes forages in dry fields. Nests in colonies in trees, shrubs, **mangroves**, sometimes on or near the ground in marshes.
Tricolored heron, *Egretta tricolor*	**Marshes, swamps**, streams, shores. Mainly in waters of coastal lowlands. In breeding season usually near salt water, on shallow, sheltered estuaries and bays, tidal marshes, **mangrove swamps**. Also, locally inland around freshwater marshes, lakes, rivers. Nests in colonies in trees, mangroves, or scrub near water.
Yellow warbler, *Setophaga petechia*	Bushes**, swamp edges**, streams, gardens. Breeds in a variety of habitats in east, including woods and thickets along edges of streams, lakes, **swamps**, and **marshes**, favoring willows, alders, and other moisture-loving plants. Also, in dryer second-growth woods, orchards, roadside thickets. In west, restricted to streamside thickets. In winter in the tropics, favors semi-open country, woodland edges, towns.
Yellow-crowned night heron, *Nyctanassa violacea*	**Marshes, wooded swamps**, and lakeshores for inland populations, and thickets, **mangroves,** and cliff-bound coasts for coastal populations.
Notes	
Bold font denotes habitat found within the Site.	

7.5.6.4 Grand Cayman blue iguana

The Grand Cayman blue iguana (*Cyclura lewisi)* species are protected under Part 1 of Schedule 1 of the NCL and is therefore protected at all times. Of the over 100,000 photos experts reviewed from the Site wildlife cameras, one iguana was observed whose identification could not be verified due to poor camera imagery. The gular patch was not visible in the imagery and differentiation between Cayman Island iguana species was not possible. Grand Cayman blue iguanas can be highly variable in colour depending on season and age and can lead to confusion between iguana species. Similarly, the invasive green iguana can be variable in colour based on these factors and activities (e.g., mud coverage when emerging from mangroves). Further, the ISWMS Site and immediately adjacent areas are not part of the recently mapped critical habitat for *C. lewisi*[63].

The Grand Cayman blue iguana is listed as Endangered on the IUCN red list[64]. Grand Cayman Blue Iguana only occurs inland, in natural dry shrubland, and along the margins of dry forest habitat[65]. Adults are primarily terrestrial, occupying rock holes and low tree cavities while younger individuals tend to be more arboreal. Like all *Cyclura* species, the Grand Cayman blue iguana is primarily herbivorous, feeding on leaves, flowers and fruits and rarely supplemented with insects. Threats to this species include habitat loss and fragmentation mainly due to development and urbanization, illegal hunting, non-native predators, and road mortality[66]. Based on the available characterization of Primary Habitat and wetland boundaries, suitable habitat is not likely present on Site. Further, Grand Cayman blue iguanas have been historically released in the east end of Grand Cayman[67] over 25 km from the proposed ISWMS Site, and there are no known Grand Cayman blue iguana communities in the vicinity of the Site. Consultation with the EAB[68] supports the interpretation that it is very unlikely that blue iguana would be present on this Site.

63 Department of Environment (DoE). *Reptiles and Amphibians*. 2023. URL: https://doe.ky/terrestrial/animals/reptiles-amphibians/
64 Burton, F.J. *Cyclura lewisi. The IUCN Red List of Threatened Species 2012: e.T44275A2994409.* 2012. https://dx.doi.org/10.2305/IUCN.UK.2012.RLTS.T44275A2994409.en. Accessed on 24 November 2022.
65 DaCosta-Cottam, M., J. Olynik, J. Blumenthal, K. D. Godbeer, J. Gibb, J. Bothwell, F. J. Burton, P. E. Bradley, A. Band, T. Austin, P. Bush, B. J. Johnson, L. Hurlston, L. Bishop, C. McCoy, G. Parsons, J. Kirkconnell, S. Halford, and G. Ebanks-Petrie. *Cayman Islands National Biodiversity Action Plan 2009, Cayman Islands Government, Department of Environment.* 2009
66 Ibid.
67 National Conservation Council. *Species Conservation Plan for Mangroves.* 2013. URL: https://conservation.ky/wp-content/uploads/2021/01/Species-Conservation-Plan-for-Mangroves-FINAL.pdf
68 EAB ReGen comments on draft Chapter 7 Terrestrial Ecology report, April 20, 2023

Grand Cayman blue iguana are assigned a value of I-4 at a project scale due to the species being listed as endangered on the IUCN Red List and protected under Schedule 1 Part 1 of the NCL.

7.5.7 Invasive species

An alien species is one that has been deliberately or accidentally introduced by humans to an environment it would not naturally occur in. An alien species becomes an invasive species once it starts to reproduce and proliferate in that environment. Invasive species are incredibly problematic as they take over habitat and resources once utilised by native species and cause an imbalance of the ecosystem[69]. There are numerous invasive species present in the Cayman Islands, with the majority being terrestrial species (Table 7.6). Those species with a high likelihood of occurring on Site are discussed further below. Invasive species are not assigned a value at project scale.

Table 7.6 Cayman Island invasive species

Common Name	Scientific Name
Birds	
Monk parakeet	*Myiopsitta monachus*
Peafowl	*Pavo cristatus*
Pigeon	*Columba livia*
Red junglefowl	Gallus gallus
Yellow-naped Amazon parrot	*Amazona auropalliata*
Mammals	
Black rat	*Rattus rattus*
Brown rat	*Rattus norvegicus*
Feral cat	*Felis catus*
Goat	*Capra hircus*
Reptiles	
Brahminy blind snake	*Indotyphlops braminus*
Green iguana	*Iguana iguana*
Red-eared slider	*Trachemys scripta elegans*
Tropical house gecko	*Hemidactylus mabouia*
Plants	
Beach naupaka	*Scaevola taccada*
Brazilian pepper	*Schinus terebinthifolia*
Casuarina pine	*Casuarina equisetifolia*
Curly bean	*Adenanthera pavonina*
Wild tamarind	*Leucaena leucocephala*
Water snowflake	*Nymphoides indica*

7.5.7.1 Feral cat

Feral cats (*Felis catus*) are members of the domestic cat species that are recorded in the wild. Feral cats were recorded during Site investigations. This species can be found throughout both urban and natural areas on the

69 Department of Environment (DoE). *Invasive Species*. 2021. URL: https://doe.ky/terrestrial/invasive-species/

island[62]. There are no predators on the island to control the populations. The feral cats stalk, catch, and/or eat pretty animals. The increase in populations is threatening the endangered species found on the island. On the island both blue iguanas and seabirds are directly threatened by feral cats. Within the first two years of the iguana's life the species are extremely vulnerable to predation and few iguanas are making it to breeding age. Additionally, seabirds nesting on the Caymans Island are directly threatened vulnerable with their chicks and the feral cats take out entire families near their nests.

7.5.7.2 Green iguana

Green iguanas were originally thought to have been introduced to the Cayman Islands through intentional releases or escapes from the pet trade and as a food source. Their population has grown exponentially since 2014 and is causing overpopulation issues effecting daily public life and the ecosystem. They cause degradation and complete destruction of vegetation, potentially hybridize with endangered Grand Cayman blue iguanas, and cause public health issues from road collisions to defecating in recreational swimming pools[70]. Widespread control efforts were commenced in 2018 and reduced the population from an estimated 1.3 million individuals to an estimated 25,000 individuals by mid-2020[71].

An iguana was observed during wildlife camera monitoring; however, identification could not be verified due to poor camera imagery. The gular patch was not visible in the imagery and differentiation between iguana species was not possible. Green iguanas are also highly variable in colour depending on season and age and can lead to confusion between iguana species. Based on the cull activities also observed on Site via wildlife camera monitoring, green iguana are inferred to be present on Site.

7.5.7.3 Red junglefowl

Red junglefowl (also known as chickens) were originally imported for agricultural use but have become feral following escape/release into the wild[72]. While they do not pose a direct, significant threat to the environment, they are a neighbourhood nuisance and a road safety hazard and are controlled by the Department of Agriculture[73]. Red junglefowl were observed numerous times on Site.

7.5.7.4 Wild tamarind

Wild tamarind are medium sized tree species that are known to quickly grow as well as spread especially when clearing has recently occurred[74]. They are a tolerant species which allows them to establish and out compete other more sensitive species. Wild tamarind is seen to be a threat as the species is a prolific seed producer and will resprout after its stems experience damage. Wild tamarind is confirmed to be on Site by DART.

7.5.8 Summary of terrestrial baseline conditions

CIEEM guidelines were used in the assessment of ecological receptors. The importance of the ecological features were first assessed with reference to Cayman Island legislation and then the impact to the species or habitat that would be impacted with the proposed ISWMS Site was taken into account.

In the absence of suitable mitigation measures, all the species confirmed or identified with potential to occur on-Site (e.g., non-echolocating bat species) have potential to be impacted from the development at the ISWMS Site directly or through change/loss of habitat.

The ecological receptors of concern for the terrestrial environment include Central Mangrove Wetland, Little Sound, Ponds and associated Marine Zones (proposed Ramsar site), Barkers wetland (proposed Ramsar site), land use

70 Department of Environment (DoE). *Invasive Species*. 2021. URL: https://doe.ky/terrestrial/invasive-species/
71 Harding, L., A. Gunn, and F.J. Burton. *Strategic Species Action Plan for the Grand Cayman Blue Iguana (Cyclura lewisi) 2021–2026*. 2021.
72 Department of Environment (DoE). *Invasive Species*. 2021. URL: https://doe.ky/terrestrial/invasive-species/
73 Cayman Islands Department of Agriculture. *Animals Law (2013 Revision)*. 2013. URL: http://gazettes.gov.ky/portal/pls/portal/docs/1/11528323.PDF
74 Department of Environment (DoE). *Invasive Species*. 2021. URL: https://doe.ky/terrestrial/invasive-species/

wetlands, land use urban and man-modified areas, primary habitat, on-Site vegetation, bats, amphibians, mammals, birds, and Grand Cayman blue iguana.

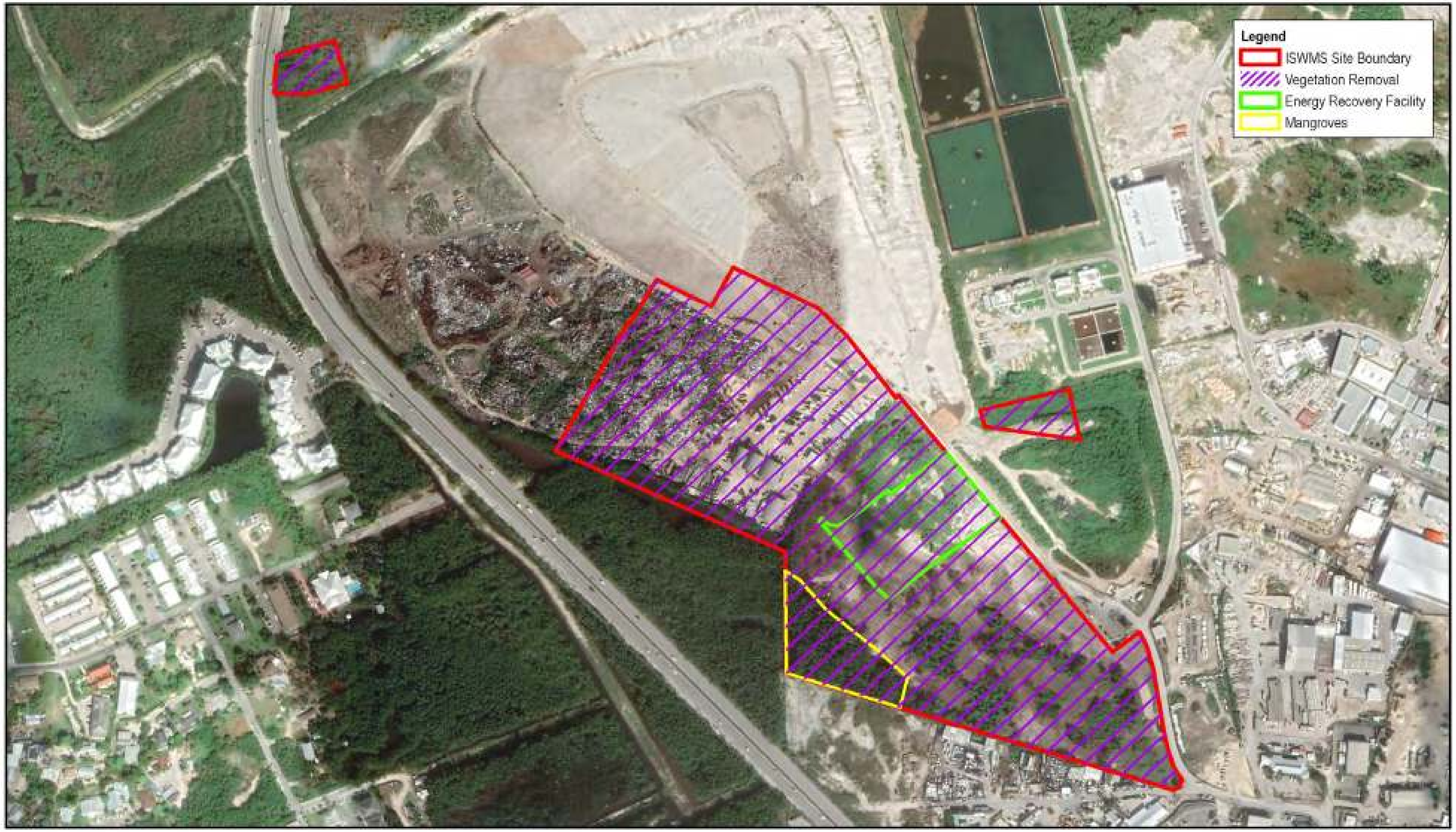
Table 7.7 Summary of terrestrial ecological features values at a project scale

Terrestrial ecological features	Value at project scale for receptors of concern
Central Mangrove Wetland, Little Sound, Ponds and associated Marine Zones - proposed Ramsar site (Section 7.5.3)	I-3: due to being a proposed site of international importance
Barkers Wetland - proposed Ramsar site (Section 7.5.3)	I-3: due to being a proposed site of international importance
Land Use – Wetlands (Section 7.5.4.1.1)	N-5: due to pools, ponds and mangrove habitat being listed in the NBAP
Land Use - Urban and Man-Modified areas (Section 7.5.4.1.2)	N-5: due to the habitat being listed in the NBAP
Primary Habitat (Section 7.5.4.2)	Ne-3: due to the Site containing common and widespread semi-natural habitats not occurring in levels elevated above those of the surrounding area
On-Site vegetation communities (Section 7.5.4.3)	Ne-3: due to the Site containing common and widespread semi-natural habitats not occurring in levels elevated above those of the surrounding area
Bats (Section 7.5.5.1 and 7.5.6.1)	N-5: due to all species and their habitats being listed in the NBAP
Amphibians and mammals (Section 7.5.5.2)	Ne-3: due to common and widespread semi-natural species that do not occur in levels elevated above those of the surrounding area
Inland mangroves (Section 7.5.6.2)	N-5: due to mangrove species being protected under Schedule 1 Part 2 of the NCL
Birds (Section 7.5.5.2, 7.5.5.3 and 7.5.6.3)	N-5: due to most species being protected under Schedule 1 Part 1 of the NCL
Grand Cayman blue iguana (Section 7.5.6.4)	I-4: due to the species being listed as endangered on the IUCN Red List and protected under Schedule 1 Part 1 of the NCL

7.6 Impact assessment and mitigation

The proposed Site development is delineated on Figure 7.7. The proposed ISWMS consists of various new waste management facilities The proposed development will result in the removal of 33 acres (13.35 hectares [ha]) of terrestrial habitat and 1.7 acres (0.7 ha) of inland mangrove habitat. An impact assessment of the identified species and their habitats was conducted based on data collected along with secondary source data. This assessment was completed for both the construction and operation phases of Site activity. General mitigation measures are detailed below to maintain the integrity of the natural environment throughout construction and operation of the ISWMS.

Figure 7.7 Terrestrial Ecology impact assessment



Paper Size ANSI A

0 30 60 90 120

Meters

Map Projection: Lambert Conformal Conic
Horizontal Datum: Cayman Islands Geodetic Datum 2011
Grid: Cayman Islands National Grid 2011

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GRAND CAYMAN, CAYMAN ISLANDS
INTEGRATED SOLID WASTE MANAGEMENT
SYSTEM FOR THE CAYMAN ISLANDS
- TERRESTRIAL ECOLOGY ASSESSMENT

TERRESTRIAL ECOLOGY
IMPACT ASSESSMENT

Project No. 12563972
Revision No. -
Date May 23, 2023

FIGURE 7.7

7.6.1 Pathways of potential effects

Potentially significant terrestrial ecology effects identified in the ToR and identified through the assessment of the terrestrial environment baseline conditions are validated in Table 7.8 to confirm pathways of potential effects.

Table 7.8 Pathways of potential effects by activity

Activity (leading to environmental change)	Effect	Feature	Pathway validity	Potential Effect Before Mitigation
Land take (during construction)	Loss of habitat that provides foraging and sheltering habitat for fauna	Protected and notable habitats and species around the Site	Direct pathway for the loss of habitat for species	Loss of habitat that provides forging and sheltering habitat for protected and notable species around the ISWMS Site
	Introduction or spread of invasive species	Protected and notable habitats and species around the Site	Direct pathway for the introduction or spread of invasive species	Introduction or spread of invasive species within the ISWMS Site
Land preparation e.g., earthworks, excavation (during construction)	Killing or injury of animals	Protected and notable species using the Site	Direct pathway for the killing or injury of animals during construction	Killing or injury of protected and notable species within the ISWMS Site
	Airborne dust creation	Protected and notable habitats and species around the Site	Direct pathway for the impact on notable habitats and species around the Site from airborne dust	Dust from land preparation affecting protected and notable habitats around the ISWMS Site
	Noise / light / visual disturbance including from movement of construction workers disturbing sensitive fauna	Wetland / migratory birds potentially on habitat functionally linked to the proposed Ramsar sites; Protected and notable species around the Site	Direct pathway for the disturbance of species from noise, light and visual disturbance during construction	Noise / light / visual disturbance including from movement of construction workers disturbing wetland/migratory birds potentially on habitat linked to proposed Ramsar sites and protected and notable species around the ISWMS Site
	Migration of contaminates from surface water/storm water and groundwater movements	Aquatic/riparian invertebrates, wetland/migratory birds using fringing mangroves and seagrass beds	Addressed in Chapter 6 - Marine Ecology Assessment	Addressed in Chapter 6 - Marine Ecology Assessment
	Spills of oil, gasoline, and other fluids	Terrestrial environment within and surrounding the ISWMS Site during construction	Direct pathway for the spills to migrate into the terrestrial environment within and surrounding the ISWMS Site	Spills of oil, gasoline, and other fluids into natural communities around the ISWMS Site
	Soil erosion and sedimentation	Terrestrial environment within and surrounding the ISWMS Site	Direct pathway for the soil erosion and sedimentation into	Soil erosion and sedimentation into

Activity (leading to environmental change)	Effect	Feature	Pathway validity	Potential Effect Before Mitigation
			adjacent areas to the ISWMS Site	adjacent areas to the ISWMS Site
Waste processing (during operation)	Migration of contaminants from surface water/storm water and ground water movements	Aquatic/riparian invertebrates, wetland/migratory birds using fringing mangroves and seagrass beds	Addressed in Chapter 6 - Marine Ecology Assessment	Addressed in Chapter 6 - Marine Ecology Assessment
	Spills of oil, gasoline, and other fluids	Terrestrial environment within and surrounding the ISWMS Site during operation	Direct pathway for spills to migrate into the terrestrial environment within and surrounding the ISWMS Site	Spills of oil, gasoline, and other fluids into natural communities around the ISWMS Site
Combustion of waste (during operation)	Deposition of contaminants on sensitive habitats or species	Designated sites, protected and notable habitats and species within range of emissions of the plant	Direct pathway for the deposition of contaminants on sensitive habitats or species	Deposition of contaminants on sensitive habitats or species within the range of emissions from the ISWMS Site
Uncontrolled vehicular movement (during operation)	Vehicle strikes on animals causing injury or death	Protected and notable species around the Site	Direct pathway for the killing or injury of species during operation	Vehicle strikes on protected and notable species causing injury or death around the ISWMS Site
Lighting (during operation)	Disturbance of animals	Protected and notable species around the Site	Direct pathway of the disturbance of species from lighting during operation	Lighting from operation causing disturbance to protected and notable species around the ISWMS Site
Noise (during operation)	Disturbance of animals	Wetland/migratory birds potentially on habitat functionally linked to the proposed Ramsar sites; Protected and notable species around the Site	Direct pathway for the disturbance of terrestrial wildlife from noise during operation	Noise from operation causing disturbance to protected and notable species around the ISWMS Site

7.6.2 Significance evaluation

The significance of a residual effect is a determination following evaluation of the identified "potential effect" with the implementation of mitigation measures. A significance evaluation of the potential effects associated with the construction and operation of the ISWMS has involved:

– Identifying those effects that could likely be significant.
– Assessing the effects of the proposed construction works against the baseline (current or future, as appropriate).
– Concluding whether or not these resultant effects are likely to be significant.

The significance of effects determination has been completed for the terrestrial environment based on professional judgement and the following:

– Predicting adverse effects from proposed construction activities and evaluating the scope and scale of those effects.

– Detailing mitigation measures triggered through regulatory requirements and/or best management practices to eliminate, reduce, or control the effect the construction activities have on environmental components.
– Determining the significance of the effects.

Significance evaluation is assessed using the criteria detailed in Table 7.9 (adapted from Table 5.7 of the ToR).

Table 7.9 Significance evaluation criteria

Characterisation	Description	Quantitative Measure or Definition of Qualitative Categories
Magnitude	The size or degree of the effects compared against baseline conditions or reference levels, and other applicable measurement parameters (i.e., standards, guidelines, objectives)	**Negligible (N) |** Differing from the average baseline conditions to a very small degree, but within the range of the natural variation **Very Low (VL) |** Differing from the average baseline conditions to a small degree, but very minimally out of the range of the natural variation **Low (L) |** Differing from the average baseline and outside the range of natural variation but less than or equal to appropriate guideline or threshold value **Medium (M) |** Differing from the average baseline and outside the range of natural variation and marginally exceeding a guideline or threshold value **High (H) |** Differing from the average baseline and outside the range of natural variation and exceeding a guideline or threshold value
Geographic Extent	The geographic area over which the effects are likely to be measurable	**Site Study Area (SSA) |** Occurs within the ISWMS Site boundary **Outside Study Area (OSA)** | Occurs outside of the ISWMS Site boundary
Timing	Considers when the environmental effect is expected to occur. Timing considerations are noted in the evaluation of the environmental effect, where applicable or relevant.	**Not Applicable (NA) |** Seasonal variations are not likely to change the effect **Applicable (A) |** Seasonal aspects may affect the outcome of the effect
Duration	The time period over which the effects are likely to last	**Short-Term (ST) |** The effect is reversible at the end of construction works **Medium-Term (MT) |** The effect is reversible within a defined length of time **Long-Term (LT) |** The effect is reversible over an extended length of time
Frequency	The rate of recurrence of the effects (or conditions causing the effect)	**Once (O) |** Effects occur once **Regular (R) |** Effects can occur at regular intervals through construction and/or operation **Continuous (C) |** Effects are continuous throughout construction and operation
Reversibility	The degree to which the effects can or will be reversed (typically measured by the time it will take to restore the environmental attribute or feature)	**Reversible (R) |** The baseline conditions will recover to their standard after the construction works are completed **Partially Reversible (PR) |** Mitigation can return the baseline conditions **Not Reversible (NR) |** Mitigation cannot guarantee a return to baseline conditions

7.6.3 Potential effects and mitigation measures

The potential effects identified in Table 7.8 are further evaluated here as the potential effects, associated mitigation and resultant significance. A potential effect to the terrestrial environment during construction is the loss of vegetation that could serve as habitat to species that have been found within and around the landfill Site. However, as noted before most of the vegetation has already been cleared and the Site is not considered suitable for species to inhabit due the ongoing activities. This evaluation is prepared in the understanding that the vegetation removal has been conducted under an approval mechanism of the Cayman Islands government.

Direct mortality of fauna species could result from construction works, particularly due to the increase in heavy machinery and commercial trucks during the Site preparation. Erecting exclusion fencing is recommended to avoid mortality of fauna (example provided on Figure 7.8). A potential indirect impact resulting from the removed vegetation is increase in erosion and sedimentation. Erosion and sedimentation measures will be established within the ISWMS Site boundary to prevent off-site migration of soils. The effects assessment of significance is presented in Table 7.10.

Figure 7.8 Terrestrial ecology wildlife exclusion fence example

Table 7.10 Terrestrial Ecology assessment of significance

Potential Effect	Mitigation Measures and Best Management Practices Proposed	Residual Environmental Effect Characterisation and Rationale						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Loss of habitat that provides foraging and sheltering habitat for protected and notable species within the ISWMS Site	During construction: – Clearly demarcate work limits at outset of construction and minimize unnecessary vegetation clearing – Any removal of mangroves on the Site should be outside the bat breeding window and bird nesting season. The bat breeding window is from June 1 to November 15. The bird nesting season is from April 1 to June 30. Therefore, with these restrictions any clearing is recommended to occur after November 15 and before April 1 of any given year – Restabilize and revegetate exposed surfaces as soon as possible following disturbance	M	SSA	A	MT	O	PR	Minor vegetation removal and habitat provided by this vegetation where the clearing occurred within the ISWSM Site.	Not significant as removal has already occurred on Site and mitigations will be utilized to reduce further impacts.
		Medium magnitude due to a permanent change to the environment that causes habitat loss to species that utilize mangroves. There is 33 acres (13.35 hectares (ha)) of terrestrial habitat and 1.7 acres (0.7 ha) of inland mangrove habitat that has been removed to accommodate this project. All the vegetation removal is within the Site boundary. Vegetation clearing is restricted to occur after November 15 and before April 1 of any given year. Partial revegetation will be observed over time once out of the construction phase. Therefore, medium term is listed as duration. The vegetation removal will only occur once at the onset of this protect. It is not anticipated that additional clearing to occur whence operations begin. Mitigations listed can be utilized to assist to ensure a gradual return to partial baseline conditions, therefore partially reversible. Ensuring the stabilization of land and revegetation of disturb surfaces where possible after construction has been completed.							

Potential Effect	Mitigation Measures and Best Management Practices Proposed	Residual Environmental Effect Characterisation and Rationale						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Introduction or spread of invasive species within the ISWMS Site	During construction and operation: – Machinery, equipment, and materials shall arrive at Site cleaned – Cleaning shall occur a minimum of 98 feet (30 m) from waterbodies – Equipment to be used in or near water shall be cleaned before and after use. Cleaning shall remove any visible attached material (mud, vegetation, fauna).	VL	SSA	A	MT	R	PR	Limited ability for introduction or spread of invasive species on the Site	Not significant as mitigations will limit the spread of invasives.
		Although it cannot be ensured there is absolutely no spread or introduction of invasive species due to current presence of species on the Island, it is anticipated that there will be very low impacts to the Site due to invasive species. This assumes that best practices regarding cleaning of machinery, handling of any encountered invasive species plants, and training in the identification of invasive species on Site will be incorporated. Seasonal aspects may impact the amount of invasives spread on Site as conditions are more wet or windy. June – October where there is generally more rain it is expected that invasive plant species can spread easier. Additionally, wind can impact the amount movement of seeds/vegetation. The windy months in Cayman include October – March with a peak in December. The effect is reversible with a defined length of time if equipment is clean prior to entering the Site, species will be contained. Therefore, a medium-term duration has been listed. Effects have the potential to occur at regular intervals throughout construction and operation, as invasives are present on the island and can be moved around at any point. Ensuring mitigation measures are fully implemented will ensure there is no introduction and spread of species. The introduction and spread of species on Site is partially reversible as mitigations can return the Site to the baseline conditions.							

<table>
<tr><th rowspan="2">Potential Effect</th><th rowspan="2">Mitigation Measures and Best Management Practices Proposed</th><th colspan="6">Residual Environmental Effect Characterisation and Rationale</th><th rowspan="2">Residual Effect</th><th rowspan="2">Significance of Residual Effect</th></tr>
<tr><th>Magnitude</th><th>Geographic Extent</th><th>Timing</th><th>Duration</th><th>Frequency</th><th>Reversibility</th></tr>
<tr><td rowspan="2">Killing or injury of protected and notable species within the iswms site</td><td rowspan="2">During construction:
– the bird nesting season for the site has been
– identified as april to june and tree and vegetation removal activities are to avoid this window where possible. if vegetation clearing within the bird nesting season is required, a nest survey will be required, to be completed by a qualified professional to identify any active nests of birds, and breeding activity of birds that may indicate nesting
– the active bat roosting season for the site has been identified as june 1 to november 15. removal of large trees (i.e., greater than 10 cm diameter at breast height) will not occur during this season to protect bats during their active season
– all vehicles and equipment will follow the posted speed limit, to reduce the potential for wildlife collisions
– all site personnel should be trained in general protected species awareness and identification of protected species with the potential to occur on site
– visual inspections will be completed daily before works commence. if fauna is found on site during the work measures will be taken to allow fauna to leave the work area passively. active relocation should be a last resort; if it is required, it will be completed in a manner that prevents harm to fauna</td><td>VL</td><td>SSA</td><td>NA</td><td>ST</td><td>R</td><td>R</td><td rowspan="2">no mortality or injury of protected and notable species due to construction and operations works with the implementation of mitigation measures listed</td><td rowspan="2">not significant as killing or injury of species in only anticipated to be a potential effect throughout construction and mitigations in place will ensure species are not impacted</td></tr>
<tr><td colspan="6">There is a very low potential impact to various protected species due to the removal of habitat and heightened risk of species collisions when all mitigation measures are utilized on Site.
Killing or injury of notable species within the Site does not have seasonal variation as there is continued movement of equipment that has the potential to kill/injure species on Site.
The impact to species is determined to be a short-term impact as the potential effect will be eliminated after construction. With construction there is an increased presence of machinery on Site that has the potential to impact species and their habitats.
These species impacts have the potential to occur at a regular interval throughout construction while a heightened number of equipment is present on Site.
Baseline conditions will return once construction has been completed. As the Site will return to vehicular/equipment traffic similar to what is currently experienced with the adjacent landfill.</td></tr>
</table>

Potential Effect	Mitigation Measures and Best Management Practices Proposed	Residual Environmental Effect Characterisation and Rationale						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
	– should the animal be resident within the site (remaining on-site longer than 24 hours), injured, or eggs/nests are observed, additional measures to avoid impacts may be required before work can restart – information posted in construction offices of protected species and siting management plan – have an experienced environmental professional on site to confirm species presence and identification								

Potential Effect	Mitigation Measures and Best Management Practices Proposed	Residual Environmental Effect Characterisation and Rationale						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Dust from land preparation affecting protected and notable habitats around the ISWMS Site	During construction: – Manage dust emissions through the use of water or dust suppressants on non-paved roads and cleaning of paved roads, where applicable, reflecting regulatory direction and approval – In dust sensitive areas (e.g., near wetlands, etc.), control dust using water and not chemical suppressants – Establish Site speed limits for vehicles traveling within the Site to minimize dust emissions – Ensure that equipment maintenance and checks occur on a regular basis – Proper stockpiling of dust producing building materials such as sand or cement in low enclosures and covered, away from drainage areas where they could easily be dispersed by wind or washed away during heavy rains – All loads entering or leaving the Site must be covered – Restabilize and revegetate exposed surfaces as soon as possible following construction to limit dust generation	VL	OSA	A	ST	R	R	No offsite dust impacts on protected and notable habitats with the implementation of mitigation measures to control dust emissions from leaving the Site.	Not significant as the effect from dust from land preparation is only anticipated throughout construction and mitigations in place will ensure the control of dust.
		It is not anticipated to see dust levels outside study area on protected and notable areas differing from baseline conditions, much of the dust will be limited with the proposed mitigation measures. There are seasonal aspects that may affect the outcome of dust impacts including rain. Therefore, there are less potential impacts anticipated throughout June – October where there is generally more rain. Additionally, wind can impact the amount of dust that would be spread. The windy months in Cayman include October – March with a peak in December. The impacts of this potential effects are anticipated to be reversible at end of construction. The impacts of dust would have the potential to be seen at regular intervals through construction of the ISWMS infrastructure while active land preparation is occurring. The potential impacts from dust are reversible to baseline conditions after construction is completed. Vehicular traffic will decline, and grounds will be stabilized as applicable.							

Potential Effect	Mitigation Measures and Best Management Practices Proposed	Residual Environmental Effect Characterisation and Rationale						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
		VL	SSA OSA	A	ST	R	R		
Noise / light / visual disturbance including from movement of construction workers disturbing wetland/ migratory birds potentially on habitat linked to proposed Ramsar sites and protected and notable species around the ISWMS Site	During construction: – Limit construction activities to daylight hours – Ensure equipment meets industry standards with respect to noise level thresholds – Undertake regular maintenance of the equipment as part of the preventative maintenance plans implemented for all mobile and stationary equipment – Train Site personnel to ensure equipment is used in ways that minimize noise – Control noise by maintaining separation distance between source and receptor and equipment design, where feasible – Establish an exclusion barrier within the Site boundary to restrict fauna access to the Site; maintain throughout construction – Ensure engines are turned off when possible; vehicles will not be left to idle Broadband reversing alarms will be chosen instead of tonal alarms	There is a very low impact anticipated to overall disturbance on wetland and migratory birds on Ramsar sites and on and around the Site. The Ramsar sites are approximately 2.8 miles (4.5 km) east and 4.7 miles (7.5 km) north away from the Site and therefore will not be disrupted by construction activities. Seasonal variations of this impact may impact the outcome of this effect including wind speed and cloud cover that may allow for light and sound to travel further. This is a short-term impact as the impacts are reversible at end of construction due to the reduction of construction activities causing potential effects. Effects would occur at regular intervals through construction as there is continued disturbance on Site. Therefore, the frequency is listed as regular. The impacts are reversible at end of construction as the construction causing the potential impacts would be eliminated. Although it is not anticipated for impacts to reach these areas with the implementation of mitigation measures. Thus, the residual effect is listed as partially reversible.						Minimal offsite and onsite disturbance effects to fauna including noise, light, visual disturbances with the implementation of mitigation measures	Not significant as effects from noise and light disturbance are only anticipated during construction and mitigations in place to maintain equipment will eliminate the effects to species

Potential Effect	Mitigation Measures and Best Management Practices Proposed	Residual Environmental Effect Characterisation and Rationale						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Spills of oil, gasoline, and other fluids into natural communities around the ISWMS Site	During construction and operation: – All machinery should be inspected for fluid leaks or other potential pollutants. The Contractor/Operator should evaluate each piece of equipment to ensure all risk of spills or sediment release due to its use is mitigated prior to putting it into service – Proper machinery inspections and maintenance – Conduct equipment maintenance and refuelling at the designated and properly contained maintenance areas located well away from watercourses and wetlands and outside retained vegetation areas – Implement an emergency and response management plan to address the potential for spills	L	SSA	NA	ST	R	PR	No residual effects from spills into natural communities around the ISWMS Site	Not significant as mitigations in place will ensure there is no impacts to natural communities around the Site from spills.
		There is a low magnitude of potential impact to the Site due to spills of oil, gasoline, and other fluids into natural communities on Site due to machinery on Site utilizing these materials to operate. The impact caused by fluid spills is the same during all times of year as there is refueling of construction and operation equipment occurring. Therefore, given a timing ranking of not applicable. Will return to baseline after construction as construction activities will be completed, and the amount of construction machinery would decrease, and regular activities would occur on Site, resulting in less opportunity for spills to occur. Therefore, resulting in a short-term duration. There is potential for spills is to occur at regular intervals throughout construction and operation, as refuelling of equipment and machinery is occurring. As such, given a frequency rating of regular. This effect is partially reversible as mitigation measured can return to environment to baseline conditions. All spills are to be addressed immediately with the emergency response management plan that is put into place before construction begins.							

Potential Effect	Mitigation Measures and Best Management Practices Proposed	Residual Environmental Effect Characterisation and Rationale						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Soil erosion and sedimentation into adjacent areas to the ISWMS Site	During construction: – Limit vegetation clearing only to areas where construction works are being completed to prevent sediment being exposed During construction and operation: – Establish and maintain erosion and sediment control fencing in good working order to capture any sediment migration whilst construction works are being completed – Maintain erosion and sediment control fencing in place until final Site development, or stabilize soils with permanent vegetation (e.g., annual seed mix and/or plantings) – Routinely inspect erosion and sediment control measures, including following storms, and repair as required All machinery should be inspected for fluid leaks or other potential pollutants. The Contractor should evaluate each piece of equipment to ensure all risk of spills or sediment release due to its use is mitigated prior to putting it in to service – Trucks and equipment shall be cleaned prior to leaving the Site to prevent mud/dirt from tracking onto roads	L	OSA	A	ST	R	PR	No offsite impacts from soil erosion or sedimentation into adjacent areas	Not significant as mitigations will ensure the stabilization of soils after construction and maintain sediment and erosion control fencing to limit movement of sediments.
		The magnitude of soil erosion and sedimentation into adjacent to the ISWMS Site outside of the study area is low due to the 33 acres (13.35 hectares (ha)) of terrestrial habitat and 1.7 acres (0.7 ha) of inland mangrove habitat that has been removed to accommodate this project which results in exposed soils on the ISWMS Site. Seasonal variation may impact the outcome of effect due to level of rain occurring during different seasons. June – October there is generally more rain that could cause increased risk of sedimentation into adjacent areas of the Site. The impacts from soil erosion and sedimentation will return to baseline after construction is completed as exposed soils will be stabilized and erosion and sediment control measures will be in place until establishment. As such the effect is listed as short-term. The effect has the ability to occur at regular frequency intervals throughout the construction phase due to exposed soils and movement of trucks and equipment. This effect is partially reversible as the mitigations can ensure a return to baseline conditions as the mitigation measures ensure any sediments cannot move to other areas that are adjacent to the Site.							

Potential Effect	Mitigation Measures and Best Management Practices Proposed	Residual Environmental Effect Characterisation and Rationale						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Deposition of contaminants on sensitive habitats or species within the range of emissions from the ISWMS Site	During operation: – Implementation of the Air Pollution Control (APC) System to capture emission contaminants. A system of humidification of the APC Residues will be provided for the flue gas residue discharge process. – Appropriate disposal of APC materials into designated engineered Residual Waste Landfill (RWL) – Regular inspection of facility and implementing good housekeeping action when required. – The Construction and Demolition processing operations will be undertaken in the open air and crushing and screening equipment will be fitted with water misters to reduce dust emissions. – Detail design shall consider including dedusting (suction to filter) in order to avoid dust emissions during the residues discharge from silo the truck.	VL	OSA	NA	LT	C	PR	No offsite impacts to sensitive habitats or species from deposition of contaminants during operation	Not significant as the APC system will capture the contaminants will be in place throughout operation.
		This effect would have a very low magnitude impact on sensitive habitats within the range of the ISWMS as the APC system implemented will capture the contaminants upon release. There are no seasonal variants that will impact the effect as the emissions will be released continuously throughout operation. The effect from emissions would occur during operation of the ISWMS Site. The duration is listed as long term as emissions will be released throughout operations of the ISWMS Site. Though, it is anticipated that mitigation measures are sufficient to negate potential effect throughout operations. The effect is listed as continuous frequency as the emissions will be released continuously throughout operation. The effect of deposition of contaminants on sensitive habitats is listed as partially reversible as the APC system will capture the contaminants upon release. Additional mitigation measures listed will also ensure limited impacts from this effect.							

Potential Effect	Mitigation Measures and Best Management Practices Proposed	Residual Environmental Effect Characterisation and Rationale						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Vehicle strikes on protected and notable species causing injury or death on the ISWMS Site	During operation: – All Site personnel should be trained in general protected species awareness and identification of protected species with the potential to occur on Site – Visual inspections will be completed daily before works commence. If fauna is found on Site during the work measures will be taken to allow fauna to leave the work area passively. Active relocation should be a last resort; if it is required, it will be completed in a manner that prevents harm to fauna – Should the animal be resident within the Site (remaining on-Site longer than 24 hours), injured, or eggs/nests are observed, additional measures to avoid impacts may be required before work can restart – All vehicles and equipment will follow the posted speed limit, to reduce the potential for wildlife collisions – Information posted in construction and operation offices of protected species and siting management plan – Have an ecologist or experienced environmental professional on Site to confirm species presence and identification	L	SSA	NA	LT	C	PR	No increase in mortality of protected species due to construction and operations works	Not significant as mitigations will ensure there is limited vehicle strikes on protected species.
		The impact on all terrestrial protected and notable species from vehicle strikes magnitude is low on Site. The ISWMS Site will be accessed along the same route as the current GTLF operations: from the South via Seymour Drive. Security has been addressed on the ISWMS Site by the proposed construction of a 12 foot (ft) (3.66 metre (m)) high metal chain link perimeter fence, which will also aid in keeping fauna outside of the ISWMS Site. Additionally, the fencing will be reinforced by species exclusion fencing. There is no seasonal variation of the effect. Impacts will be the same throughout all conditions on Site as species can pre present on Site throughout the year. The effect from vehicle strikes would occur during operation of the ISWMS Site. The duration is listed as long term as there is a potential for vehicle strikes to occur throughout the operation of the Site. It is anticipated that mitigation measures are sufficient to negate potential effect throughout operation. There is a continuous potential risk of the effect as there is continuous vehicular traffic on Site that has to potential to cause vehicular strikes on protected species. The effect from vehicle strikes is partially reversible as with mitigations utilized the risk of vehicle strikes is lowered and will return the effect to baseline conditions.							

Potential Effect	Mitigation Measures and Best Management Practices Proposed	Residual Environmental Effect Characterisation and Rationale						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Lighting from operation causing disturbance to protected and notable species around the ISWMS Site	During operation: – Limit operation activities to daylight hours – Reduce the intensity of lighting fixtures – Ensure downcast lighting on buildings where lights are required overnight	VL	OSA	NA	LT	C	PR	Minimal effects to fauna from lighting during operation	Not significant as the mitigation measures in place limit the light causing disturbance to species.
		The impact to terrestrial notable species outside of the Site from light is anticipated to be very low. Operations should be limited to during day light hours allowing for minimal light pollution to the Site during evening hours when impacts to species would occur from light. As 90 percent of the activity at the ISWMS Site occurs from dawn to dusk, lighting is restricted to the main access road (to allow for solid waste deliveries) and building eves. The impacts will not be seasonally variant as the lighting conditions will be the same throughout the year for security purposes. The effect of lighting would occur during operation of the ISWMS Site. The duration is listed as long term as lighting on the buildings will be consistent throughout operation for safety of the Site. It is anticipated that mitigation measures are sufficient to negate potential effects from lighting. With continued implementation of mitigation measures will ensure no impacts to species. There is a frequency of continuous listed for this effect, as throughout operation lighting will be used for safety of the Site. The impacts to species are partially reversible due to the fact that mitigation measures listed can return the impacts to baseline conditions.							

Potential Effect	Mitigation Measures and Best Management Practices Proposed	Residual Environmental Effect Characterisation and Rationale						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Noise from operation causing disturbance to protected and notable species around the ISWMS Site	During operation: – Ensure equipment meets industry standards with respect to noise level thresholds – Undertake regular maintenance of the equipment as part of the preventative maintenance plans implemented for all mobile and stationary equipment, to ensure all equipment is well-maintained to minimise noise emissions. – Train Site personnel to ensure equipment is used in ways that minimize noise – Control noise by maintaining separation distance between source and receptor and equipment design, where feasible – Establish an exclusion barrier within the Site boundary to restrict fauna access to the Site; maintain throughout operation – Ensure engines are turned off when possible; vehicles will not be left to idle – Legio-type blocks utilized for internal pushwalls providing additional noise absorption. – Construction and demolition process operations that have a high noise level (shredder and crusher) will only be activated intermittently which will reduce noise emission duration. – Bottom Ash process operations that have a high noise level (trommel) will only be activated intermittently which will minimise noise emissions duration. – High noise emitting equipment (baler and shear in particular) will only be used intermittently to minimise noise exposure time.	VL	SSA OSA	A	MT	R	R	Minimal offsite effects to fauna from noise during operation	Not significant as mitigations in place will reduce the noise impacts from operation on species.
		It is anticipated that the degree of noise effects on protected and notable species within and surrounding the Site are very low. Noise will mainly be confined within the ISWMS buildings. The project Site is located within a designated industrial area, therefore species in the area are used to movement and noise from industrial operations. There is a potential for a seasonal variation of noise impact due to wind speed and cloud cover that may allow for sound to spread more. The effect is seen to occur at regular intervals through operation due to the operation of machinery throughout working hours on Site. Effects causing disturbance from operations noise are reversible as the operations noise will be similar to baseline conditions based on adjacent landuses. Additional mitigation measures will be implemented to further reduce noise through noise absorption blocks incorporated into the facility design.							

7.6.4 Summary of effects

The predicted environment effects on the terrestrial environment are assessed to be adverse but not significant. Effects are associated with vegetation loss, fauna collision, soil erosion, dust, noise and vibration, invasive species, and spills. However, with the implementation of mitigation measures, best management practices that will be outlined in the Environmental Management Plan (EMP) in the Environmental Statement (ES), and any restoration or offsetting conditions from the Central Planning Authority or Development Control Board, the residual effect on the terrestrial environment is not significant. The effects anticipated are as summarized below:

- Minor vegetation removal and habitat provided by this vegetation
- Limited ability for introduction or spread of invasive species on Site
- No increase in mortality or injury of protected species due to construction and operations works
- No offsite dust impacts on protected and notable habitats
- Minimal offsite noise, light and visual disturbance effects to fauna during construction and operation
- No offsite impacts from soil erosion or sedimentation into adjacent areas
- No residual effects from spills into natural communities around the ISWMS Site
- No offsite impacts to sensitive habitats or species from deposition of contaminants during operation

While not significant, effects to the terrestrial environment will occur but will be mitigated through the implementation of the identified BMPs outlined in this ES. An EMP will be established to consolidate all mitigation measures and BMPs, which will be implemented prior to the start of the ISMWS construction.

7.6.5 Residual effects

The residual effects remaining after the implementation of mitigation measures during construction and operations identified for the terrestrial environment is minor vegetation removal and habitat provided by this vegetation.

7.7 Monitoring

For the purposes of construction works and operations, limited monitoring requirements have been identified. As previously noted in Section 7.6, the potential effects are adverse but not significant. The following monitoring requirements are recommended based on the effects identified:

During pre-construction:

- Fauna monitoring: exclusion fencing will be established around the ISWMS Site to mitigate fauna from entering areas where clearing or construction works are to be undertaken. Fencing is to be installed prior to construction works commencing. However, even with this fencing there is a potential for fauna to enter the Site. If fauna is found on Site measures will be taken to allow fauna to leave the work area passively. Active relocation should be a last resort; if it is required, it will be completed in a manner that avoids injury to the identified fauna.
- Erosion and sediment control monitoring: silt fencing will be established around the ISWMS Site to limit sediment run-off into the surrounding environment. Regular inspections (i.e., weekly, before and following 0.98 inches (25 millimetres [mm]) or more rainfall) should be conducted to identify any damage to the fencing and ensure a prompt repair.

During construction and operation:

- Fauna monitoring: If fauna is found on Site measures will be taken to allow fauna to leave the work area passively. Active relocation should be a last resort; if it is required, it will be completed in a manner that avoids injury to the identified fauna.
- Erosion and sediment control monitoring: Regular inspections (i.e., weekly, before and following 0.98 inches [25 mm] or more rainfall) should be conducted to identify any damage to the fencing and ensure a prompt repair.

Additional monitoring may be required based on approvals from the Central Planning Authority, Development Control Board, or if the vegetation clearing avoidance windows cannot be adhered to.

7.8 Conclusions

Grand Cayman is the most developed of the three islands, hosting 95 percent of the population[75]. Wildlife have shown adaptation to artificial habitats resulting in complaints of wildlife inhabiting the developed environment. Protection of the natural environment is encouraged as this will maintain biodiversity within these landscapes[76].

Natural heritage information from secondary sources and associated reports, and primary field data were collated to establish this document. There is potential for protected species occurrence in select areas throughout the Site, mainly of highly mobile, mangrove-dwelling wildlife species, such as birds and bats. As such, general habitat and species-interaction mitigation measures have been provided as recommendations to be implemented throughout construction and operation phases.

Potential impacts associated with land development will be avoided or minimized through the implementation of recommended mitigation efforts outlined in this chapter. It is anticipated that the construction and operation of the proposed facility will result in limited residual effects to the terrestrial environment.

75 DaCosta-Cottam, M., J. Olynik, J. Blumenthal, K. D. Godbeer, J. Gibb, J. Bothwell, F. J. Burton, P. E. Bradley, A. Band, T. Austin, P. Bush, B. J. Johnson, L. Hurlston, L. Bishop, C. McCoy, G. Parsons, J. Kirkconnell, S. Halford, and G. Ebanks-Petrie. *Cayman Islands National Biodiversity Action Plan 2009, Cayman Islands Government, Department of Environment*. 2009.

76 Ibid.

8. Hydrology and Hydrogeology

8.1 Purpose

GHD Limited (GHD) was retained by ReGen and the Cayman Islands Government (CIG) as approved by the Environmental Assessment Board (EAB) to undertake a hydrology and hydrogeology assessment as part of the Environmental Impact Assessment (EIA) for the proposed Integrated Solid Waste Management System (ISWMS, Project). This hydrology and hydrogeology assessment in part overlaps with matters considered in other assessments within the EIA. In particular as highlighted within the Terms of Reference (ToR), Marine Ecology, Terrestrial Ecology, and Land Quality.

8.2 Study area

The Hydrology and Hydrogeology Study Area encompasses the entire footprint of the ISWMS and some of its environs within a 1.2 mile (2 kilometre (km)) buffer zone, as outlined in the ToR and shown on Figure 8.1.

As referenced in the ToR, the construction and operation of the proposed facilities on the Sister Islands will be managed by the Department of Environmental Health (DEH), and so will lie outside the scope of this EIA. Furthermore, with respect to the landfill closures on each of the three islands, it is understood that such activities will be subject to risk-based assessments that will be conducted outside the EIA.

Figure 8.1 Hydrology and hydrogeology Study Area

8.3 Methodology

The assessment methodology is described in the following section and based on that prescribed within the ToR.

8.3.1 Potential receptors

The main potential water receptors and flood risk that could be affected by, or impact, the proposed development at the Site are summarised in Table 8.1, as identified in the ToR. It is important to note that this assessment examines potential changes of the Site on the water environment supporting designated conservation sites and potential undesignated groundwater-dependent terrestrial ecosystems (GWDTEs), not the habitats themselves, which are considered in the Marine Ecology and Terrestrial Ecology assessment reports.

Table 8.1 Potential hydrology (including flood risk) and hydrogeology receptors identified in the ToR

Receptor	Location
Water Environment	
Ironshore Formation aquifer (limestone and marl bands up to 25 ft (7.6 m) thick)	Beneath the proposed development Site (0 to -25 ft / 0 to -7.6 m below mean sea level)
Bluff Group aquifer (Pedro Castle Formation aquifer, Cayman Formation and Brac Formation; dolomite, limestone and dolostone)	Beneath the proposed development Site (<-25 ft /-7.6 m below mean sea level)
North Sound (contains Replenishment and Environmental Zone which are marine protected areas)	2,460 ft (750 m) northeast of the Site
Water Use	
Groundwater abstraction for geothermal cooling system and potable water supply for use on the development site	At the proposed development Site
Groundwater abstraction for reverse osmosis plant for Laundry Facility	0.2 miles (0.3 km) northeast of the proposed development Site
Groundwater abstraction for potable water supply following desalination at WAC's Red Gate Road Water Works (reverse osmosis plants)	0.6 miles (1 km) southeast of the proposed development Site
Groundwater abstraction for geothermal cooling purposes at the CUC electrical power generation facility	0.5 miles (0.75 km) southeast of the proposed development Site
Groundwater abstraction for geothermal cooling purposes undertaken by various other developments including Fosters warehouses and the Owen Roberts International Airport, with expectation of further future projects	0.7 miles (1.2 km) southeast (Fosters warehouse) and south (Airport) of the proposed development Site
Humans, properties, and infrastructure within areas prone to flooding	
Site infrastructure, staff, and visitors	Proposed development Site
Surrounding land infrastructure, users, and visitors	Surrounding land

8.3.2 Review of existing conditions

Available secondary sources of information were collected and reviewed to characterize the existing hydrological and hydrogeological conditions at the ISWMS Site. The following sources of secondary information have been considered in relation to hydrology and hydrogeology:

– Google Earth – web-based aerial imagery.

– Online topographic map[1]
– Cayman Islands Government (CIG)[2],
– ToR,
– GTLF Environmental Risk Based Assessment,[3]
– Hydrogeological Investigation ReGen Geothermal System. Grand Cayman Island, Grand Cayman[4] (**Appendix 8.A (Hydrology and Hydrogeology Assessment – Appendix B)**),
– Flood Risk Assessment (**Appendix 8.A (Hydrology and Hydrogeology Assessment – Appendix C)**),
– ReGen Geological report[5] (**Appendix 8.A (Hydrology and Hydrogeology Assessment – Appendix D)**),
– Natural and man-made hazards in the Cayman Islands. Natural Hazards. November 2010. (55), pp.441–466. Springer Science[6],
– Achieving a Low Carbon Climate-Resilient Economy: Cayman Islands' Climate Change Policy. Report produced for presentation to the Cabinet of the Cayman Islands[7],
– Intergovernmental Oceanography Commission Website[8] (http://www.ioc-sealevelmonitoring.org/station.php).

8.3.3 Hydrology (surface water) and hydrogeological (groundwater) assessment

Based on the information reviewed, the assessment of potential hydrological and hydrogeological effects involved:

– Describing baseline hydrological and hydrogeological conditions:
  - Outlining the local surface water and groundwater information (relating to quality and levels).
  - Identifying factors that may affect the future baseline.
– Assessing hydrological and hydrogeological risks to identify potentially significant effects:
  - Details of the method used to assess each risk (presented in Section 8.3.3.1).
  - Details of the method adopted to assess the significance of each effect (presented in Section 8.3.5).
– Consideration of the influence of any cumulative effects of different hydrological and hydrogeological issues.
– Presenting relevant mitigation measures for any significant effects following accepted engineering practice standards with clear confirmation that the proposed mitigative solutions are technically and environmentally sound.

8.3.3.1 Hydrological and hydrogeological risk assessment

As requested in the ToR, the assessment of hydrology and hydrogeology has been conducted, where possible, in line with the Directive for EIAs[9] issued in accordance with The National Conservation Law[10] and will take into account the Water Authority Act[11]. Section 19 of which states that groundwater vests in the name of the Crown and appoints the Water Authority Cayman (WAC) as the custodian of groundwater in the name of, and on behalf of, the Crown.

1 **http://en-gb.topographic-map.com/places/George-Town-133291**
2 Cayman Islands Government, *Environmental Assessment of Grand Cayman Sanitary Landfill, Grand Cayman Island, B.W.I.,* 1992
3 GHD. *George Town Landfill: Environmental Risk Based Assessment*. For: DECCO Consortium, Revision: 3, 2021
4 R.C. Minning & Associates, Inc., *Hydrogeological Investigation: Regen Geothermal System*, 2023
5 Carbex Geological Services. *Geological Report*. 2023
6 Novelo-Casanova, D.A. and Suarez, G, *Natural and man-made hazards in the Cayman Islands.* Natural Hazards. November 2010. (55), pp.441–466. Springer Science, 2010
7 National Climate Change Committee, *Achieving a Low Carbon Climate-Resilient Economy: Cayman Islands' Climate Change Policy*. Report produced for presentation to the Cabinet of the Cayman Islands, 2011
8 **http://www.ioc-sealevelmonitoring.org/station.php**
9 Cayman Islands Government, *Directive for EIAs*, 2016
10 Cayman Islands Government, *National Conservation Law*, 2013
11 WAC, 2018 Revision

As there are no specific standards for water quality within the Cayman Islands, the assessment has adopted Florida Clean up Standard target levels (CCTLs), where available. Given the brackish groundwater within the assessment area, and proximity to marine surface water features, target levels protective of both low yield/poor quality groundwater and marine surface water are considered appropriate for use at the Site. The CCTLs for such ground waters are generally higher (i.e., 10-times) than those for more sensitive groundwaters. According to Chapter 62-780 of the Florida Administrative Code (F.A.C)[12], 'Poor quality' means "*groundwater within the affected monitoring zone with background concentrations, as defined in subsection 62-780.200(3), F.A.C., that exceed any of Florida's Primary or Secondary Drinking Water Standards referenced in Chapter 62-550, F.A.C.*" and 'Low yield' means "*groundwater that is contained in an aquifer that has an average hydraulic conductivity of less than one foot per day, determined by performing slug tests or an equivalent method for determining hydraulic conductivity on a minimum of three monitoring wells in each affected monitoring zone; and a maximum yield of 80 gallons per day, determined by pumping a four-inch well screened across the cross-section of the plume, for a minimum of two hours*". The ToR states that an aquifer with hydraulic connectivity between the centre of the landfill into the North Sound has an average of 12 feet (4 m) per day. However, given the brackish nature of the groundwater beneath the Site and lack of any nearby abstractions, the use of these criteria at the Site is considered to be reasonable. Where relevant CCTLs are not available, alternative criteria have been sought from alternative sources, such as USEPA, European Water Framework Directive (WFD), and World Health Organisation (WHO).

8.3.4 Future baseline

The future baseline considers the changes that would take place in the absence of the advancement of the ISWMS Project, including natural occurrences and process that would alter the current baseline conditions during the anticipated lifetime of the project, or other changes occurring in the surrounding area which may positively or negatively effect environmental conditions.

In the event of unavoidable changes being identified in relation to hydrology and hydrogeology, these are reflected in suitable amendments to the current baselines in the relevant section of this chapter.

8.3.5 Significance evaluation

8.3.5.1 Value and Magnitude of Receptors

The significance of the effects resulting from the ISWMS Project has primarily been determined by the value of the relevant hydrological features and the magnitude of change as a consequence of the ISWMS Project. In terms of the hydrology and hydrogeology, the key types of effects relate to water levels, flow, and quality. Where appropriate, effects on surface water flows, effects on immediate and downstream morphology, sediment dynamics, and flood risk have also been considered.

Described below is the method and criteria which have been used to determine value, magnitude of change, and the significance of the effects.

The value of hydrological and hydrogeological water features scoped into the assessment has been related to the importance of the surface water or groundwater features. Table 8.2 provides a summary of the criteria used in the valuation of water features and introduces the concept of receptor type (a collection of receptors whose value is assessed using the same set of criteria). Professional judgement has been applied to the assessment due to the semi-quantitative nature of the criteria.

The magnitude of change on water receptors is considered independently from the value of the receptor. Its assessment - both potential, taking into account any inherent integral mitigation to the proposed ISWMS, alongside residual, following the implementation of additional mitigation measures – is also semi-quantitative and therefore professional judgement has also been applied to the assessment. Table 8.3 provides examples of how various levels of change can be determined with respect to water features.

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[12] State of Florida, Florida Administrative Code: Chapter 62-780 *Contaminated Site Cleanup Criteria*, 2005

Table 8.2 Summary of value definition of hydrology (including flood risk) and hydrogeology receptors

Value	Criteria	Receptor type*	Examples
High	Features with a high yield, quality or rarity with little potential for substitution	Aquatic environment	Conditions supporting a site with an international conservation designation, where the designation is based specifically on aquatic features. High status (quantity and/or quality) watercourse, also any associated upstream unclassified watercourse. Principal aquifer (high permeability, able to support water supply and/or watercourse baseflow on a strategic scale).
	Water use supporting human health and economic activity at a regional scale	Water use	Regionally important public surface water or groundwater supply (and associated catchment) or permitted discharge.
	Features with a high vulnerability to flooding	Flood risk	Land use type considered as 'Essential Infrastructure' (i.e., critical national infrastructure, such as essential transport and utility infrastructure) and 'Highly Vulnerable' (e.g., police/ambulance stations that are required to operate during flooding, mobile homes intended for permanent residential use).
Medium	Features with a medium yield, quality or rarity, with a limited potential for substitution	Aquatic environment	Conditions supporting a site with a national conservation designation, where the designation is based specifically on aquatic features. Good status (quantity and/or quality) watercourse, also any associated upstream unclassified watercourse. Secondary aquifer (permeable, able to support water supply and/or watercourse baseflow on a local scale).
	Water use supporting human health and economic activity at a local scale	Water use	Local public surface water and groundwater supply (and associated catchment) or permitted discharge. Licensed non-public surface water and groundwater supply abstraction (and associated groundwater catchment) which is relatively large relative to available resource, or where raw water quality is a critical issue, e.g., industrial process water, or permitted discharge.
	Features with a medium vulnerability to flooding	Flood risk	Land use type considered as 'More Vulnerable' (e.g., most types of residential development, hostels and hotels, landfill and waste management facilities).
Low	Features with a low yield, quality or rarity, with some potential for substitution	Aquatic environment	Conditions supporting a site with a local conservation designation, where the designation is based specifically on aquatic features, or an undesignated but highly/moderately water-dependent ecosystem. Lower status (quantity and/or quality) watercourse, also any associated upstream unclassified watercourse. Secondary aquifer (lower permeability, limited yield).
	Water use supporting human health and economic activity at household/individual business scale	Water use	Licensed non-public surface water and groundwater supply abstraction (and associated catchment), which is small relative to available resource, or where raw water quality is not critical, e.g., cooling water, spray irrigation, mineral washing or permitted discharge. Unlicensed potable surface water and groundwater abstraction (and associated catchment) (e.g., private domestic water supply, well, spring or permitted discharge).
	Features with a low vulnerability to flooding	Flood risk	Land use type considered as 'Less Vulnerable' (e.g., most types of business premises).

Value	Criteria	Receptor type*	Examples
Very Low	Commonplace features with very low yield or quality with good potential for substitution	Aquatic environment	Conditions supporting an undesignated and low water-dependent ecosystem. Unclassified watercourse. Non-aquifer (low permeability, minimal yield)
	Water use does not support human health, and of only limited economic benefit	Water use	Unlicensed non-potable surface water and groundwater abstraction (and associated catchment) (e.g., livestock supply).
	Features that are resilient to flooding	Flood risk	Land use type considered as 'Water-compatible use' (e.g., appropriately designed flood control infrastructure; water transmission infrastructure).

Notes:
*Receptor types map onto receptors such as those identified in Table 8.1 as follows:
- Aquatic environment – aquifers, watercourses, conditions supporting GWDTEs and designated conservation sites
- Water use – springs, abstractions
- Flood risk – humans, properties and infrastructure.

Table 8.3 Summary of hydrology (including flood risk) and hydrogeology magnitude of change definition

Magnitude	Criteria	Receptor type	Example
High	Results in major change to feature, of sufficient magnitude to affect its use/integrity.	Aquatic environment	Deterioration in river flow regime, morphology or water quality, leading to sustained, permanent or long-term breach of relevant conservation objectives (COs) or non-temporary downgrading (deterioration) of watercourse status (quantity and/or quality) or dependent receptors. Deterioration in groundwater levels, flows or water quality, leading to non-temporary downgrading of status (quantity and/or quality) of aquifer or dependent receptors.
		Water use	Complete or severely reduced water availability and/or quality, compromising the ability of water users to abstract.
		Flood risk	Change in flood risk resulting in potential loss of life or major damage to property or infrastructure.
Medium	Results in noticeable change to feature, of sufficient magnitude to affect its use/integrity in some circumstances.	Aquatic environment	Deterioration in river flow regime, morphology or water quality, leading to periodic, short-term and reversible breaches of relevant COs, or potential temporary downgrading of watercourse status (quantity and/or quality) or dependent receptors. Deterioration in groundwater levels, flows or water quality, leading to potential temporary downgrading of status (quantity and/or quality) of aquifer or dependent receptors.
		Water use	Moderate reduction in water availability and/or quality, which may compromise the ability of the water user to abstract on a temporary basis or for limited periods, with no longer-term effect on the purpose for which the water is used.
		Flood risk	Change in flood risk resulting in potential for moderate damage to property or infrastructure.
Low	Results in minor change to feature, with insufficient magnitude to affect its use/integrity in most circumstances.	Aquatic environment	Slight change in river flow regime, morphology or water quality, but remaining generally within COs, and with no short-term or permanent change to watercourse status (quantity and/or quality) or dependent receptors. Slight deterioration in groundwater levels, flows or water quality, but with no short-term or permanent downgrading of status (quantity and/or quality) of aquifer or dependent receptors.

Magnitude	Criteria	Receptor type	Example
		Water use	Minor reduction in water availability and/or quality, but unlikely to affect the ability of a water user to abstract.
		Flood risk	Change in flood risk resulting in potential for minor damage to property or infrastructure.
Very Low	Results in little change to feature, with insufficient magnitude to affect its use/integrity	Aquatic environment	Very slight change in river flow regime or water quality, and no consequences in terms of COs or watercourse status (quantity and/or quality) or dependent receptors. Very slight change in groundwater levels or quality, and no consequences in terms of status (quantity and/or quality) of aquifer or dependent receptors.
		Water use	Very slight change in water availability or quality and no change in ability of the water user to exercise licensed rights or continue with small private abstraction.
		Flood risk	Increased frequency of flood flows, but which does not pose an increased risk to property or infrastructure.

8.3.5.2 Significance of effects

As outlined in the ToR, both the value of the water feature and the magnitude of change are used to derive the overall significance of the water-based effects. In the case of this assessment, the effects are assessed as being significant, probably significant or not significant as per the matrix in Table 8.4, with 'Major' effects taken to be 'Significant' and 'Moderate' effects, in the majority of cases, the significance can be determined as 'Beneficial', 'Adverse' or 'Neutral'.

Table 8.4 Significance evaluation matrix relating to the water environment

		Magnitude of change			
		High	**Medium**	**Low**	**Very Low**
Value	**High**	Major (Significant)	Major (Significant)	Moderate (Probably significant)	Minor (Not significant)
	Medium	Major (Significant)	Moderate (Probably significant)	Minor (Not significant)	Negligible (Not significant)
	Low	Moderate (Probably significant)	Minor (Not significant)	Negligible (Not significant)	Negligible (Not significant)
	Very Low	Minor (Not significant)	Negligible (Not significant)	Negligible (Not significant)	Negligible (Not significant)

Note: 'Significant' effects are those identified as 'Major'. 'Moderate' effects would normally be deemed to be 'significant'. There may however be some exceptions, dependent upon the environmental topic and the outcome of professional judgment.

Residual effects which remain 'Significant' following the implementation of additional mitigation measures will be identified. It is possible that there are no additional mitigation measures required, or that there are no residual effects following the application of mitigation measures.

8.4 Current baseline: hydrology and hydrogeology

8.4.1 Topography

As noted in the ToR:

– Site elevation ranges approximately between 7 and 20 ft (2.13 to 6.10 m) above mean sea level.
– The surrounding land is mainly flat and low lying and, where developed, is formed of reclaimed former mangrove swamp.

8.4.2 Climate

The following meteorological conditions for Grand Cayman are summarised in Table 8.5, as outlined in the ToR.

Average monthly rainfall in Grand Cayman varies from just under 1 inch (25 mm) per month, to over 20 inches (508 mm) per month. Average annual rainfall varies significantly, depending on individual storm events. The long-term annual average rainfall is 64.3 inches (1.63 m). The climate for Cayman Islands is tropical marine, including warm, rainy summers from May to October, with average temperatures approximately 80 to 85°F (27 to 29°C). The maximum average monthly temperature in July at 83.9°F (28.8°C), and winters are only slightly cooler on average, from November to April, with the lowest average monthly temperatures in February at 77.2°F (25.1°C). The heaviest rainfall typically occurs in October. Tropical low-pressure systems affect Grand Cayman during the summer months, and can comprise tropical waves, depressions, tropical storms, and hurricanes (with sustained winds at times exceeding speeds of 74 mph (119 kmph)). Hurricanes that periodically affect the island typically range from Category I through Category V on the Saffir Simpson scale. The hurricane season for this region is June 1 to November 30. Throughout the winter period, the Cayman Islands can experience 'Nor'wester' storms which can result in cooler temperatures and strong northwest winds across the islands.

Table 8.5 Meteorological summary for Grand Cayman[13]

Month	Average Rainfall (inches)[a]	Average Wind Speed (mph)[b]	Average Wind Direction	Average Temperature (°F)
January	1.68	11.3	ENE	77.3
February	2.88	9.6	ENE	77.2
March	7.42	9.9	ENE	78.4
April	20.36	10.2	ENE	80.0
May	3.56	8.6	E	81.7
June	1.69	8.9	E	83.3
July	11.51	8.8	E	83.9
August	5.35	8.4	E	83.6
September	3.85	6.7	E	83.1
October	0.71	9.8	ENE	81.8
November	1.97	11.4	ENE	80.7
December	3.36	9.7	ENE	78.7

Notes: Data sources:
[a] CIG National Weather Service 30-year average for George Town, Grand Cayman Island.
[b] CIG National Weather Service 21-year average for George Town, Grand Cayman Island.
[c] CIG **www.caymanislands-guide/weather/wind**

[13] Cardno ENTRIX. *Grand Cayman Waste Management Facility Draft Environmental Statement.* 2013.

8.4.3 Geology

The geology in the vicinity of the proposed development is described in CIG[14], WAC[15], Jones[16], and Carbex Geological Services Ltd[17] and summarised in Table 8.6, sourced from the ToR. Further detail can be found within Chapter 9 (Land Quality).

The Cayman Islands are outcrops of an undersea mountain range, known as the Cayman Ridge, within a tectonically active region. Elevated above the general level of the Cayman Ridge, the islands are formed from a separate fault block. The islands have a granodiorite base, capped with basalt and approximately 4,265 ft (1,300 m) of Tertiary carbonates – limestones and dolostones. The Tertiary Period geological succession consists of the Pleistocene Ironshore Formation unconformably overlying the Bluff Group. At surface level across much of Grand Cayman is peat (formed within the low-lying wetlands), alongside some areas of imported fill.

The Ironshore Formation comprises coralline limestones (from soft to hard) with hard lenses interspersed throughout, alongside coral ledge and pockets of calcareous sand. The underlying Bluff Group comprises the following formations; Pedro Castle Formation, Cayman Formation, and Brac Formation. The Cayman Formation exhibits a number of geological features including joints, fractures, and (primarily in-filled) sinkholes and solution cavities. The Cayman Formation is divided into the upper 'cap rock' (5.5 to 65 ft (1.7 to 19.8 m) below ground level (bgl)), and the lower part of the Cayman Formation which extends to depths below 250 ft (76 m) deep. The 'cap rock' comprises hard dolostones with low porosities and low permeabilities.

Investigation of the geology of the Site area by Carbex Geological Services Ltd[18] confirms that the geological makeup noted above is consistent with the geology beneath the Site. Data based upon three wells installed at the Site in December 2022, concludes that the Site is underlain by the following strata, from youngest to oldest; Ironshore Formation, Pedro Castle Formation, Cayman Formation, and Brac Formation. The characteristics of which correspond to those identified in other wells within the vicinity of the Site. Porosity and permeability values were obtained for twenty-five samples from various parts of the succession in each well on site, with all formations ranging from 10.1 to 39.7 percent.

Table 8.6 Geology summary for the Cayman Islands

Period	Series	Formation	Elevation (ft/m above mean sea level)	Thickness (ft / m)
Made ground	Made ground	Imported fill	+1.5 to +4.0 ft +0.45 to +1.2 m	2.5 ft/ 0.75 m
Quaternary	Holocene	Peat (swamp deposits)	0 to +1.5 ft 0 to +0.45 m	1.5 ft/ 0.45 m (4-10 ft/ 1.2-3.0 m below wastewater treatment lagoons to the west of the proposed development)
Quaternary	Pleistocene	Ironshore Formation (calcareous marl)	0 to -3.0 ft 0 to -0.9 m	3.0 ft/ 0.9 m
Quaternary	Pleistocene	Ironshore Formation (very soft friable limestone)	-3.0 to -7.5 ft -0.9 to -2.3 m	4.5 ft/ 1.4 m
Quaternary	Pleistocene	Ironshore Formation (soft friable limestone and marl bands)	-7.5 to -25 ft -2.3 to -7.6 m	17.5ft/ 5.3 m

14 Cayman Islands Government, *Environmental Assessment of Grand Cayman Sanitary Landfill, Grand Cayman Island, B.W.I.,* 1992
15 WAC, *Investigation of Groundwater Quality at Grand Cayman Wastewater Treatment Plant 1999-2001,* 2001
16 Jones, B., 2. *The Geology of the Cayman Islands.* In M. A. Brunt and J. E. Davies (eds). The Cayman Islands: Natural History and Biogeography, (pp. 13-49) Kluwer Academic Publishers, Netherlands, 1994
17 Carbex Geological Services. *Geological Report*. 2023
18 Carbex Geological Services. *Geological Report*. 2023

Period	Series	Formation	Elevation (ft/m above mean sea level)	Thickness (ft / m)
Tertiary	Pliocene	Bluff Group- Pedro Castle Formation (hard dolomite and limestone)	-25 to -45 ft -7.6 to -13.7 m	20ft/ 6.1 m
Tertiary	Miocene	Bluff Group- Cayman Formation (dolostone)	-45 to >-300 ft -13.7 to >-91.4 m	>250ft/ >76 m
Tertiary	Oligocene	Bluff Group- Brac Formation (limestone and sucrosic dolostone)	>-300 ft >-91.4 m	-
Notes: Based on information reported in CIG (1992), WAC (2001) and Jones (1992). Thickness of Brac Formation not reported.				

8.4.4 Potential sources of ground and surface water contamination

Potential soil contamination at the Site, which may represent sources of groundwater and surface water contamination, is discussed in detail within Chapter 9 (Land Quality). This includes information regarding:

– The adjacent Georgetown Landfill (GTLF) including:
  - Its boundary and layout.
  - Its historical development.
  - Results of leachate sampling.
  - Plans for its closure, remediation, and restoration.

– Other known or potential sources of contamination within the proposed ISWMS footprint including:
  - The old scrap and tyre stockpile area (OSTSA).
  - The arsenic containment cell.
  - The equipment storage area (including the oil, hazardous waste storage area, and area of suspected bund overtopping in 2004).
  - Evidence of earlier waste disposal activities outside of the GTLF.

Based on the available information, groundwater and surface water contamination within the proposed ISWMS footprint is most likely to result from current and historical waste disposal activities at the GTLF, which is understood to be owned by CIG. Management of the known environmental impacts of the GTLF is one of the drivers of the development of the ISWMS.

Overall, due to the current design and practices at the GTLF and potential resulting impacts to groundwater and surface water quality, it is likely that the construction of the ISWMS will result in net environmental benefits in the long-term.

8.4.5 Hydrogeology

The groundwater beneath the Site is reportedly tidally influenced, with a hydraulic gradient towards the North Sound to the east[19]. Observation boreholes (OBHs) located around the GTLF have been used for groundwater level monitoring and assessment in relation to tidal cycles[20]. An OBH within the central part of the landfill exhibited a head difference of between 0.45 ft (0.14 m) and 0.68 ft (0.2 m) (mean 0.56 ft (0.17 m)) above the corresponding tidal level within North Sound, with the groundwater levels indicating a tidal lag. The amplitude of the tidal fluctuations in North Sound were 1.2 times that of the OBH.

According to the ToR, assuming a net mean hydraulic head of 0.56 ft (0.17 m), and an average distance from a central point in the landfill to North South of 3,000 ft (914 m) and using an aquifer permeability of 0.00188 ft (0.00057 m) per

[19] Cayman Islands Government (CIG). *Environmental Assessment of Grand Cayman Sanitary Landfill, Grand Cayman Island, B.W.I.* 1992.
[20] Ibid

minute (constant head permeability test measurement), alongside a porosity of 15 percent, the groundwater flow was calculated at a rate of 12 ft (3.6 m) per day[21].

More recent groundwater monitoring undertaken by Amec Foster Wheeler[22] at 10 boreholes within and around the GTLF, on the western edge of the Site, is indicative of groundwater levels ranging from 1.87 ft (0.57 m) and 11.4 ft (3.47 m) bgl and subject to tidal variation (0.59 to 0.62 ft (0.18 to 0.19 m) across a 24-hour timeframe.

The tidal influence of the groundwater indicates hydraulic connectivity between the groundwater and ocean (Figure 8.2). This reportedly results in considerable mixing of saltwater from the ocean and freshwater, causing a transition zone of brackish water[23]. This mixing zone was anticipated to be present beneath the Site. Although Amec Foster Wheeler did not determine groundwater flow direction, they did confirm that groundwater is considered to be in continuity with surface waters[24]. GHD suggested that "*It can be assumed that the groundwater at the Site is flowing towards the canals and North Sound due to their closer proximity and proven tidal influence*"[25].

Interpretation of the hydrogeological conditions on Site, by R.C. Minning & Associates Inc[26] details that the groundwater flow system directly in contact with both the North Sound and the Caribbean Sea with the water table elevation fluctuating (with a slight lag) in response to local tidal cycles.

The groundwater is also assumed to be in hydraulic connectivity with the various mosquito-control canals, including the 'northern channel' on the northern boundary of the Site.

[21] Ibid
[22] Amec Foster Wheeler (now Wood). *Landfill Site Environmental Review. Task 2: Environmental Investigations Interpretative Report.* 2016
[23] Ibid
[24] Ibid
[25] GHD. *George Town Landfill: Environmental Risk Based Assessment, For: Dart Consortium, Revision: 3*. 28th May 2021
[26] R.C. Minning & Associates, Inc., *Hydrogeological Investigation: Regen Geothermal System*, 2023

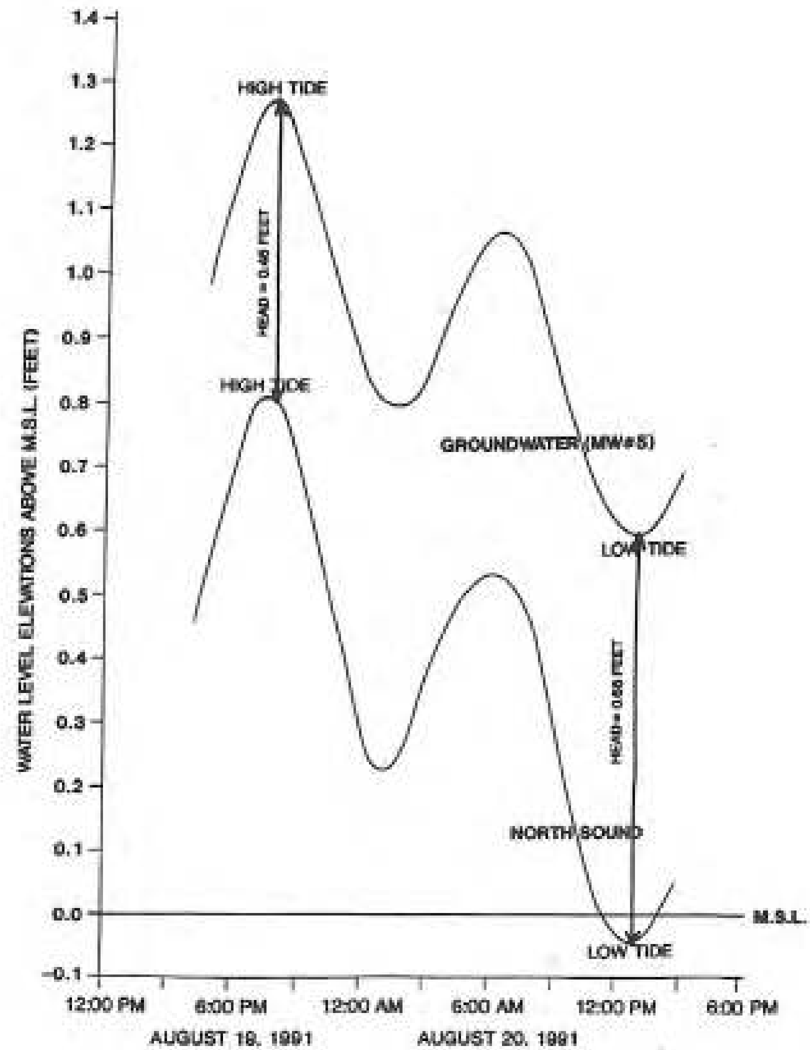

Figure 8.2 Net hydraulic head difference between groundwater levels at OBH within the central part of GTLF and water levels in the North Sound[27]

8.4.5.1 Available monitoring data

Quantitative water quality analysis data (surface water and groundwater) for the period of 2006 to December 2022 was provided by DART on 19 April 2023. GHD has relied upon this data and assumed that it is accurate and representative of the conditions at the Site during this period.

A spreadsheet of collated data was provided for 2006 to June/July 2022 and as laboratory certificates and digital data for the 2022 analysis. GHD has relied on the data within the spreadsheet and manually added the December 2022 data to it.

8.4.5.2 Groundwater quality

Groundwater quality to the north of the Site, in and around the GTLF, has been monitored by DEH between 2006 and December 2022. The monitoring locations are shown in Figure 8.3 and the full dataset is provided in **Appendix 8.A (Hydrology and Hydrogeology – Appendix A)**. Groundwater samples were analysed for a wide suite of

27 CIG. *Environmental Assessment of Grand Cayman Sanitary Landfill, Grand Cayman Island, B.W.I.* 1992.

contaminants and the concentrations compared to applicable assessment criteria, predominantly CCTLs. A summary of these results is provided in Table 8.7.

In general, elevated concentrations of organic contaminants were not reported:

– Polychlorinated Biphenyls (PCBs) were not detected above the relevant LoD in any of the 41 samples tested.
– In general, the concentrations of Volatile Organic Compounds (VOCs) were below relevant LoDs. However, Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX), acetone, carbon disulfide, chlorobenzene, 1,4-dichlorobenzene, and cis-1,2-dichloroethene were detected in one or more samples but not at concentrations above the CCTL.
– Diesel Range Organics (DRO C10-C28) were detected in all 20 samples tested but Gasoline Range Organics (GRO C6-C10) were only detected in 5 percent of these samples. No assessment criteria are available for these contaminants.

Table 8.7 Summary of groundwater contamination within the Site between 2006 and December 2022[28]

Substance	Unit	Florida Clean Up Standard Target Levels (CCTLs)	Samples With Data (No.)	Samples Below LoD (%)	Samples Exceeding CCTLs (%)	Concentration		
						Minimum	Maximum	Mean
"Ammonia or total Nitrogen"*	mg/L	28	78	0	21	0.073	330	36.31
Total Dissolved Solids (TDS)	mg/L	5000	85	0	71	330	27000	8756.82
1,2-Dibromoethane	µg/L	0.2	49	100	100	0.25	1	0.81
Dibromomethane	µg/L	0.2	55	100	100	0.34	1	0.77
1,2,3-Trichloropropa ne	µg/L	0.2	55	100	100	0.39	1	0.82
Antimony	mg/L	0.06	71	62	4	0.0005	0.68	0.03
Arsenic	mg/L	0.1	74	43	4	0.0018	8.5	0.18
Barium	mg/L	20	75	5	3	0.0056	290	5.03
Beryllium	mg/L	0.04	69	88	6	0.00017	0.2	0.01
Cadmium	mg/L	0.05	69	83	4	0.000078	0.15	0.01
Chromium	mg/L	1	75	37	4	0.00036	4.7	0.17
Copper	mg/L	10	71	55	1	0.0009	13	0.26
Iron	mg/L	3	50	28	28	0.031	5700	123.05

28 Appendix 8.A (Hydrology and Hydrogeology – Appendix A)

Substance	Unit	Florida Clean Up Standard Target Levels (CCTLs)	Samples With Data (No.)	Samples Below LoD (%)	Samples Exceeding CCTLs (%)	Concentration		
						Minimum	Maximum	Mean
Lead	mg/L	0.15	69	58	4	0.00034	12	0.27
Nickel	mg/L	1	74	59	4	0.0018	7.3	0.17
Selenium	mg/L	1	73	84	5	0.001	1.2	0.07
Thallium	mg/L	0.02	69	99	67	0.00049	0.49	0.05
Mercury	mg/L	0.02	66	94	11	0.00008	0.08	0.01
Aldrin	µg/L	0.02	29	100	38	0.0012	0.95	0.09
Alpha-BHC	µg/L	0.06	29	100	21	0.00098	0.95	0.9
Beta-BHC	µg/L	0.02	29	100	10	0.0012	0.95	0.10
Dieldrin	µg/L	0.02	29	100	38	0.0012	0.95	0.09

Notes: * This term is used in the data relied on by GHD, but these are different determinands so the meaning of this data is not clear. For the purpose of this assessment GHD has assumed that these values can be compared to the CCTL for ammonia.

Cells shaded red indicate an exceedance of the CCTL, cells shaded orange indicate exceedances where the LoD exceeds the CCTL, cells shaded green indicate that concentrations fall below the CCTL.

Consistent CCTL exceedances of ammonia or total nitrogen have been recorded in the north of the Site, alongside several isolated exceedances across the rest of the Site, but there does not appear to be any increasing or decreasing trend in concentrations over time. This may relate to the bund overtopping from the GTLF.

Exceedances CCTL for Total Dissolved Solids (TDS) were identified across the majority of the Site, except for areas in the far south-east. These exceedances of TDS have been recorded since the earliest monitoring round in 2006 and appear to be significantly fluctuating over time with no obvious trend aside from generally exceeding the CCTL consistently. These fluctuations may potentially be explained by the location of the Site within the transition zone where considerable mixing of groundwater and saltwater occurs, together with any dissolved solids that either water body is transporting.

Exceedances CCTL for both arsenic and antimony have been recorded in MW19 (south-east of the Site) and MW20 (south-west of the Site) in recent monitoring rounds, potentially indicating a potential relationship in their source and pathway into the groundwater. This may either be associated with the arsenic containment cell detailed within Chapter 9 (Land Quality), which is located in the centre/south of the Site, or the data may have been reported in the incorrect unit. The latter explanation may justify the high variability, inconsistency, and lack of apparent trend in these concentrations.

Historically, iron concentrations have been identified above the CCTL in MW1 (east, on Seymour Road, exact location not known), MW5 (Site centre, exact location not known), and MW8 (north-eastern corner). However, no data has been obtained from these locations since 2015, and therefore it is not possible to assess this trend over time or current status. In the more recent monitoring rounds, substantial exceedances of iron have also been found in MW19 (south-east of the Site) and MW20 (south-west of the Site). It is possible that these increases in iron concentrations may be related to the increases in arsenic and antimony that were identified within the same time frame and potentially sharing the same source, or the data may have also been reported in an incorrect unit.

Metals barium, beryllium, cadmium, chromium, copper, lead, nickel, selenium, thallium, and mercury also exceed their respective CCTLs and also exhibit highly fluctuating results with no trend. While this is potentially indicative of the groundwater being impacted by a wide range of metals, potentially associated with the GTLF, the results may also be caused by data discrepancies between monitoring rounds.

VOCs 1,2-dibromoethane, dibromomethane, and 1,2,3-trichloropropane also exceeded their respected CCTLs in all 55 samples; however, all 55 samples were also recorded below the LoD. As a result, the analysis of the data remains inconclusive.

Several CCTL exceedances of pesticides aldrin, alpha-BHC, beta-BHC, and dieldrin were also noted in several samples. As all sample data falls below the LoD, analysis of the exceeding data also remains inconclusive.

While no assessment criteria is available for DROs, concentrations have been identified above the LoD in MW-15A and MW16 within the area of suspected overtopping of the bund within the equipment storage area in 2004 in the south of the Site. Out of the three results obtained for this area (MW-15A in 2015 and 2016, MW16 in 2013) the maximum detected concentration is 1.7 mg/L in MW16 in 2013. It is possible that this concentration is related to the overtopped bund incident, however, as no earlier or more recent data has been obtained it is not possible to comment on any potential trends. It should also be noted that the concentrations within this area are consistent with other concentrations detected across the rest of the Site. The highest concentration recorded on Site is 26 mg/L in MW21 in 2016, on the northern boundary of the Site.

Figure 8.3 Surface water and groundwater monitoring location plan

8.4.5.3 Groundwater abstractions

The ToR identified three groundwater abstractions within 1.2 miles (2 km) of the proposed development site as presented in Table 8.8. It is noted that the nearest abstraction is 0.5 miles (0.75 km) northeast of the proposed development Site.

Table 8.8 Potential groundwater abstraction receptors identified in the ToR

Receptor	Location
Groundwater abstraction for reverse osmosis plant for Laundry Facility	0.2 miles (0.3 km) northeast of the proposed development Site
Groundwater abstraction for potable water supply following desalination at WAC's Red Gate Road Water Works (reverse osmosis plants)	0.6 miles (1 km) east of the proposed development Site
Groundwater abstraction for geothermal cooling purposes at the CUC electrical power generation facility	0.5 miles (0.75 km) northeast of the proposed development Site
Groundwater abstraction for geothermal cooling purposes undertaken by various other developments including Fosters warehouses and the Owen Roberts International Airport, with expectation of further future projects	0.7 miles (1.2 km) northwest (Fosters warehouse) and south (Airport) of the proposed development Site

Due to the general high salinity of groundwater and lack of significant freshwater resources on Grand Cayman, potable water is reportedly supplied from desalinisation plants by reverse osmosis. Water is reportedly sourced from wells drilled deep into the limestone bedrock beneath the Island and is treated to drinking water quality standard[29],[30]. This abstraction occurs from wells with response zones exceeding 100 ft (30 m) deep[31]. Abstractions for the WAC's Red Gate Road Water Works are reportedly sourced from a depth of approximately 100 feet[32].

Although freshwater lenses are present in several isolated areas of Grand Cayman[33], these are not used as a primary source of drinking water for the Island. The Site is not considered to be in close proximity to any major freshwater lenses, with the nearest freshwater lens approximately 4.9 miles (8 kilometres) southeast of the site.

The two non-potable abstractions listed in Table 8.8 are reportedly for cooling purposes therefore the requirements for water quality for this purpose may potentially limited to consideration of physico-chemical properties (such as total suspended solids, pH, temperature or similar), so that the abstracted water does not block or damage equipment associated with or inhibit the functionality of the cooling systems.

8.4.6 Hydrology

As noted in the ToR, the porous nature of the limestone bedrock and the flat topography of the Grand Cayman results in a lack rivers or streams across the island. Constructed mosquito-control channels transverse the local area and discharge into North Sound approximately 2,460 ft (750 m) northeast of the Site. The closest channel ('northern channel') runs west to east along the northern boundary of the Site. The northern channel is fringed with mangroves and is culverted below Esterly Tibbetts Highway to the west of the Site. Other channels are present around the GTLF to the west of the Site and discharge into the 'northern channel'.

The ToR also states that the water level in the channels and the North Sound fluctuate with the tide. The tidal variation in the North Sound recorded by CIG was in the order of 0.8 ft (0.24 m)[34]. Data from an Intergovernmental Oceanography Commission (IOC) sea level monitoring station at George Town indicates the tidal variation in North

[29] Wood Integrated Solid Waste Management System for the Cayman Islands: Environmental Impact Assessment: Final Terms of Reference, By Wood Environment & Infrastructure Solutions UK Limited, For: Environmental Assessment Board for the Integrated Solid Waste Management System, Grand Cayman, Revision: 07, Dated: October 2021

[30] https://www.caymancompass.com/2018/03/15/compass-investigation-caymans-water-where-it-comes-from-where-it-goes/

[31] GHD. *George Town Landfill: Environmental Risk Based Assessment*, For: DECCO Consortium, Revision: 3. 2021

[32] R.C. Minning & Associates, Inc., *Hydrogeological Investigation: Regen Geothermal System*, 2023

[33] Bugg, S.F. and Lloyd, J. W. *A Study of Freshwater Lens Configuration in the Cayman Islands using Resistivity Methods*. Quarterly Journal of Engineering Geology (QJEG). V. 9, p. 291-302. 1976.

[34] CIG. *Environmental Assessment of Grand Cayman Sanitary Landfill, Grand Cayman Island, B.W.I.* 1992.

Sound at the time of water sampling on 14 April 2015 was approximately 1 ft (0.3 m). The depth of the canals is such that they will likely be in hydraulic conductivity with groundwater.

8.4.6.1 Surface water quality

Surface water quality in the 'northern channel' and the North Sound near the Site has been monitored by DEH between 2006 and 2013 and by Amec Foster Wheeler in 2015. The data is provided in full in Amec Foster Wheeler[35] and summarised in Table 8.9. The data shows that the 'northern channel' is potentially affected by leachate from GTLF, which acts as a source of contaminants, including ammonia, orthophosphate, Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD), entering the North Sound. A review of available data indicates that there is apparently a relatively rapid dilution/dispersion of the discharge within North Sound.

Table 8.9 Summary of general surface water quality surrounding the Site[36]

Substance	Unit	Northern Channel			North Sound		
		Min	Mean	Max	Min	Mean	Max
Ammonia	mg/l	0.32	4.26	13	0.51	0.81	1.1
Orthophosphate	mg/l	0.03	0.13	0.44	<0.015	0.039	0.052
COD	mg/l	23	1,902	11,000	200	200	200
pH	-	7.34	7.56	8.25	n.m.	n.m.	n.m.
Specific Conductance	μmhos/cm	15,000	52,000	130,000	n.m.	n.m.	n.m.
BOD	mg/l	2.5	11	36	<2.0	-	3
Diesel Range Organics [C10-C28]	mg/l	0.046	0.119	0.33	-	-	0.048
GRO-C6-C10	mg/l	<0.047	-	-	n.m.	n.m.	n.m.

In addition to the groundwater data (Section 8.4.5.1), DART also provided GHD with surface water quality data, whereby concentrations of a suite of contaminants have also been analysed throughout the sampling period. Their locations are shown on Figure 8.3. The most recent round of sampling was conducted by DEH as per their monitoring schedule/plan. Table 8.10 summarises the concentrations of contaminants detected across the Site and surrounding area in comparison with relevant CCTLs. The data discrepancies detailed in Section 8.4.5.1 apply to this data set and are considered in the interpretation of data.

Table 8.10 Summary of surface water contamination surrounding the Site between 2006 and December 2022[37]

Substance	Unit	Florida Clean Up Standard Target Levels (CCTLs)	Samples With Data (No.)	Samples Below LoD (%)	Samples Exceeding CCTLs (%)	Concentration		
						Minimum	Maximum	Mean
Turbidity	NTU	29	91	1	31	0.23	320	36.109
Acrylonitrile	μg/L	0.2	50	92	85	0.001	20	15.228
1,2,3-Trichloropropane	μg/L	0.2	52	93	85	0.00048	1	0.803
Vinyl Chloride	μg/L	2.4	52	91	2	0.00048	10	0.979*

35 Amec Foster Wheeler (now Wood). *Landfill Site Environmental Review. Task 2: Environmental Investigations Interpretative Report.* 2016
36 Amec Foster Wheeler (now Wood). *Landfill Site Environmental Review. Task 2: Environmental Investigations Interpretative Report.* 2016
37 Appendix8.A (Hydrology and Hydrogeology – Appendix A)

Substance	Unit	Florida Clean Up Standard Target Levels (CCTLs)	Samples With Data (No.)	Samples Below LoD (%)	Samples Exceeding CCTLs (%)	Concentration		
						Minimum	Maximum	Mean
Arsenic	mg/L	0.05	84	34	7	0.0015	4.9	0.129
Beryllium	mg/L	0.00013	76	93	95	0.00017	0.2	0.010*
Cadmium	mg/L	0.009	77	94	4	0.000078	0.078	0.0055
Chromium (Hexavalent)	mg/L	0.05	77	44	9	0.0016	7.4	0.237
Copper	mg/L	0.004	76	88	50	0.0004	0.9	0.051*
Iron	mg/L	0.3	30	32	16	0.037	310	20.124
Lead	mg/L	0.0085	65	64	49	0.00034	3.6	0.235
Nickel	mg/L	0.008	77	90	48	0.0018	2.4	0.099
Silver	mg/L	0.0004	79	95	52	0.0001	0.39	0.020
Thallium	mg/L	0.0063	77	99	49	0.00026	0.26	0.023*
Zinc	mg/L	0.086	79	77	8	0.00049	10	0.439*
Mercury	mg/L	0.000025	57	97	99	0.00008	0.08	0.004
4,4'-DDD	µg/L	0.0003	25	100	86	0.00012	1	0.114
4,4'-DDE	µg/L	0.0002	25	100	86	0.00012	1	0.113
Alpha-BHC	µg/L	0.005	25	100	71	0.000007	1	0.114

Notes: * Predominantly due to LoD exceeding CCTL, however some actual exceedances have been recorded in samples where the LoDs are lower.

Cells shaded red indicate an exceedance of the CCTL, cells shaded orange indicate exceedances where the LoD exceeds the CCTL, cells shaded green indicate that concentrations fall below the CCTL.

Site-wide CCTL exceedances in turbidity have been identified, being particularly consistent in the north and northwest of the Site, which may be explained by the location of the Site being within the transition zone where considerable mixing of groundwater and saltwater occur.

VOCs acrylonitrile, 1,4-dichlorobenzene, 1,1-dichloroethene, bromomethane, and 1,2,3-trichloropropane were found to exceed their respective CCTLs. In many samples it is suspected that this is caused by data reporting in a different unit, and in other samples it may potentially be due to the LoD exceeding the CCTL. While the results indicate a sharply rising trend in recent concentrations within leachate, it is uncertain whether this data provides an accurate representation of surface water conditions and therefore the analysis of this data is inconclusive.

Vinyl chloride was identified above the CCTL in SW12 toward the south of the Site, also exhibiting a sharply rising pattern within the three data points obtained for leachate between July 2020 and December 2022. Due to the assumed north/north-easterly groundwater flow from the Site to the Northern Channel and North Sound, it is unlikely that these exceedances are related. However, these results, in particular those associated with the December 2022 monitoring round, may be caused by data reporting in a different unit.

Arsenic concentrations were noted to be consistent within the leachate (Site centre) and within the western area of the Site. A significant increase in concentration of arsenic was identified in these locations during the December 2022 round of sampling, which is consistent with increases in chromium (hexavalent), magnesium, and zinc in the same locations. This may indicate a potential relationship between the substances and their potential source. The exceedances of arsenic and chromium (hexavalent) may potentially be associated with the arsenic containment cell detailed within Chapter 9 (Land Quality), located in the centre/south of the Site since circa 2005, due to presence of timber treated with chromated copper arsenate (CCA) preservatives. However, it is considered more likely that many of these exceedances, in particular those associated with the December 2022 monitoring round, may be caused by data reporting in a different unit. This may also explain many of the exceedances for other substances including antimony, beryllium, cadmium, copper, iron, lead, nickel, silver, thallium, and mercury.

Consistent exceedances of lead were identified in SW7 (north of the Site) alongside some isolated exceedances across the wider Site area during the older sampling periods between 2006 and 2013. Zinc concentrations were also found to exceed the CCTLs in samples obtained from the Site drains.

Several exceedances of pesticides 4,4'-DDD, 4,4'-DDE, and alpha-BHC were also noted in several samples. Whilst this could have been associated with treated timber within the arsenic containment cell, all sample data falls below the LoD, therefore analysis of the exceeding data remains inconclusive.

In general, contaminant concentrations within the leachate sample do not appear to be particularly consistent with groundwater data (Section 8.4.5.2) for the central area of the Site. However, leachate sampling records only cover the period of June 2020 to December 2022 with no historic data available to determine if there is a relationship.

8.4.7 Flood risk

As stated in the ToR, surface water flooding occurs as a result of rainfall intensity exceeding the capacity of local drainage and infiltration, causing water to flow overland. This is considered a potential hazard following heavy rainfall events. In the Cayman Islands, heavy rainfall typically only takes place for several hours which, at worst, reportedly causes moderate flooding in some low-lying regions of the island. This is due to the rapid infiltration of water enabled by the island's surface, which mostly comprises a limestone outcrop or very thin and porous limestone soils. However, if a tropical depression settles over the island, it can rain for a period of several days with surface water flooding resulting in severe problems[38].

The Cayman Islands has experienced a total of 74 tropical storms and hurricanes over the period of 1852 to 2008 (156 years), with nine major storms of Category three or higher. In September 2004, Hurricane Ivan reportedly caused sustained winds of up to 155 mph (249 km/h), producing storm surges of 9.5 ft (2.9 m) and wave heights of greater than 26 ft (7.9 m) that flooded large coastal areas and deposited large amounts of sediment onshore[39].

No delineated floodplain mapping was found for the Cayman Islands. However, the Site, like much of Grand Cayman, is low-lying which indicates that tidal flooding and hurricane/tropical storm-associated flooding are significant potential hazards. Novelo-Casanova and Suarez (2010) delineated flood zones resulting from hurricanes according to hurricane categories on the Saffir-Simpson Scale (Figure 8.4)[40]. Exposure scores for flood hazards were determined by Novelo-Casanova and Suarez based on a) flood distribution areas during Hurricane Ivan, and b) topographic elevation and potential for flooding, as follows:

– Level 5 (very high exposure score) as shown in Figure 8.4a was assigned to zones where coastal flooding and wave action are the highest during Category 1 and 2 hurricanes which, on average, hit the Cayman Islands every 2.33 years.
– Level 4 (high exposure) was applied to Category 3 flood areas (Figure 8.4b) with hurricanes of this magnitude typically hitting the islands once every 9.1 years).
– Level 3 (moderate exposure) given to flood areas associated with hurricane Categories 4 and 5 (Figure 8.4c) that take place approximately every 100 years.

This shows that the Site is within an area of very high exposure to hurricanes and associated flooding and storm surge. Storm surges combined with wave action are responsible for much of the damage usually caused by hurricanes, especially in large, low-lying coastal settlements. In addition to causing flooding and damage to coastal

38 Novelo-Casanova, D.A. and Suarez, G.. *Natural and man-made hazards in the Cayman Islands.* Natural Hazards. November 2010. (55), pp.441–466. Springer Science. 2010
39 Cayman Islands National Emergency Website http://www.caymanprepared.ky/portal/page/portal/hmchome/resources/brochures/196853%20Past%20Hurricanes.pdf, undated
40 Novelo-Casanova, D.A. and Suarez, G.. *Natural and man-made hazards in the Cayman Islands.* Natural Hazards. November 2010. (55), pp.441–466. Springer Science. 2010

structures, storm surges may also cause flooding further inland through the blockage of the outfalls of drainage systems.

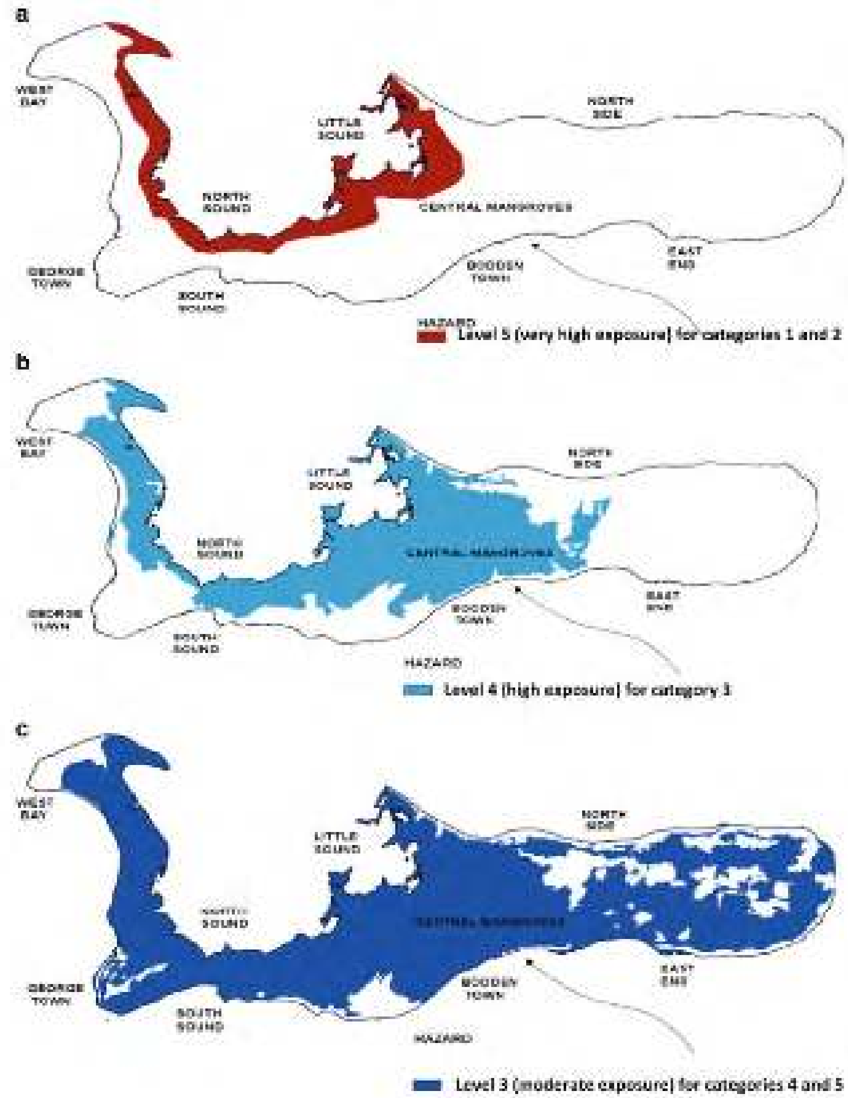

Figure 8.4 Level of exposure to due to flooding from hurricanes: a) Hurricane categories 1 and 2, b) Hurricane category 3, c) Hurricane categories 4 and 5. The arrow indicates the direction of approach of the hurricane[41]

GHD undertook a flood risk assessment for the proposed development, which included calibration to the measurements taken during Hurricane Ivan, then simulating Category 2, 3 and 5 cyclone events. The results of the assessment show that the most severe storm surge conditions occur in the interior of the North Sound, corresponding with previous models. Category 5 conditions result in the largest storm surges, peaking at 9.5 ft (2.9 m) within the North Sound, and Category 2 and 3 conditions produce similar peak water surface elevations of approximately 5.6 and 5.9 ft (1.7 and 1.8 m) respectively. The severity of the surges on the shoreline are reduced due to the generally steep bathymetry surrounding the majority of Grand Cayman, however, the North Sound area is susceptible to surge effects due to shallow bathymetry and semi-enclosed geometry within this region. In the event of an extreme rainfall event occurring in combination with a coastal storm surge, flooding is likely to be exacerbated.

[41] Novelo-Casanova, D.A. and Suarez, G.. *Natural and man-made hazards in the Cayman Islands.* Natural Hazards. November 2010. (55), pp.441–466. Springer Science. 2010.

8.4.8 Protected areas

According to the ToR. the closest proposed international designated (proposed Ramsar) sites are located approximately 2.75 miles (4.5 km) to the east (Central Mangrove Wetland, Little Sound, Ponds and associated Marine Zones) and 4.75 miles (7.5 km) to the north (Barkers Wetland) of the Site. The Central Mangrove Wetland, Little Sound, Ponds and associated Marine Zones comprise pristine mangrove wetlands supporting important habitats, marine invertebrates and internationally important populations of migratory birds. Barkers Wetland is a continuum from coral reef to coastal forest and mangrove supporting endangered marine and terrestrial reptiles, breeding and migratory birds as well as important invertebrates and endemic fish.

The Cayman Islands has a network of marine protected areas. There are three categories of marine parks for Grand Cayman:

– Environmental zone: in which prohibited activities include the removal of any form of marine life, the use of anchors, entry into the water and exceeding a speed of five knots.
– Replenishment zone: where the removal of conch and lobster is prohibited, and fishing methods restricted.
– Marine park zone: in which marine life is protected and anchoring forbidden, except in certain circumstances.

The closest marine protected area to the Site is the Marine Reserve on the west coast which comprises the Seven Mile Beach. The North Sound to the east of the Site also contains marine protected areas (Replenishment and Environmental zones). The closest nationally important terrestrial areas to the Site include the Mangrove Buffer Zone near the west coast and three Terrestrial Protected Areas between 0.9 miles (1.4 km) and 1.5 miles (2.5 km) to the north.

8.4.9 Future Baseline

Land use changes, and particularly climate change, could affect baseline conditions at the Site in the future. Climate change could affect the amount, intensity and duration of rainfall, temperature and evapotranspiration, occurrence of extreme weather (hurricanes) and amount and rate of sea level rise.

As outlined in the ToR, estimates of future sea-level rise within the Caribbean in the Model for the Assessment of Greenhouse-gas Induced Climate Change (MAGICC) indicates an increase of 0.4 ft (12 cm) to 2.6 ft (80 cm) in sea levels by 2100 from a 1990 baseline. This range encompasses the conservative estimates by the Intergovernmental Panel on Climate Change (IPCC) for global sea-level rise and represents a rise of approximately 0.05 to 0.35 inches (0.14 to 0.91 cm) per year. The Cayman Islands are amongst those islands showing regional variation in rainfall projections, with a decrease of between 0.4 to 2.0 inches (10 and 50 mm) in annual rainfall totals predicted between 2011 and 2099[42]. This could change the hydrological characteristics of the Site and wider catchment areas over time.

With respect to groundwater and surface water quality at the Site and the surrounding area, analysis of laboratory results using a highly precautionary approach (Section 8.4.5.1) suggest that groundwater and surface waters are already affected to some extent. These are believed to be primarily driven by emissions from GTLF, the closure of which is only possible if ISWMS proceeds at the Site providing an alternative waste disposal option. In the absence of ISWMS, it is likely that operation of the GTLF would be prolonged and, even if operational controls of leachate were improved, the associated emissions are likely to continue to impact groundwater and surface water quality over a prolonged period.

Local pollution incidents unrelated to the Site could also cause changes in the water quality within the proposed development Site and wider catchment.

[42] National Climate Change Committee, *Achieving a Low Carbon Climate-Resilient Economy: Cayman Islands' Climate Change Policy*. Report produced for presentation to the Cabinet of the Cayman Islands, 2011.

8.5 Impact assessment

8.5.1 Potential effects

The potential hydrology (including flood risk) and hydrogeology effects associated with the proposed development are summarised in Table 8.11. A number of these are sourced from the ToR.

When considering potential impacts the following design specifications for the proposed development were considered with regards to water supply and wastewater management which will require the necessary consents and permits from the relevant authority:

- Potable water supply will be sourced from the municipal water supply provided by the Cayman Water Authority.
- Cooling water for the Energy Recovery Facility (ERF) will be sourced from groundwater abstractions located within the Project Site, abstracted from approximate depth of 51 to 149 feet/130 (15.5 to 45.4 m).
- Following the ERF cooling cycle, cooling water will be discharged to the ground via discharge wells located within the Project Site, at discharge depth at circa 250 to 400 feet (76 to 121 m).
- Sewage and wastewater from toilet blocks will be disposed of either to mains sewer and the neighbouring wastewater treatment plant (subject to agreement for the Operator) or via septic tank to groundwater.

Table 8.11 Potential hydrology (including flood risk) and hydrogeology effects

Activity	Potential effect	Receptor
Temporary dewatering associated with the excavation of the foundations for infrastructure	Localised and temporary decline in groundwater levels and baseflows, deterioration in groundwater quality via induced saline intrusion	• Aquifers • Surface waters (North Sound & Mosquito control canals) • Groundwater abstractions
Temporary storage/stockpiling of materials	Change surface water drainage patterns and locally increase flood risk	• Site infrastructure, staff, and visitors • Surface waters (North Sound & Mosquito control canals)
Soil compaction and introduction of areas of hardstanding	Reduce infiltration recharge and groundwater levels and baseflows	• Aquifers • Surface waters (North Sound & Mosquito control canals) • Groundwater abstractions
	Increase surface water runoff and sediment-loading	• Surface waters (North Sound & Mosquito control canals)
	Increase surface water runoff and flood risk	• Surrounding land infrastructure, staff, and visitors
Groundwater abstraction for on-Site non-potable supply for ERF cooling, compost irrigation and general Site maintenance	Localised decline in groundwater levels and baseflows, further deterioration in groundwater quality via induced saline intrusion, increase in local groundwater temperature.	• Aquifers • Surface waters (North Sound & Mosquito control canals) • Groundwater abstractions
Disposal of wastewater generated at the Site (including sanitary effluent, facility wash water, Composting Area runoff and non-contact ERF cooling water)	Deterioration in groundwater and baseflow quality	• Aquifers • Surface waters (North Sound & Mosquito control canals) • Groundwater abstractions • Subsurface infrastructure

Activity	Potential effect	Receptor
Disposal of landfill leachate from the RWL	Deterioration in groundwater and baseflow quality	• Aquifers • Surface waters (North Sound & Mosquito control canals) • Groundwater abstractions • Subsurface infrastructure
Disturbance of existing contamination (discussed in the Land Quality Assessment of this EIA)	Exposure (and potential spread) of contaminated soils at the Site surface and release of runoff, deteriorating water quality	• Aquifers • Surface waters (North Sound & Mosquito control canals) • Groundwater abstractions • Subsurface infrastructure
Potentially contaminative activities on-Site	Release of pollutants directly (e.g., spillages) or indirectly (via surface water runoff), leading to deterioration in surface water and groundwater quality	• Aquifers • Surface waters (North Sound & Mosquito control canals) • Groundwater abstractions • Subsurface infrastructure
Tidal flooding, surface water flooding and extreme weather and climate change-induced flood events	Multiple effects (e.g., sediment-loading release of pollutants, flooding, mobilisation of contaminants off-Site by flood water)	• Aquifers • Surface waters (North Sound & Mosquito control canals) • Groundwater abstractions • Site infrastructure, staff, and visitors

8.5.1.1 Groundwater abstractions

The cooling water for the proposed ERF will be sourced from groundwater using abstraction wells within the Project Site. Following the ERF cooling cycle, this groundwater (which will be warmer than ambient groundwater temperature) will be discharged to the ground via discharge wells located within the Project Site.

R. C. Minning & Associates Inc (2023) undertook a hydrogeological investigation and modelling to investigate the potential impacts of the proposed ERF 'cooling water' wells relative to each other (abstraction and discharge points) and existing groundwater users in proximity of the development. It incorporated site-specific geological and hydrogeological data as well as available geological and hydrogeological information for the region. Groundwater modeling was undertaken to simulate the groundwater flow system and to simulate future heat and groundwater transport scenarios associated with the installation and operation of the cooling water system.

The R. C. Minning & Associates Inc assessment was undertaken on the basis of an assumed groundwater abstraction rate for the geothermal cooling system of 11,000 gpm (gallons per minute) via four abstraction wells, each yielding two, 750 gpm[43]. The assumed abstraction well depth was approximately 51 to 149 ft (15.5 to 45.4 m) below ground surface with injection (discharge) via three wells to a depth of approximately 250 to 400 ft (76-121 m) below ground surface.

Modelling by R.C. Minning & Associates Inc[44], alongside previous studies and operational history within the area, indicated that this abstraction is likely to be sustainable, with limited drawdown of groundwater levels anticipated once the system is in operation. The volumes of abstracted water were anticipated to be recharged via horizontal groundwater flow from the North Sound, alongside periodic discharge from on-Site stormwater drainage into the abstraction zone coupled with local precipitation. Recharge via horizontal groundwater flow from the North Sound

[43] R. C. Minning & Associates, Inc. *Hydrogeological Investigation: Regen Geothermal System.* Status: Draft, Dated April 2023.

[44] APEC. *Grand Cayman Proposed Integrated Solid Waste Management Facility: Energy Recovery Facility -Geotechnical Investigation and Report*, Status: Draft Final, Dated Mar 2021, Ref: 17015

indicates that saline intrusion could occur, however, the groundwater in the area is brackish to saline, with saline conditions (>10,000 mg/L TDS) occurring in proximity to the 'northern channel' or North Sound (refer Section 8.4.5).

The findings of the hydrogeological investigation and modelling were as follows:

– Limited drawdown of the groundwater levels will occur when the ERF cooling water system is in operation.
– Limited warming of the groundwater (0.1°C to 0.6°C) in the cooling water system abstraction zone (at the site), due to the hydrogeological characteristics and the operation of the cooling water system, i.e., low vertical permeability and injection (discharge) at a significantly lower depth and geology (between ~-250 and ~-400 ft (76 and 121 m) below ground surface).
– No impact on any adjacent groundwater abstractions associated with the proposed ERF cooling water system.
– None of the injected warm water from the ReGen facility reached the Caribbean Sea, North Sound, the residential canals or nearby water users in the modelled simulations.

The hydrogeological investigation also considered the potential for 'short-circuiting' by two pathways:

– Vertical migration from the injection zone upward into the abstraction zone via joint and fracture systems (i.e., high vertical permeabilities). This was considered unlikely due to:
  - The vertical difference in depths between injection and abstraction wells, as well as low permeability with fractures rarely evident in the strata above -350 ft (106 m).
  - Groundwater flow is primarily horizontal via intra formational pathways such as bedding plains and solution channels.
  - Empirical support for minimal vertical hydraulic communication between these zones and operation of similar cooling water systems which indicate that the vertical permeability of the 150 – 200 ft (45 – 61 m) BGS layer is sufficiently low to prevent short circuiting.
– Inadequate well construction (particularly the injection wells).
  - To be mitigated through appropriate grouting in the annulus to create a between the well casing and the surrounding rock.

The R. C. Minning & Associates Inc (2023 is provided in **Appendix 8.A Hydrology and Hydrogeology (Appendix B).**

8.5.2 Embedded measures

The currently proposed layout, design, and operation of the ISWMS is described in Chapter 4 and includes consideration of potential hydrology and hydrogeology effects, explicitly or otherwise. Some of these proposed mitigation measures are outlined in more detail in the sections below.

8.5.2.1 Leachate management

As noted in Chapter 4, "*the Residual Waste Landfill will be an engineered facility with a composite liner, leachate containment, leachate treatment, environmental controls and monitoring*". It will be designed, constructed and/or operated in line with relevant modern US standards, which should include procedures to manage landfill by-products including leachate, dusts, odours, and landfill gas, such as:

– Resource Conservation and Recovery Act (RCRA) (Sub-Title D Non-Hazardous Rules and Sub-Title C Hazardous Rules)
– RCRA Subtitle D (258) Seismic Design Guidance for Municipal Solid Waste Landfill Facilities.
– 40 Code of Federal Regulations
  - Part 258 – Criteria for Municipal Solid Waste Landfills
  - Part 264 – Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities

- Part 265 – Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, And Disposal Facilities

– Standards for the GTLF design (remediated as part of the ISWMS Project):
  - Florida Administrative Code No. 62-701.500: Landfill Operation Requirements
  - Florida Administrative Code No. 62-701.600: Landfill Final Closure

The nature of the residual waste (principally post-combustion residues from the ERF) will limit its leachability and putrescibility but, if fully complied with, the standards stipulate requirements for leachate emissions to be mitigated appropriately. This would therefore reduce the likelihood of deterioration in surface water or groundwater quality via pollutant (leachate) release.

The Landfill Facility design will incorporate pollution control features (e.g., leachate extraction wells, transmission pipework and a sequencing batch reactor type leachate treatment plant) to collect and treat leachate produced within the landfill cell(s). The leachate will be treated on-Site and potential reuse of the effluent for dust suppression purposes will be considered. The effluent quality will be suitable for discharge from the Site in compliance with local environmental licence requirements.

Subject to the quality of the effluent from the leachate treatment plant, in addition to reuse on-Site, disposal mechanism include to the off-Site and adjacent wastewater treatment plant (subject to agreement with Water Authority Cayman) or disposed of on-Site via deep well injection. The quality of the leachate post treatment will be assessed as part of the detailed design of the treatment plant.

The following features are proposed for the leachate management system:

– Leachate from the waste bunker will be pumped out in accordance with the expected composition of the waste, into a suitable containment system followed by treatment if necessary.
– A leachate drainage network will be installed, with all roads and operating areas to be instated and maintained to ensure that no damage occurs.
– Leachate that has been recirculated will be sprayed over the composting windrow, in the event that the moisture content must be raised. It will also be used for dust suppression purposes for the non-capped areas of the facility via tractor and bowser.
– Clean surface water from non-active areas will be prevented from making contact with the leachate in the active areas via temporary internal bunds and storm flaps to prevent contamination of this water.
– A leachate treatment plant will be developed to receive, treat, and dispose of leachate from the landfill facility, prior to the landfill facility becoming operational. The volume of generated leachate will determine the capacity of the leachate treatment plant and the ability to balance with the volumes of recirculated leachate required for dust suppression. Where volumes of recirculated leachate are insufficient for the demand, grey water shall be used instead.

8.5.2.2 Storage and material handling

As described in Chapter 4, "*Facility designs include consideration of laydown areas which will be set aside for the storage of construction materials and waste management activities and located away from potential contaminant pathways.*". This would therefore reduce the likelihood of construction materials and wastes becoming a potential pollutant source within a potential contaminant pathway, reducing the likelihood of deterioration in surface water or groundwater quality via pollutant release.

8.5.2.3 Facility design standards

As noted in Chapter 4, each of the ISWMS facilities will be designed to a still water elevation of 8 ft (2.4 m) above mean sea level (AMSL), based on Hurricane Ivan (a 1 in 100 year return period) records and US Federal Emergency Management Agency (FEMA) guidance has been used to arrive at Base Flood Elevation (BFE) of +12 ft (3.7 m) AMSL and Design Flood Elevation (DFE) of +13 ft (4.0 m) AMSL. . Drainage systems will be designed to manage the impacts of extreme weather conditions and reduce risk of flooding and will comply with all applicable building design codes and regulations.

8.5.2.4 Stormwater management

A general site drainage system to manage surface water run-off from non-operational areas of the Site has been developed and is described in Chapter 4. The design of the Site's drainage system incorporates pollution control features and system divisions to isolate specific areas as appropriate.

8.5.3 Assessment of effects

The potential significance of the effects identified in Section 8.5.1 have been assessed in line with the methodology outlined in Section 8.3 in order to identify potentially significant effects in the absence of mitigation beyond that considered integral to the design (embedded measures) (see Table 8.12).

Table 8.12 Significance assessment of potential water-related effects in the absence of mitigation (except for embedded design measures)[45]

Activity	Receptor	Value	Magnitude	Significance	Rationale
Temporary dewatering associated with the excavation of the foundations for infrastructure	Aquifer quality	Medium	Low	Minor	As aquifers on Grand Cayman are of high salinity and high yield, they are not considered to support human health without desalinisation and treatment to achieve drinking water quality standards. Therefore, a deterioration in quality due to saline intrusion is not considered a Significant Effect.
	Surface waters (North Sound & Mosquito control canals)	Medium	Low	Minor	While the North Sound surface waters support local economic activity and recreation, saline intrusion via hydraulic connectivity is not considered to significantly deteriorate quality. As groundwater flow acts as a baseline flow for surface waters, there may be a temporary slight decline in water levels, however this is not considered to be significant.
	Groundwater abstractions	Medium	Low	Minor	As dewatering works will be transient, and groundwater abstractions likely being unnecessary for the development at this stage, the effect on groundwater abstractions and therefore not considered to be significant. For off-Site abstractions identified, these are 0.6 miles (0.9 kilometres) (potable water supply) and 0.5 miles (0.8 kilometres) (cooling water) from the proposed development and likely abstract at significant depth (100 feet or 30.5 m depth for potable water, from 70 feet or 21 m depth for CUC cooling water) and therefore not likely to be impacted by the shallow and transient anticipated groundwater disturbance taking place during construction. This is not considered a Significant Effect.

45 All potentially significant effects are highlighted in bold

Activity	Receptor	Value	Magnitude	Significance	Rationale
Temporary storage/stockpiling of materials	Site infrastructure, staff, and visitors	Medium	Low	Minor	As described in Chapter 4, drainage systems will be designed to manage the impacts of extreme weather conditions and reduce risk of flooding and will comply with all applicable building design codes and regulations. Further a general site drainage system to manage surface water run-off from non-operational areas of the Site has been developed and is described in Chapter 4. This is not considered a Significant Effect.
	Surface waters (North Sound & Mosquito control canals)	Medium	Low	Minor	Localised flooding would be unlikely to cause significant effect to surface waters located off-site, due to likely low volumes of flood water alongside the effects being temporary.
Soil compaction and introduction of areas of hardstanding	Aquifer quality	Medium	Low	Minor	As aquifers on Grand Cayman are of high salinity and low yield, they are not considered to support human health without desalinisation and treatment to achieve drinking water quality standards. A reduction in groundwater levels due to slight increase in hardstand surfaces at the site is considered unlikely to result in a significant effect to users. Surface water management measures may also enable infiltration in some areas of the Site, minimising the potential reduction in groundwater levels.
	Surface waters (North Sound & Mosquito control canals)	Medium	Very low	Minor	As described in Chapter 4, drainage systems will be designed to manage the impacts of extreme weather conditions and reduce risk of flooding and will comply with all applicable building design codes and regulations. Further a general site drainage system to manage surface water run-off from non-operational areas of the Site (as well as associated pollution management measures) has been developed and is described in Chapter 4. This is not considered a Significant Effect.

Activity	Receptor	Value	Magnitude	Significance	Rationale
	Groundwater abstractions	Medium	Low	Minor	Reduced infiltration could locally result in a minor and localised change to groundwater recharge. However, it is considered unlikely to significantly affect water table levels outside of the site and, therefore, there is likely to be limited effect on groundwater abstractions identified within 1.2 miles of the proposed development. The proposed abstraction of water for on-site cooling purposes is also unlikely to be impacted due to the depth of the proposed abstraction (51 to 149 feet (15 to 45 metres) below ground surface). This is not considered a Significant Effect.
	Surrounding land infrastructure, staff, and visitors	High	Very low	Minor	As described in Chapter 4, drainage systems will be designed to manage the impacts of extreme weather conditions and reduce risk of flooding and will comply with all applicable building design codes and regulations. Further a general site drainage system to manage surface water run-off from non-operational areas of the Site has been developed and is described in Chapter 4. This is not considered a Significant Effect.
Groundwater abstraction for on-Site non-potable supply for ERF cooling, compost irrigation and general Site maintenance)	Aquifer quality	Medium	Medium	Minor	As aquifers on Grand Cayman are of high salinity, they are not considered to support human health without desalinisation and treatment to achieve drinking water quality standards. Therefore, a deterioration in quality via potential saline intrusion associated with groundwater abstraction is not considered a Significant Effect on groundwater quality.

Activity	Receptor	Value	Magnitude	Significance	Rationale
	Surface waters quality (North Sound & Mosquito control canals)	Medium	Low	Minor	While the North Sound surface waters support local economic activity and recreation, saline intrusion via hydraulic connectivity is not considered to significantly deteriorate quality in surface water (due to groundwater already being saline). Abstraction modelling by R.C. Minning & Associates Inc[46] indicates that the proposed abstraction rate of 11,000 gpm is unlikely to affect surface waters, due to the limited extent of drawdown identified from the groundwater modelling (**Appendix 8.A (Hydrology and Hydrogeology Assessment – Appendix B)**).
	Groundwater abstractions	Medium	Low	Minor	An assessment of the impact of the proposed abstraction rate of 11,000 gpm for the proposed ERF cooling water suggests that there is limited drawdown, is unlikely to significantly affect water table levels and therefore there is likely to be limited effect on groundwater abstractions identified within 1.2 miles (1.9 kilometres) of the proposed development (**Appendix 8.A (Hydrology and Hydrogeology Assessment – Appendix B)).**
Disposal of wastewater generated at the Site (including potential sanitary effluent, facility wash water, Composting Area runoff and non-contact ERF cooling water)	Aquifer quality	Medium	Low	Minor	As aquifers on Grand Cayman are of high salinity, they are not considered to support human health without desalinisation and treatment to achieve drinking water quality standards. The modelled groundwater discharge of cooling water by R.C. Minning and Associates Inc (2023) suggests that there is limited impact to groundwater in terms of temperature increase. Therefore, a deterioration in quality is not considered a Significant Effect.

46 R.C. Minnings & Associates, Inc., *Hydrogeological Investigation: Regen Geothermal System*, 2023

Activity	Receptor	Value	Magnitude	Significance	Rationale
	Surface waters (North Sound & Mosquito control canals)	**Medium**	**Medium**	**Moderate**	**The North Sound surface waters support local economic activity and recreation, and marine protected areas, therefore a deterioration in quality from potential contamination from discharge of wastewater to groundwater (or quality impacted groundwater in connectivity with surface waters) could negatively affect surface water users. The potential disposal of sanitary wastewater to shallow groundwater via septic tanks would be considered the potential source. This is considered a Potentially Significant Effect and depends on the potential contaminant properties and concentrations as to how much this could effect water quality. This also depends on whether the mains sewerage disposal route can be used for sanitary wastewater discharge.** The disposal of non-sanitary waste (e.g., cooling water) is of sufficient depth (circa 250-400 feet (76-121 metres)) to be considered to not impact surface water quality.
	Groundwater abstractions	Medium	Low	Minor	Groundwater abstractions (on-site and off-site) are likely to be deep in the limestone aquifer, at a depth considered unlikely to be impacted by either discharge from septic tanks (to shallow groundwater) or from the deeper (circa 250-400 feet (76-121 metres)) discharge of cooling water. Therefore, a deterioration in groundwater quality is not considered a Significant Effect on the off-site abstractions or proposed on-Site abstractions (for cooling water purposes).
	Subsurface infrastructure at the site	**Medium**	**Medium**	**Moderate**	**Potential contamination of groundwater with elevated concentrations of contaminants, including sulphate, may compromise the structural integrity of concrete infrastructure (such as foundations) depending on the concrete grade used within the development. This could cause significant effect to the Site infrastructure.**

Activity	Receptor	Value	Magnitude	Significance	Rationale
Disposal of landfill leachate from the RWL	Aquifer quality	Medium	Low	Minor	Assuming compliance with the leachate management procedures, any leachate emissions would be managed and mitigated appropriately and would therefore reduce the likelihood of water quality deterioration. Also, as aquifers on Grand Cayman are of high salinity and they are not considered to support human health without desalinisation and treatment to achieve drinking water quality standards. Therefore, a deterioration in quality is not considered a Significant Effect.
	Surface waters quality (North Sound & Mosquito control canals)	Medium	Low	Minor	The North Sound surface waters support local economic activity and recreation, and marine protected areas, therefore a deterioration in quality from potential contamination from landfill leachates could negatively effect surface water users. However, leachate management procedures reduce the likelihood of this occurring. This is therefore considered not Significant.
	Groundwater abstractions	Medium	Low	Minor	Leachate management procedures reduce the likelihood of leachate reaching and impacting groundwater quality. In the event of an uncontrolled release of leachate to groundwater then this is considered unlikely to impact on-Site or off-Site groundwater abstractions due to a combination of depth of on-site abstraction (circa 51-149 feet (15 to 45 metres)), as well as depth of abstraction and distance to the off-site abstractions. Any uncontrolled release of leachate is likely to be limited in duration (i.e. temporally limited) due to mitigation measures that will be documented in the detailed design of the ISWMS facility and associated environmental management plans. This is therefore considered not Significant.

Activity	Receptor	Value	Magnitude	Significance	Rationale
	Subsurface infrastructure	Medium	Low	Minor	Potential contamination of groundwater with elevated concentrations of sulphate may compromise the structural integrity of any concrete infrastructure (such as foundations) depending on the concrete grade used within the development. Any uncontrolled release of leachate is likely to be limited in duration (i.e., temporally limited) due to mitigation measures that will be documented in the detailed design of the ISWMS facility and associated environmental management plans. This is therefore considered not Significant.
Disturbance of existing contamination (discussed in the Land Quality Assessment of the EIA)	Aquifer quality	Medium	Medium	Moderate	As aquifers on Grand Cayman are of high salinity and low yield, they are not considered to support human health or economic activity without desalinisation and treatment to achieve drinking water quality standards. The groundwater quality is considered to potentially already be impacted by GTLF operations. Therefore, a deterioration in quality is not considered a Significant Effect.
	Surface waters quality (North Sound & Mosquito control canals)	**Medium**	**Medium**	**Moderate**	**While the North Sound surface waters support local economic activity and recreation, disturbance of contamination on-site has the potential to migrate via surface water runoff or shallow groundwater and subsequent discharge to surface water.**
	Groundwater abstractions	Medium	Low	Minor	The disturbance of contaminated land is considered unlikely to impact on-site or off-site groundwater abstractions due to a combination of depth of on-site abstraction (circa 51-149 feet (15 to 45 metres)), as well as depth of abstraction and distance to the off-site abstractions. The potential effect is therefore not considered significant.

Activity	Receptor	Value	Magnitude	Significance	Rationale
	Subsurface infrastructure	**Medium**	**Medium**	**Moderate**	**While potential contamination of groundwater is considered unlikely, and may not result in elevated sulphate concentrations, potential contamination of groundwater with elevated concentrations of Sulphate may compromise the structural integrity of any concrete infrastructure (such as foundations) depending on the concrete grade used within the development. This is a general consideration for the whole Site.**
Potentially contaminative activities on-Site	Aquifer quality	Low	Medium	Minor	As aquifers on Grand Cayman are of high salinity and low yield, they are not considered to support human health or economic activity without desalinisation and treatment to achieve drinking water quality standards. The groundwater quality is considered to potentially already be impacted by GTLF operations. Therefore a deterioration in quality is not considered a Significant Effect.
	Surface waters quality (North Sound & Mosquito control canals)	**Medium**	**Medium**	**Moderate**	**The North Sound surface waters support local economic activity and recreation, and marine protected areas, therefore a deterioration in quality from potential contamination from Site activity (from surface runoff or migration via groundwater) could negatively affect surface water users. This is considered a Potentially Significant Effect and depends on the potential contaminant properties within the leachate and other sources and their respective concentrations.**
	Groundwater abstractions	**Medium**	**Low**	**Minor**	Contaminating activities on Site is considered unlikely to significantly impact on-site or off-site groundwater abstractions due to a combination of depth of on-Site abstraction (circa 51-149 feet (15 to 45 metres)), as well as depth of abstraction and distance to the off-Site abstractions. The potential effect is therefore not considered significant.

Activity	Receptor	Value	Magnitude	Significance	Rationale
	Subsurface infrastructure	**Medium**	**High**	**Moderate**	**Potential contamination of groundwater with elevated concentrations of sulphate may compromise the structural integrity of any concrete infrastructure (such as foundations) depending on the concrete grade used within the development. This could cause Significant effect to the Site infrastructure. This is a general consideration for the whole Site.**
Tidal flooding, surface water flooding and extreme weather and climate change-induced flood events	Aquifer quality	**Medium**	**Medium**	**Moderate**	**This relates to the potential mobilisation of contaminants (associated with waste material, fuel storage, etc) on site during a flood, with contaminants subsequently infiltrating to the underlying groundwater.** **As aquifers on Grand Cayman are of high salinity and they are not considered to support human health without desalinisation and treatment to achieve drinking water quality standards. The groundwater quality is considered to potentially already be impacted by GTLF operations. Due to the value of the receptor, this is considered a Potentially Significant Effect.**
	Surface waters (North Sound & Mosquito control canals)	**Medium**	**Medium**	**Moderate**	**This relates to the potential mobilisation of contaminants (associated with waste material, fuel storage, etc) on Site during a flood, with contaminants subsequently discharging to the surface water or infiltrating to the underlying groundwater and then discharging to the surface water bodies.** **The North Sound surface waters support local economic activity and recreation, and marine protected areas, therefore a deterioration in quality from Site-related contamination migrating via floodwater could negatively affect surface water users. This is considered a Potentially Significant Effect and depends on the potential contaminant properties within the leachate and their respective concentrations.**

Activity	Receptor	Value	Magnitude	Significance	Rationale
	Groundwater abstractions	**Medium**	**Low**	**Minor**	This relates to the potential mobilisation of contaminants (associated with waste material, fuel storage, etc) on site during a flood, with contaminants subsequently infiltrating to the underlying groundwater. Contamination resulting from flooding on Site is considered unlikely to significantly impact on-site or off-Site groundwater abstractions due to a combination of the depth of on-site abstraction (circa 51-149 feet (15 to 45 metres)), as well as depth of abstraction and distance to the off-Site abstractions. The potential effect is therefore not considered significant.
	Site infrastructure, staff, and visitors	**Medium**	**Medium**	**Moderate**	**Potential localised flooding has the potential to cause lasting effects on Site infrastructure sensitive to flood water inundation and users, potentially compromising the integrity of the system and posing a risk to life. Therefore, the effect is considered potentially Significant.**

8.5.4 Summary of findings

An assessment of the significance of each of the potential hydrological and hydrogeological effects identified with respect to the proposed development are presented in Table 8.12. This identified the following potentially significant (moderate or major) effects:

1. Deterioration in local water quality as a result of contamination associated with potential wastewater disposal (sanitary waste disposed via septic tank) may affect recreational users of surface waters, in particular for the North Sound. Subsurface concrete infrastructure could also be affected, depending on the contents of the wastewater and the grade of concrete used.
2. Deterioration of surface water quality resulting from contamination caused by disturbance of existing contamination on-site. Subsurface concrete infrastructure could also be affected, depending on the contaminants present and the grade of concrete used.
3. Deterioration in water quality resulting from potentially-contaminative activities on-Site could affect end users of groundwater abstractions. Subsurface concrete infrastructure could also be affected, depending on the contaminants present and the grade of concrete used.
4. Flooding from tidal sources and weather-induced events could affect surface waters and their suitability for use (both North Sound and mosquito control channels), through the potential mobilisation of contaminants (associated with waste material, fuel storage, etc.) on site. Flooding of surface waters could also cause detrimental effects to the Site's infrastructure, staff, and visitors, compromising the integrity of the ISWMS system and potentially risking life.
5. Flooding from tidal sources and weather-induced events could affect aquifer quality, in the event of a flood potentially causing mobilisation of contaminants which may subsequently infiltrate into the groundwater and impacting its quality.

8.6 Mitigation measures

8.6.1 Localised flooding

A number of Potentially Significant Effects have been identified associated with localised flooding at the Site.

8.6.1.1 Stormwater management plan

A detailed stormwater management plan should also be prepared for the construction phase of the proposed development, which details all areas from which runoff can arise. This should also consider if or how this system interface with existing drainage systems (e.g., the neighbouring GTLF). The plan should then propose appropriate and adequate runoff collection and treatment options for the identified runoff, without compromising existing systems. It is recommended that, wherever possible, the principles of Sustainable Urban Drainage Systems[47] should be applied and associated pollution control measures.

8.6.1.2 Environmental management plan – flood risk measures

Environmental management plan (EMP) to include flood risk mitigation measures regarding minimising the risk of equipment sensitive to floodwater inundation, the siting of temporary stockpiles (or other potential sources of contamination) and measures to ensure safety of Site workers (e.g., evacuation plans).

[47] Woods Ballard B, Wilson S, Udale-Clarke H, Illman S, Scott S, Ashley R, & Kellagher R. *C753 - The SuDs Manual.* CIRIA: London, UK. 2015. Accessed from https://www.ciria.org/ItemDetail?iProductCode=C753&Category=BOOK&WebsiteKey=3f18c87a-d62b-4eca-8ef4-9b09309c1c91

8.6.2 Deterioration of water quality

A number of Potentially Significant Effects have been identified associated with deterioration of water quality for both surface water and within aquifers.

A detailed wastewater and sewerage plan should be prepared in order to minimise the risk of leaks and spills within the system. The plan should incorporate suitable treatment options for wastewater prior to discharge, in accordance with projected volumes and with the requirements of the regulatory authority.

The cap used to seal completed sections of the RWL remain effective and intact into the future, to prevent the escape of leachate or other waste material. Consideration of foreseeable changes to the local climate and sea level due to climate change must be included in the design. The RWL is intended to be constructed in a phased manner and capping of the first phase is not anticipated in the near future. Prior to any capping, additional contemporary studies should be undertaken to ensure that the current design is adequate in light of the latest climate data and modelling and procedures put in place to ensure that the ultimate construction is in line with the agreed design.

A robust strategy must be made and adhered to, preventing the disturbance of or managing existing known areas of contamination on the Site (as detailed in Chapter 9 (Land Quality)). Disturbance of existing contamination is not proposed as part of the development construction or operation without a prior assessment of the contamination status of areas of potential concern and appropriate measures in place to manage risk to human health and the environment. All Site staff should have a thorough awareness of the locations of the existing contamination to reduce the likelihood of accidental disturbances or exposures.

Method statements should be prepared for all potentially-contaminative activities taking place on the Site. This must be inclusive of mitigation procedures to be used in the event of a spill or accident. It is recommended that potentially-contaminative activities are reduced where possible and take place in zoned areas whereby access to contaminant pathways and receptors are minimised as much as practicably possible (e.g., bunded areas to contain spills and minimise risk of infiltration to ground). This should ideally be factored into the design and layout of the proposed development and operational management plans.

A waste management plan should be prepared inclusive of appropriate waste management for emergency situations, factoring in emergency response and flooding.

It is also recommended that groundwater is sampled and tested regularly to ensure that the abstracted water is of suitable quality for its intended use and the requirements would be documented in the environmental management plan. This would also contribute to monitoring of the groundwater to identify any potential changes in quality in response to abstraction or Site operations over time.

8.6.3 Degradation of subsurface infrastructure

A number of Potentially Significant Effects have been identified associated with degradation of subsurface concrete infrastructure as a result of potential Sulphate or other contamination.

It is recommended that the design of the proposed development considers the use of an appropriate grade of concrete to prevent Sulphate attack in the event of groundwater contamination. It is recommended that soil and groundwater analysis is undertaken to inform a ground aggressivity assessment in order to determine a suitable design sulphate class (DS class) for the concrete structures proposed in the subsurface region.

8.6.4 Significance evaluation considering mitigation measures

The mitigation measures proposed in the subsections above have been applied to the assessment of potential hydrology and hydrogeology effects to reassess significance considering mitigation measures. Only those effects identified as "Potentially Significant" from Table 8.12 have been reassessed in consideration of mitigation in Table 8.13.

Table 8.13 Significance assessment of potential water-related effects with the application of mitigation measures[48]

Activity	Receptor	Value	Magnitude	Mitigation	Magnitude (considering mitigation)	Significance (considering mitigation)	Rationale
Disposal of wastewater generated at the Site (including potential sanitary effluent, facility wash water, Composting Area runoff and non-contact ERF cooling water)	Surface waters (North Sound & Mosquito control canals)	Medium	Medium	Prepare a detailed wastewater and sewerage plan to minimise the risk of leaks and spills within the system and incorporate suitable treatment options for wastewater prior to discharge. Detailed design to consider the feasibility of the option to connect to local wastewater network for disposal of sewerage to the local wastewater treatment works.	Low	Minor	Reduced potential for contamination from wastewater (or quality impacted groundwater in connectivity with surface waters) through the preparation and implementation of a detailed wastewater and sewerage plan, including suitable treatment options for wastewater prior to discharge and in line with the regulatory consent requirements. This is not considered a Significant Effect.
	Subsurface infrastructure	Medium	Medium	Prepare a detailed wastewater and sewerage plan to minimise the risk of leaks and spills within the system and incorporate suitable treatment options for wastewater prior to discharge. Construct using an appropriate grade of concrete to prevent Sulphate attack in the event of groundwater contamination.	Very low	Minor	The potential for contamination of groundwater with elevated concentrations of contaminants, including sulphate, is reduced through the preparation and implementation of a detailed wastewater and sewerage plan. Further, the potential for compromise to the structural integrity of concrete infrastructure (such as foundations) is reduced through use of appropriate concrete grade. This is not considered a Significant Effect.

48 All potentially significant effects are highlighted in bold

Activity	Receptor	Value	Magnitude	Mitigation	Magnitude (considering mitigation)	Significance (considering mitigation)	Rationale
Disturbance of existing contamination (discussed in Chapter 9 (Land Quality))	Aquifer quality	Medium	Medium	Implementation of a strategy to prevent or appropriately manage the disturbance of existing known areas of contamination on the Site (as detailed in Chapter 9 (Land Quality)).	Low	Minor	With the implementation of a strategy to prevent or appropriately manage the disturbance of existing known areas of contamination on the Site (as detailed in Chapter 9 (Land Quality), the effect of potential contamination is not considered a Significant Effect.
	Surface waters (North Sound & Mosquito control canals)	Medium	Medium	Implementation of a strategy to prevent or appropriately manage the disturbance of existing known areas of contamination on the Site (as detailed in Chapter 9 (Land Quality)).	Low	Minor	With the implementation of a strategy to prevent or appropriately manage the disturbance of existing known areas of contamination on the Site (as detailed in Chapter 9 (Land Quality), the effect of potential contamination is not considered a Significant Effect.
	Subsurface infrastructure	High	Low	Implementation of strategy to prevent or appropriately manage the disturbance of existing known areas of contamination on the Site (as detailed in Chapter 9 (Land Quality)). Construct using an appropriate grade of concrete to prevent sulphate attack in the event of groundwater contamination.	Very low	Minor	With the implementation of a strategy to prevent or appropriately manage the disturbance of existing known areas of contamination on the Site (as detailed in Chapter 9 (Land Quality), the effect of potential contamination is not considered a Significant Effect. Further, the potential for compromise to the structural integrity of concrete infrastructure (such as foundations) is reduced through use of appropriate concrete grade. This is not considered a Significant Effect.

Activity	Receptor	Value	Magnitude	Mitigation	Magnitude (considering mitigation)	Significance (considering mitigation)	Rationale
Potentially contaminative activities on-Site	Surface waters (North Sound & Mosquito control canals)	Medium	Medium	Include protocols for all potentially-contaminative on-Site activities in the Site EMP. Prepare a detailed wastewater and sewerage plan to minimise the risk of leaks and spills within the system and incorporate suitable treatment options for wastewater prior to discharge. Detailed design to consider the feasibility of the option to connect to local wastewater network for disposal of sewerage to the local wastewater treatment works.	Very low	Minor	Reduced potential for contamination through protocols included in the EMP and the preparation and implementation of a detailed wastewater and sewerage plan, including suitable treatment options for wastewater prior to discharge. This is not considered a Significant Effect.
	Subsurface infrastructure	Medium	High	Include protocols for all potentially-contaminative on-Site activities in the Site EMP. Prepare a detailed wastewater and sewerage plan to minimise the risk of leaks and spills within the system and incorporate suitable treatment options for wastewater prior to discharge. Detailed design to consider the feasibility of the option to connect to local wastewater network for disposal of sewerage to the local wastewater treatment works. Construct using an appropriate grade of concrete to prevent Sulphate attack in the event of groundwater contamination.	Very low	Minor	The potential for contamination of groundwater with elevated concentrations of contaminants, including sulphate, is reduced through the inclusion of protocols for all potentially-contaminative on-Site activities in the Site EMP and the preparation and implementation of a detailed wastewater and sewerage plan. Further, the potential for compromise to the structural integrity of concrete infrastructure (such as foundations) is reduced through use of appropriate concrete grade. This is not considered a Significant Effect.

Activity	Receptor	Value	Magnitude	Mitigation	Magnitude (considering mitigation)	Significance (considering mitigation)	Rationale
Tidal flooding, surface water flooding and extreme weather and climate change - induced flood events	Aquifer quality	Medium	Medium	Include protocols for all potentially-contaminative on-Site activities in the Site EMP. A waste management plan should be prepared inclusive of appropriate waste management for emergency situations, factoring in emergency response and flooding.	Low	Minor	Due to the relatively low elevation of the Proposed Development, localised flooding could occur. Implementation of appropriate management of potentially contaminative activities and waste will minimise the risk of uncontrolled release of these materials if the site flooded.
	Surface waters (North Sound & Mosquito control canals)	Medium	Medium	Include protocols for all potentially-contaminative on-Site activities in the Site EMP. A waste management plan should be prepared inclusive of appropriate waste management for emergency situations, factoring in emergency response and flooding.	Low	Minor	Due to the relatively low elevation of the proposed development, localised flooding could occur. Implementation of appropriate management of potentially contaminative activities and waste will minimise the risk of uncontrolled release of these materials if the Site flooded.
	Site infrastructure, staff, and visitors	Medium	Medium	The design should include consideration of the layout of the Site (in terms of vulnerability/sensitivity to flooding), establishing finished floor levels or raising equipment above anticipated flood water levels, topographic gradients of surfaces to direct floodwater away from sensitive infrastructure and evacuation routes or refuges. A hazard management plan for the Site will document evacuation procedures in response to government issued warnings.	Medium	Moderate	Flooding has the potential to cause lasting effects to Site infrastructure potentially compromising the integrity of the system even with mitigation measures adopted (i.e., a flood event occurring that exceeds the design criteria). Therefore, the effect is considered Significant.

8.7 Conclusions

A review of the hydrology and hydrogeology indicates that the Study Area is affected by extreme weather events, exposing the Site to potential tidal- and weather-related flood events, with the magnitude amplified by the low-lying nature of the Site.

Groundwater within the vicinity of the Site area is hydraulically connected to the ocean and other surface water bodies (such as the nearby mosquito control channels). This infers a tidal influence on the groundwater, and results in a considerable degree of mixing of saline water and fresher water at the transition zone, which is anticipated to be present beneath the Site. As a result, the groundwater is of high salinity and considered to be of 'low quality' and is therefore unsuitable for potable use without treatment. This is typical for groundwater on Grand Cayman, with the exception of some freshwater lenses located on the eastern side of the island. A highly precautionary assessment of groundwater and surface water quality suggests that these waters may already be affected by contamination assumed to source from the GTLF. Based on current trends, it is anticipated that concentrations of these contaminants may increase in the near future without influence from the proposed development.

A qualitative assessment of the potential risks relating to hydrology and hydrogeology was undertaken. Based on the current proposed design (Chapter 4), a variety of potential environmental effects associated with the construction, operation and decommissioning of the ISWMS have been identified. A number of these effects have been assessed as Potentially Significant impacts in the absence of mitigation.

Appropriate mitigation measures for these Potentially Significant Impacts have been recommended, many of which relate to the design of the proposed development and strategies to be adhered to throughout the construction, operation, and decommissioning phases of ISWMS.

However, it should be appreciated that, due to the current unsustainable design and practices at the GTLF and resulting impacts to groundwater quality, it is likely that the construction of the ISWMS will result in net environmental benefits in the long-term. This is due to improved waste management practices and facilities replacing the current practices at the GTLF (unlined landfill) that are currently impacting groundwater and surface water quality.

A residual significant risk relates to potential flooding occurring at the Site that exceeds the criteria adopted in the Site design and impacts Site infrastructure.

9. Land Quality

9.1 Purpose

GHD Limited (GHD) was retained by ReGen and the Cayman Islands Government (CIG) as approved by the Environmental Assessment Board (EAB) to undertake a Land Quality Assessment as part of the Environmental Impact Assessment (EIA) for the proposed Integrated Solid Waste Management System (ISWMS, Proposed Development).

The purpose of this chapter is to present the baseline geotechnical (i.e., land stability) and geoenvironmental (i.e., land contamination including ground gases and vapours) conditions at the proposed development Site in George Town and to identify any such land quality issues that may affect the proposed development. This Land Quality assessment is inter-related with the Hydrology (including flood risk) and Hydrogeology assessments presented in Chapter 8. It has been prepared to address the Land Quality (geotechnical and geoenvironmental effects) requirements of the Final Terms of Reference (ToR).

9.2 Study Areas

9.2.1 Spatial scope

The Study Area considered for the Land Quality assessment encompasses the entire footprint of the ISWMS and some of its environs. It also includes surrounding land within approximately 250 yards (229 metres [m]), which could potentially be affected by, or contribute to, the migration of ground gases, vapours or wind-blown dusts, etc. (see Figure 9.1). According to the ToR, this includes:

– The existing George Town Landfill (GTLF), which lies immediately north and east of the Site;
– Parts of the land owned by the Cayman Water Authority to the east of the Site, which comprises four large former wastewater treatment lagoons (now used for sludge storage), current wastewater treatment plant, some buildings and four smaller basins;
– The mangrove and industrial and commercial development (including a concrete batching plant and a concrete block and paver stone manufacturer) to the south of the Site; and
– The Esterly Tibbetts Highway and the land immediately adjacent to it (including parts of the Lakeside Development[1]), which lies to the west of the Site.

For the avoidance of doubt, this Land Quality assessment excludes:

– Potential contamination effects to or from ground- or surface waters, which are assessed independently within their respective chapters;
– Potential effects resulting from the operation and subsequent closure of the GTLF; and
– Consideration of the existing and / or future ISWMS facilities on Cayman Brac and Little Cayman.

[1] This development comprises 12 three-storey residential apartments with car parking and leisure/landscape areas (including a small lake).

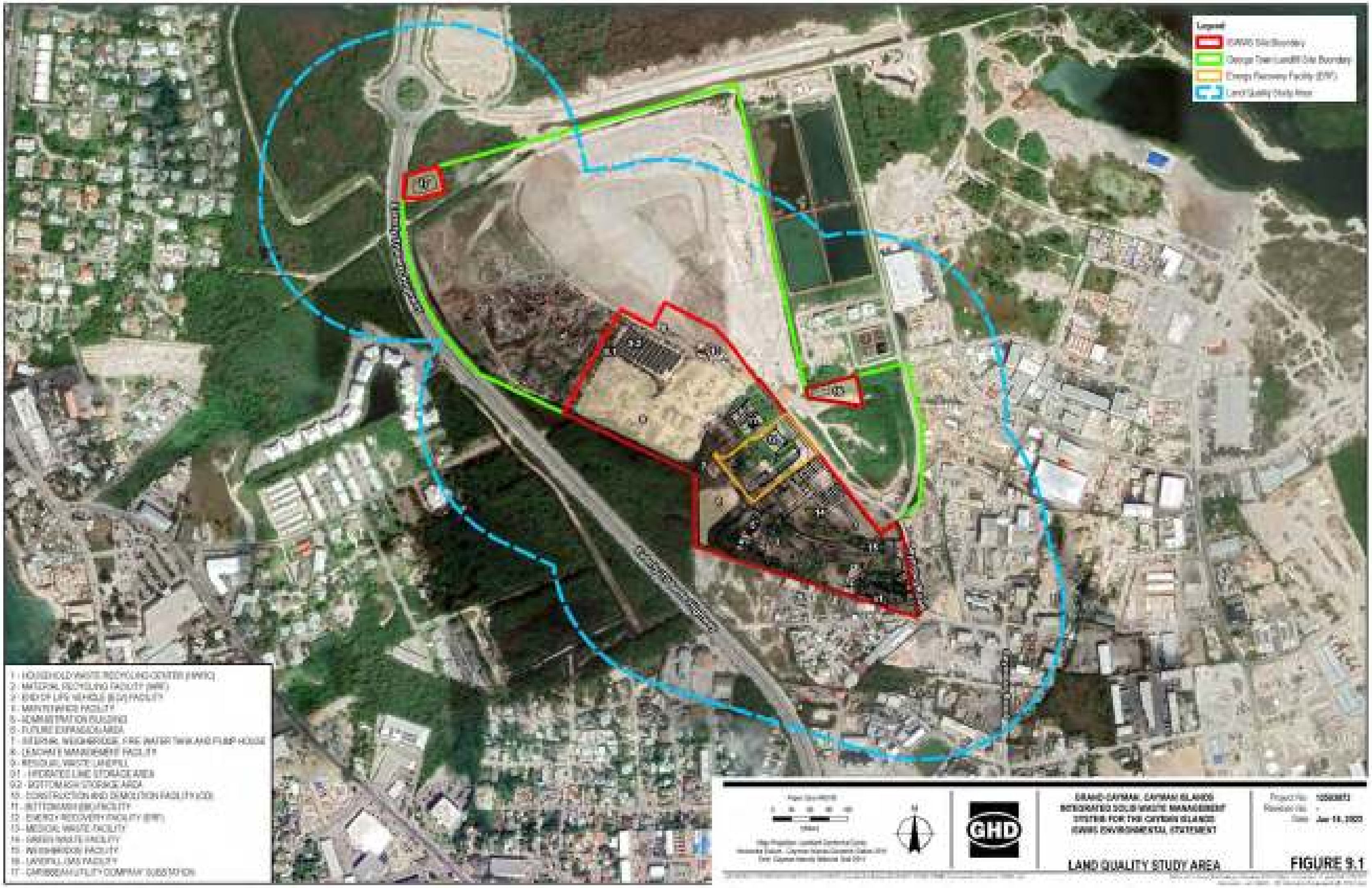

Figure 9.1 *Land Quality Study Area*

9.2.2 Sub-areas of the Site

In considering the potential geoenvironmental effects, within this assessment the ISWMS Site has been considered as 4 sub-areas as shown in Figure 9.2:

– **Area 1**: Consists of the northern third of the main ISWMS Site, which will include the Residual Waste Landfill (including the hydrated lime and bottom ash weathering areas), the Medical Waste Facility and Leachate Management Facility. It is assumed that, in general, workers will predominantly be outdoors in this area with minimal above-ground buildings and structures (in which gases and vapours may accumulate) and that appropriate PPE (Personal Protection Equipment) and working practices will limit exposure to any soil contamination;

– **Area 2**: All other ISWMS components in the south of the main ISWMS Site, including the ERF and admin areas etc. It is understood that this area will include above ground buildings and structures and that workers will be generally indoors with appropriate operational PPE;

– **Area 3**: The CUC (Caribbean Utilities Company) Substation, where it is not anticipated that workers will be present except for infrequent maintenance; and

Area 4: Landfill Gas Facility (LGF) will be constructed on the 'Old Landfill'.

The temporal scope considered within this chapter covers the construction, operation and decommissioning of the ISWMS, which covers a contract term of 25 years.

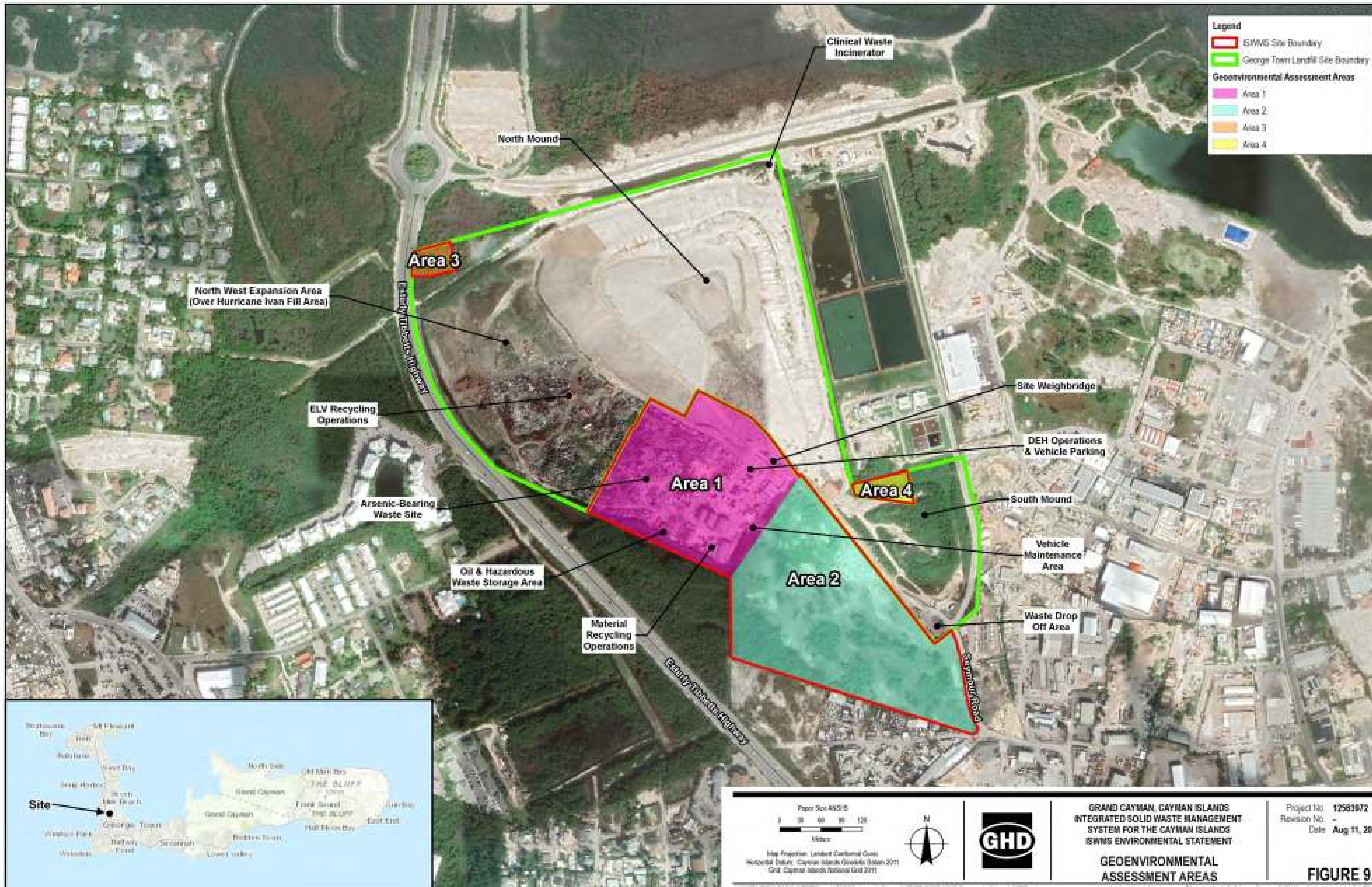

Figure 9.2 Showing the four sub-areas considered during the geoenvironmental assessment Temporal scope

9.3 Applicable standards

In preparing this Land Quality Assessment, where relevant, GHD has had due regard for:

- UK Environment Agency (EA) guidance Land Contamination Risk Management (LCRM)[2]
- British Standard BS5930:2015 Code of practice for ground investigations[3]
- British Standard BS 8576:2013 Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOCs)[4]
- British Standard BS 10175 Investigation of potentially contaminated sites - Code of Practice[5]
- State of Florida (2005) Contaminant Cleanup Target Levels (CCTLs)[6]
- Directive for EIAs (2016), The National Conservation Law (2014)[7]
- UK Department for Environment, Food and Rural Affairs (DEFRA) and UK Environment Agency (EA) publication Land Contamination: Risk Management (LCRM)[8]
- The Florida Administrative Code (FAC): United States Environmental Protection Agency (USEPA) & Code of Federal Regulations (CFR) Title 40 Part 258 – Criteria for Municipal Solid Waste Landfills and FAC Chapter 62-701 Solid Waste Management Facilities[9]
- Resource Conservation and Recovery Act (Sub-Title D – Non Hazardous Rules, Sub-Title C – Hazardous Rules)[10]
- USEPA CFR Title 40 (Part 60 – Standards for Performance for Municipal Solid Waste Landfills, Part 258 – Criteria for Municipal Solid Waste Landfills, Part 264– Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities, Part 265 – Interim)[11]

9.4 Methodology

9.4.1 Relationship with other sections of the EIA

This Land Quality Assessment in part overlaps with matters considered in other assessments within the EIA. In particular, as highlighted within the ToR[12] "*The land quality baseline is also inter-related with, and uses information from, other sections of this ToR, particularly … Hydrology (including flood risk) and hydrogeology*". Land contamination related dust and odour issues will also be relevant to the Air Quality and Greenhouse Gases Emissions Assessment.

9.4.1.1 Potential receptors

The ToR identified the main potential land quality receptors that could be affected by the proposed development (Table 9.1). No additional potential receptors have been identified during this assessment.

However, it should be noted that the most significant receptor for any land contamination is likely to be the water environment (ground and surface waters), which are excluded from the remit of this assessment. The potential effects on surface and ground water receptors are considered within Hydrology and Hydrogeology Assessment.

2 Environment Agency, 2020 (Last updated 19 April 2021)
3 BSI, *Code of practice for ground investigations,* 2020, and its normative references
4 BSI, *Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOCs),* 2013
5 BSI, *Investigation of potentially contaminated sites,* 2017
6 Florida Department of State, *Contaminant Cleanup Target Levels (CCTLs),* 2005
7 Department of Environment (DoE). *The National Conservation Law,* 2013
8 Department for Environment, Food and Rural Affairs and Environment Agency. *Land Contamination: Risk Management.* 2020
9 Florida Department of State, *Criteria for Municipal Solid Waste Landfills and FAC Chapter 62-701 Solid Waste Management Facilities,* 2012
10 EPA, *Non Hazardous Rules, Hazardous Rules,* 2023
11 National Archives and Records Administration, *Standards for Performance for Municipal Solid Waste Landfills, Criteria for Municipal Solid Waste Landfills, Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities*, 2023
12 Wood, *Integrated Solid Waste Management System for the Cayman Islands: Environmental Impact Assessment- Terms of Reference,* 2021

Table 9.1 Potential land quality receptors identified in the ToR (Table 5.22 in Wood, 2021[13])

Receptor	Location
Site staff, construction workers and visitors (human health)	Proposed development Site
ISWMS infrastructure	Proposed development Site
Surrounding land users e.g., residential, commercial/industrial, schools* (human health)	Surrounding land

Notes: * Some surrounding land users may be too far away for there to be any relevant potential contaminant linkages

9.4.2 Assessment methodology

The assessment methodology was based on that prescribed within the ToR[14]. The geotechnical and geoenvironmental assessments are generally addressed under separate sections within this Land Quality Assessment.

9.4.2.1 Consistent terminology

To assist the reader, consistent terminology has been adopted within this Land Quality Assessment. In particular, the word 'effect' is used to describe the consequence of environmental changes that are caused by development-related activities. The word 'impact' should not be used other than in the phrase EIA or where it appears in references).

9.4.2.2 Review of existing conditions

Available secondary sources of information were collected and reviewed to characterize the existing land quality conditions within the Study Area. A number of documents were identified within the ToR[15] but, in preparing this Land Quality Assessment, GHD identified additional relevant documents. The following sources of secondary information (listed chronologically) have been considered in relation to geology and ground conditions (geotechnical matters):

– Cruise Berthing Terminal for Cayman Islands - Final EIA Terms of Reference[16]
– Grand Cayman Waste Management Facility Draft Environmental Statement[17]
– Landfill Site Environmental Review Task 1: Environmental Investigations and Risk Assessments[18]
– Landfill Site Environmental Review Task 2: Environmental Investigations Interpretative Report[19]
– Grand Cayman Proposed Integrated Solid Waste Management Facility: Energy Recovery Facility -Geotechnical Investigation and Report[20]
– Integrated Solid Waste Management System for the Cayman Islands: Environmental Impact Assessment- Terms of Reference[21]

The following sources of secondary information (listed chronologically) have been considered in relation to land quality, contamination and ground gases (geoenvironmental matters):

– Memorandum: Environmental tests carried out at hurricane debris sites[22]
– Landfill Site Environmental Review Task 1: Environmental Investigations and Risk Assessments[23]

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13 Wood, *Integrated Solid Waste Management System for the Cayman Islands: Environmental Impact Assessment- Terms of Reference,* 2021
14 Wood, *Integrated Solid Waste Management System for the Cayman Islands: Environmental Impact Assessment- Terms of Reference,* 2021
15 Wood, *Integrated Solid Waste Management System for the Cayman Islands: Environmental Impact Assessment- Terms of Reference,* 2021
16 Mott MacDonald, *Cruise Berthing Terminal for Cayman Islands – Final EIA Terms of Reference,* 2013
17 Carddno ENTRIX, *Grand Cayman Waste Management Facility Draft Environmental Statement*, 2013
18 Amec Foster Wheeler, *Landfill Site Environmental Review Task 1: Environmental Investigations and Risk Assessments*, 2016a
19 Amec Foster Wheeler, *Landfill Site Environmental Review Task 2: Environmental Investigations Interpretative Report*, 2016b
20 APEC, *Grand Cayman Proposed Integrated Solid Waste Management Facility: Energy Recovery Facility -Geotechnical Investigation And Report*, 2021
21 Wood, *Integrated Solid Waste Management System for the Cayman Islands: Environmental Impact Assessment- Terms of Reference*, 2021
22 CIRO, *Memorandum: Environmental tests carried out at hurricane debris sites*, 2005
23 Amec Foster Wheeler, *Landfill Site Environmental Review Task 1: Environmental Investigations and Risk Assessments*, 2016a

- Landfill Site Environmental Review Task 2: Environmental Investigations Interpretative Report[24]
- National Solid Waste Management Strategy for the Cayman Islands[25]
- Grand Cayman Residual Waste Composition Analysis 2016[26]
- Grand Cayman Waste Management Facility Draft Environmental Statement[27]
- Technical note: George Town and Cayman Brac Landfills: Review of DEH Monitoring Report, 31 January 2017[28]
- Technical note: George Town Landfill Site: Surface Emissions Survey September 2016[29]
- Technical note: George Town Landfill Site: Surface Emissions Walkover Survey, April 2018[30]
- *Cayman Island's Landfill Report Summary 2020: Supplementary Information,* EHL (2020)[31]
- *Cayman Island's Landfill Report Summary 2020: Supplementary Information,* EHL (2021)[32]
- Integrated Solid Waste Management System for the Cayman Islands: Environmental Impact Assessment- Terms of Reference[33]
- George Town Landfill: Environmental Risk Based Assessment[34]
- George Town Landfill: Remediation Options Report[35]

9.4.2.3 Site visits, inspections and investigations

GHD did not undertake bespoke Site visits or surveys nor undertake any additional Site investigations during the preparation of this Land Quality Assessment. Consequently, the geotechnical and geoenvironmental assessments are based on pre-existing environmental investigation and assessment reports relating to the Study Area.

9.4.2.4 Geotechnical (land stability) assessment

Based on the information reviewed, the assessment of potential geotechnical effects involved:

- Describing the baseline geotechnical conditions at the Site and the variability within them;
  - Outlining the regional tectonic and seismic information; and
  - Identifying factors that may affect the future baseline.
- Assessing any land instability risks to identify any significant effects;
  - Details of the method adopted to determine the significance of each effect is presented in Section 9.4.3.6;
- Consideration of the influence of any cumulative effects; and
- Presenting relevant mitigation measures for any significant effects following accepted engineering practice standards with clear confirmation that the proposed mitigative solutions are technically and environmentally sound.

9.4.2.5 Geoenvironmental (land contamination and ground gases assessment)

Based on the information reviewed, the assessment of potential geoenvironmental effects involved:

- Describing the development history of the Site;

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24 Amec Foster Wheeler, *Landfill Site Environmental Review Task 2: Environmental Investigations Interpretative Report*, 2016b
25 Amec Foster Wheeler, *National Solid Waste Management Strategy for the Cayman Islands*, 2016c
26 Amec Foster Wheeler, *Grand Cayman Residual Waste Composition Analysis*, 2016d
27 Carddno ENTRIX, *Grand Cayman Waste Management Facility Draft Environmental Statement*, 2013
28 Amec Foster Wheeler, *Technical note: George Town and Cayman Brac Landfills: Review of DEH Monitoring Report*, 2017b
29 Amec Foster Wheeler, *Technical note: George Town Landfill Site: Surface Emissions Survey*, 2017a
30 Wood, *Technical note: George Town Landfill Site: Surface Emissions Walkover Survey*, 2018
31 GHD, *Cayman Island's Landfill Report Summary 2020: Supplementary Information,* 2020
32 GHD, *Cayman Island's Landfill Report Summary 2020: Supplementary Information*, 2021
33 Wood, *Integrated Solid Waste Management System for the Cayman Islands: Environmental Impact Assessment- Terms of Reference*, 2021
34 GHD, *George Town Landfill: Environmental Risk Based Assessment,* 2021a
35 GHD, *George Town Landfill: Remediation Options Report*, 2021b

– Describing baseline geoenvironmental conditions[36];
  - Identifying factors that may affect the future baseline
– Assessing any land contamination risks to identify any significant effects;
  - Details of the method used to assess each risk (presented in Section 9.4.3.5.1);
  - Details of the method adopted to assess the significance of each effect (presented in Section 9.4.3.7).
– Assessing any ground gas or vapour risks to identify any significant effects; and
  - Details of the method used to assess each risk (presented in Section 9.4.3.5.2);
  - Details of the method adopted to assess the significance of each effect (presented in Section 9.4.3.7).
– Consideration of the influence of any cumulative effects; and
– Presenting relevant mitigation measures for any significant effects following accepted engineering practice standards with clear confirmation that the proposed mitigative solutions are technically and environmentally sound.

9.4.2.5.1 Land contamination risk assessment

As requested in the ToR, the assessment of land contamination was conducted, where possible, in line with UK Environment Agency's online Land Contamination Risk Management (LCRM) guidance[37], which:

– Adopts the sources-pathways-receptors paradigm;
– Requires the development and incremental refinement of a Conceptual Site Model (CSM); and
– Relies heavily on BS10175 (BSI, 2017).

In line with LCRM, where quantitative soils quality data relevant to the Site is available, Generic Quantitative Risk Assessment has been undertaken using appropriate Generic Assessment Criteria (GAC).

The ToR states that the State of Florida (2005) Contaminant Cleanup Target Levels (CCTL) are the GAC for potential human health risks relevant to the Cayman Islands *"considering geography, climate and given that the FAC levels also consider marine surface water criteria, which is an important factor for the islands*". Given the nature of the waste treatment and landfill facilities of the ISWMS, the CCTL for 'Commercial/Industrial' land uses ($CCTL^{comm}$) are considered the most appropriate for use at the Site.

Although a detailed assessment of risks to groundwater is outside the scope of this report, it is considered appropriate to also screen against GAC for potential risks to the water environment on a precautionary basis. In line with earlier assessments[38], the Florida's CCTL for the protection of "*groundwater of Low Yield/Poor Quality*" ($CCTL^{GW}$) have been adopted. The CCTLs for such ground waters are generally higher (i.e., 10-times) than those for more sensitive groundwaters. According to Chapter 62-780 of the Florida Administrative Code[39], 'Poor quality' means "*groundwater within the affected monitoring zone with background concentrations, as defined in subsection 62-780.200(3), F.A.C., that exceed any of Florida's Primary or Secondary Drinking Water Standards referenced in Chapter 62-550, F.A.C.*" and 'Low yield' means "*groundwater that is contained in an aquifer that has an average hydraulic conductivity of less than one foot per day, determined by performing slug tests or an equivalent method for determining hydraulic conductivity on a minimum of three monitoring wells in each affected monitoring zone; and a maximum yield of 80 gallons per day, determined by pumping a four-inch well screened across the cross-section of the plume, for a minimum of two hours*". In the absence of such yield measurements, given the brackish nature of the groundwater beneath the Site and lack of any nearby abstractions, the use of these criteria at the Site would seem reasonable.

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[36] Almost no quantitative data related to the levels of contamination and emissions of ground gases and vapours within the footprint of the ISWMS were identified. The baseline presented is therefore based mainly on a qualitative assessment of the available information.

[37] https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm . Accessed 7th Sept 2021

[38] Amec Foster Wheeler, *Landfill Site Environmental Review Task 2: Environmental Investigations Interpretative Report*, 2016b, GHD, *Cayman Island's Landfill Report Summary 2020: Supplementary Information,* 2020a

[39] State of Florida, *Florida Administrative Code: Chapter 66-777 Contaminant Cleanup Target Levels,* 2005

Consequently, where contaminant concentrations are available, risk screening has been undertaken using the lower of the CCTL for 'Commercial/Industrial' land uses ($CCTL^{comm}$) and the CCTL for "*groundwater of Low Yield/Poor Quality*" ($CCTL^{GW}$).

9.4.2.5.2 Ground gas and vapour risk assessment

The assessment of ground gases and vapours was conducted, where possible, in line with British Standard BS 8576:2013[40]. As no quantitative data relevant to the gas regime beneath the footprint of the ISWMS is available, this principally constitutes the development of a gas conceptual site model (gCSM), which includes consideration of the sources of ground gases and vapours in and around the Site, pathways for gas migration and the potential receptors.

Where gas emission data is available its evaluation has been undertaken using British Standard BS 8485[41], which has superseded CIRIA C665[42] and the Ground Gas Handbook[43].

Where ground vapours have been documented due regard has been given to C682 The VOCs Handbook[44].

9.4.2.6 Future baseline

The future baseline should take account of any changes that would occur even in the absence of the ISWMS Project going ahead. For example, any natural processes that will modify the current baseline during the lifetime of the Project or any enacted changes in legislation or business practices at surrounding sites, which may reduce (or increase) their industrial emissions to the environment.

Where such unavoidable changes are identified in relation to the land quality assessment, these are reflected in suitable amendments to the current baselines in the relevant section of this report.

9.4.2.7 Significance evaluation

Significance evaluation used a significance test to assess which of the identified potential effects are sufficiently serious to warrant additional mitigation during project planning. The conclusion that is made using the significance test is based upon professional judgement, with reference to the Project description, and available information about:

– The magnitude and other characteristics of the potential changes that are expected to be caused by the proposed development;
– The sensitivity of receptors to these changes;
– The effects of these changes on relevant receptors; and (where relevant); and
– The value of receptors.

The generic approach taken to significance evaluation within this EIA is described in Section 4 of the ToR. This uses a combination of professional judgement and a topic-specific significance evaluation methodology based on available documents and data.

Within this Land Quality Assessment, the significance of any given effect was assessed using Table 9.2. Magnitude and Value/Sensitivity scores are defined in Table 9.4 and Table 9.3, respectively. Significant effects are those identified as 'High'. 'Medium' effects have the potential to be significant, and indeed they would normally be deemed to be significant. However, there may be some exceptions, depending on the environmental topic and the application of professional judgement.

[40] BSI, *Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOCs),* 2013
[41] BSI, *Code of Practice for the Design of Protective Measures for Methane and Carbon Dioxide Ground Gases for New Buildings,* 2019
[42] S.A Wilson et al., *Assessing risks posed by hazardous ground gases to buildings (C665),* 2007
[43] S Wilson et al., *Ground Gas Handbook,* 2009
[44] Baker et al., *Investigating, assessing and managing risks from inhalation of VOCs at a land affected by contamination (C682),* 2009

Table 9.2 Classification of effects (after ***Table 5.24 in Wood, 2021[45]). This table is specifically for assessing the potential geotechnical and geoenvironmental effects identified within this Land Quality Assessment***

Magnitude	Value and Sensitivity of Receptor		
	High	**Medium**	**Low**
High	High	High	Medium
Medium	High	Medium	Medium
Low	Medium	Medium	Low
Negligible	Low	Low	Negligible

9.4.2.7.1 Value and sensitivity of receptor

The main receptors anticipated are human health and infrastructure (buildings and services, etc.) (see Section 9.4.1.1). The criteria used to assess the value and sensitivity of these receptors in this Land Quality Assessment are shown in Table 9.3.

The ToR states that "*The sensitivity of human health receptors should generally be considered as high although it can be less sensitive with, for example, health and safety controls in industrial areas*". Consequently, within this assessment the sensitivity of on-Site human health receptors (i.e., Site staff, construction workers and visitors at the ISWMS) has been considered to be medium, while for off-Site human health receptor (i.e., surrounding residential, commercial/industrial, schools) it has been considered to be high.

Table 9.3 Definition of the sensitivity assessment criteria for ***land quality*** *receptors*

Activity	Example Receptor Definition
High	The environmental parameter is fragile, and an effect is likely to leave it in an altered state from which recovery would be difficult or impossible.
Medium	The parameter has a degree of adaptability and resilience and is likely to cope with the changes caused by an effect, although there may be some residual modification as a result.
Low	The parameter is adaptable and is resilient to change.

9.4.2.7.2 Magnitude

The general criteria used to assess the magnitude of each effect in this Land Quality Assessment are shown in Table 9.4. No relevant quantitative data was identified regarding soil quality and ground gas upon which a quantitative risk assessment could be based. In the absence of such data, uncertainty remains about if, and to what extent, soil contamination and the ground gas regime pose a risk at the Site. Consequently, in assigning magnitude assessment criteria to each potential soil quality and ground gas effects professional judgement has been used to derive a magnitude score that considered both a likely 'worst case' consequence and the likelihood of such an event arising. For example, where the consequence could potentially be "high" but is considered unlikely or very unlikely to occur, a magnitude of "medium" or "low" were ascribed, respectively.

Table 9.4 Definition of the magnitude assessment criteria for any ***land quality*** *effects*

Activity	Example Receptor Definition
High	Short term, acute effect on human health affecting both Site users and users of sites in the vicinity, arising from contamination on the proposed development Site, or chronic damage to human health affecting users of both the Site and other sites in the vicinity arising from contamination on the proposed development Site. Catastrophic damage to buildings or property on the proposed development site arising from contamination or geotechnical risks.

[45] Wood, *Integrated Solid Waste Management System for the Cayman Islands: Environmental Impact Assessment- Terms of Reference*, 2021

Activity	Example Receptor Definition
Medium	Chronic damage to human health of users of the proposed development Site. Significant damage to buildings or property from contamination or geotechnical risks.
Low	Non-permanent effects to human health e.g., short-term intermittent nuisance such as odours not hazardous to human health. Minor damage to buildings or property from contamination or geotechnical risks.
Negligible	Minimal economic or social uses. Repairable effects of damage to buildings, structures and services e.g., staining or discoloration of building materials.

The ToR identified two potential future developments in the vicinity; the Planned Area Development for Camana Bay; and the proposed Cruise Berthing Facility.

Due to the nature of geotechnical and geoenvironmental risks, which are unlikely to extend beyond the Site boundary, GHD do not consider that there are likely to be any cumulative effects on land quality due to these potential future developments and so not cumulative affects have been considered within this report.

9.5 Baseline Conditions: Geotechnical

The most relevant geotechnical information available for the approximately 30 acre (12.4 hectare (ha)) Site is presented in the APEC final report (APEC Report) titled '*Grand Cayman Proposed Integrated Waste Management System, REGEN, Geotechnical Investigation and Report*' dated July 2023[46], included in **Appendix 9.A (Land Quality Assessment – Appendix B)**. A total of 42 geotechnical soundings were performed across the whole Site for this investigation (15 boreholes and 27 test pits). The geotechnical baseline presented hereafter is mainly based on the information provided in the APEC report.

9.5.1 Topography

According to the ToR:

- Site elevation ranges approximately between 7 and 20 ft (2 and 6 m) above mean sea level (AMSL).
- The surrounding land is mainly flat and low lying, with the exception of the GTLF, and, where developed, is formed from reclamation of former mangrove swamp.
- The GTLF North Mound is approximately 100 ft (30.5 m) AMSL and the South Mound is approximately 40 ft (1 m) AMSL.

9.5.2 Geology

The three islands, Grand Cayman, Cayman Brac, and Little Cayman are emergent peaks of the generally submerged Cayman Ridge that forms the southern margin of the North American Plate. The islands mainly comprise Pleistocene age cemented corals locally known as the Ironshore Formation overlying Oligocene-Miocene karstic dolomitised limestone Bluff Formation of unknown thickness that in turn overlies igneous granodiorite that forms the core of Cayman ridge.

A review of the APEC report[47] shows that the subsurface stratigraphy at the Site within the normal influence zone of a building foundation likely comprises 4 stratigraphic units: 1) Man-Made Deposits, 2) Organic peat, 3) Ironshore Formation (Marl) and 4) Karstic Limestone (Dolostone). These stratigraphic units are briefly described in the following subsections.

[46] APEC. *Grand Cayman Proposed Integrated Solid Waste Management System, ReGen -Geotechnical Investigation and Report*, Dated July 2023, Ref: 17015

[47] Ibid

9.5.2.1 Man-made deposits

According to the APEC Report[48] the man-made deposits at the Site consist of two types of materials 1) waste materials interbedded with marl layers probably placed as daily cover and are covered with a veneer of topsoil forming the existing ground surface, and 2) shot rock. The APEC test pit and borehole logs show that the waste and marl man-made deposits are present in the central and eastern portion of the Site and range in thickness from 3.5 to 16 ft (1.1 to 4.9 m), with thicker deposits generally encountered along the eastern portion and northern margin of the eastern half of the Site.

The western, junk yard, portion of the Site is generally covered with shot rock although waste material was also encountered at the location of Borehole B-15. The shot rock was approximately 8 to 12 ft (2.4 to 3.7 m) thick.

Additionally, there is a small (approx. 1 acre [0.4 ha]) geomembrane lined and capped area in the eastern part of the GTLF, within the footprint of the proposed RWL. This area reportedly contains ash, a by-product of Hurricane Ivan timber waste that was burned. The ash is reported to have a degree of arsenic content arising from insecticides originally used to treat the timber. No construction records are available for this area but there are some marker posts indicating its position on the ground. The geoenvironmental impact of this containment cell is considered further in Section 9.10.3.1.

9.5.2.2 Organic Peat

The presence of a highly compressible organic material (peat) is reported at some locations, in particular in the central part of the Site. This 1 to 9 ft (0.3 to 2.7 m) thick layer is either present at the soil surface or mixed and buried beneath the above-described man-made deposits. As reported by APEC[49], deeper pockets of peat may be present at other locations on the Site which may not be detected, if at all, until earthwork for the proposed development commences.

9.5.2.3 Ironshore formation

According to Matley, as reported in Jones[50] late Pleistocene Ironshore Formation was initially colloquially referred to as the Ironshore due to its indurated calcrete crusted nature and presence along the shoreline, the term that is now used to identify these deposits across the Caymans. The Ironshore Formation was probably deposited in lagoonal, shoal, beach ridge, and reef settings, and is characterized by poorly consolidated friable limestone, calcarenites, and marl/calcite cemented oolitic limestone, when the sea level was approximately 400 ft (120 m) below the present sea level during the Ice Age. Oolitic limestone is made up of small spheres called ooiliths cemented together by lime mud. They form when calcium carbonate is deposited on the surface of sand-sized grains rolled (by waves) around on a shallow sea floor.

APEC[51] borehole and test pit logs show that the Ironshore Formation extends to depths ranging from approximately 13.5 ft (4 m) to 20 ft (6 m) below ground level (bgl) corresponding to thicknesses of 6 ft (1.8 m) to 12 ft (3.7 m). According to the published geology, the Ironshore Formation encountered on the Island is up to 29 ft (9 m) thick.

Cavities are present in this Formation and typically found in a zone called *epikarst* and located at or near the interface with the Bluff Formation briefly described below.

9.5.2.4 Bluff formation – Pedro Castle/ Cayman/ Brac Formations

The Ironshore Formation unconformably overlies the middle Oligocene to Miocene Bluff Formation of karstic dolomitic limestone/ dolostone/ limestone lithologies, which are further subdivided into Pedro Castle Formation, Cayman Formation and Brac Formation in order of increasing depth.

48 Ibid

49 APEC. *Grand Cayman Proposed Integrated Solid Waste Management Facility: Energy Recovery Facility -Geotechnical Investigation and Report*, Status: Draft Final, Dated Mar 2021, Ref: 17015

50 Jones B, Smith D.S, *Open and Filled Karst Features on the Cayman Islands: Implications for the Recognition of Paleokarst; Canadian Journal of Earth Sciences*, (1988)

51 APEC. *Grand Cayman Proposed Integrated Solid Waste Management Facility: Energy Recovery Facility -Geotechnical Investigation and Report*, Status: Draft Final, Dated Mar 2021, Ref: 17015

These formations are characterized by spectacular examples of filled and unfilled karst features[52]. Surficial karst is characterized by cavities and holes giving the Bluff Formation surface a honeycombed appearance. The presence of surficial karst at the Site is strongly indicated by relatively large cavities encountered directly below the Ironshore Formation ranging in depth from 3 ft (0.9 m) to 9 ft (2.7 m) bgl.

9.5.3 Groundwater table

Groundwater table is at a depth of 2 ft (0.6 m) to 4.5 ft (1.4 m) below the existing grades corresponding to elevation 0 ft AMSL. During Mean High Water Spring (MHWS) tide the groundwater elevation reaches higher elevation estimated to approximately 2.0 ft (0.6 m) AMSL.

9.5.4 Seismicity

9.5.4.1 Seismic site class

The Cayman Islands use the 2009 International Building Code (IBC), which in turn refers to ASCE 7 for Seismic Site classification.

ASCE 7 requires the assignment of a Seismic Site Class for calculations of earthquake design forces and the structural design based on a two percent probability of exceedance in 50 years. According to ASCE 7, the Seismic Site Class is a function of soil profile and is based on the average properties of the subsoil strata to a depth of 100 ft (30 m) bgl. ASCE 7 provides the following three methods to obtain the average properties for the top 100 ft (30 m) of the subsoil strata:

- Average shear wave velocity;
- Average Standard Penetration Test (SPT) N-values (uncorrected for overburden); or
- Average undrained shear strength.

The APEC investigations extended to maximum depth of 20 ft (6 m) below the existing grades. The SPT carried out in the Ironshore Formation are not considered representative due to the nature of materials being neither soil nor rock. Based on the criteria listed in Table 20.3.1 of ASCE7-16, and the discussion on local geology above, a Seismic Site Class 'C' can be used for preliminary design purposes pending shear wave velocity measurements.

According to APEC, the following Site coefficients can be used for design purposes:

Table 9.5 Seismic coefficients[53]

Seismic Parameter	Coefficient
Short-period Site Coefficient F_a	1.136
Long-term Site coefficient F_v	1.5
Spectral response acceleration at short period S_{MS}	1.136 x 0.659 = 0.749g
Spectral response acceleration at period of 1 second S_{M1}	1.5 x 0.300 = 0.450g

9.5.4.2 Earthquakes

Grand Cayman is located on and along a fault line. A major 6.8 magnitude earthquake occurred on December 14, 2004, approximately 20 miles (32 km) south of Georgetown, without causing any damage on the island. A more recent 7.7 magnitude earthquake occurred on January 28, 2020 in the Cayman Islands area with its epicentre located farther

52 Jones B, Smith D.S, *Open and Filled Karst Features on the Cayman Islands: Implications for the Recognition of Paleokarst; Canadian Journal of Earth Sciences*, (1988)
53 APEC, *Grand Cayman Proposed Integrated Solid Waste Management Facility: Energy Recovery Facility -Geotechnical Investigation And Report*, 2021

and approximately 160 miles (250 km) from Grand Cayman.A lack of strong events in Grand Cayman in the past 300 years could mean that seismic energy is accumulating in the fault and it may be released in the form of a large magnitude earthquake, estimated to be between Mw 7.2 and 7.5 based on the magnitudes of the three largest events over the past 100 years[54].

9.5.4.3 Liquefaction

No liquefiable soils are identified at or in the vicinity of the Site.

9.5.5 Slope stability

The ISWMS Site, which excludes mounds associated with the GTLF, is relatively flat, and no slope stability issues are expected.

9.5.6 Foundation recommendations

The existing waste and marl mix material is not considered suitable for foundation support. The proposed structures may potentially be founded either into the Ironshore Formation or into the Bluff Formation. However, due to the seismic design requirements, most of these structures would likely be required to be supported in the underlying karstic Bluff Limestone.

Different foundation types and Site preparation techniques may be used for the construction of the proposed structures. The foundation type and corresponding Site preparation to first consider will depend on the structure type (architecture and loads) and the depth of the bearing stratum in the footprint of this structure. The usable foundations features are presented and discussed in Section 9.10.1 – Geotechnical mitigation measures.

9.6 George Town Landfill

The current GTLF is owned by CIG and operated by the Department of Environmental Health.

Amec Foster Wheeler[55] summarised the history of the landfill largely based on an earlier report by Post Buckley Schuh & Jernigan. Observations made during Site visits have also been reported by Amec Foster Wheeler[56].

Amec Foster Wheeler (2016a) state that *"Waste disposal at the site began in the mid 1960's when GIS [sic] leased a 8 hectare (20 acre) parcel of land. Canals and dykes were constructed to drain the site and the indigenous mangroves cleared. Some waste was placed below the water table in dredged areas 3 to 6 ft (0.9m – 1.8m) deep where marl was recovered to obtain fill for roads and as cover to the waste deposits. Up until around 1985 the volume of waste deposited in the landfill was reduced by burning. The old landfill area is therefore likely to comprise ash towards the base"*. GHD understand that this refers to the 'Old Landfill Area' shown in Figure 9.3. **All of the proposed ISWMS footprint, <u>except for Area 4 (Landfill Gas Facility),</u> appears to lie outside of the Old Landfill Area.**

The majority of the land within the current GTLF footprint, including the Main Landfill Area (Figure 9.3), was acquired in 1989. **The Main Landfill Area is outside of the proposed ISWMS footprint.** It "i*s characterized by a mound rising to 77 ft. (23.6 m) AMSL and was formed by tipping over an area of former mangrove swamp which was partially excavated to recover the underlying marls (calcareous soils)*"[57]. In 1989, landfill operations involved *"placing and compacting the solid waste with heavy equipment and covering the waste with soil on a daily basis. The cover soil is generally marl excavated from on-Site sources, or supplied by a contractor from off-Site sources"*[58]. Elsewhere, Amec Foster Wheeler[59] confirm that since ~1990 the limestone of the Ironshore Formation[60] has also been excavated to a

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54 Novelo-Casanova D.A., Gerardo, *Suarez Natural and Man-Made Hazards in the Cayman Islands, Natural Hazards*, 2010
55 Amec Foster Wheeler, *Landfill Site Environmental Review Task 1: Environmental Investigations and Risk Assessments,* 2016a
56 Amec Foster Wheeler, *Landfill Site Environmental Review Task 1: Environmental Investigations and Risk Assessments,* 2016a, *National Solid Waste Management Strategy for the Cayman Islands,* 2016c
57 Amec Foster Wheeler, *National Solid Waste Management Strategy for the Cayman Islands,* 2016c
58 Amec Foster Wheeler, *Landfill Site Environmental Review Task 1: Environmental Investigations and Risk Assessments,* 2016a
59 Amec Foster Wheeler, *Landfill Site Environmental Review Task 1: Environmental Investigations and Risk Assessments,* 2016a
60 The Ironshore formation (Cayman Islands) has marl sediment in some places and coral type limestone elsewhere

depth of 14 ft (4.2 m) below the water table for use as daily cover. In 1991, further land to the south was acquired in 1991 giving the current total area of 30 hectares or~73 acres ~[61]. The majority of the GTLF site is likely to have received some degree of waste materials[62], with the exception of the outlying extremities to the west of the highway and to the north of the North Canal (Figure 9.3). **All of the proposed ISWMS footprint appears to lie outside of the Main Landfill Area.**

The Cayman Islands were heavily impacted by Hurricane Ivan in September 2004 and the GTLF was the ultimate destination for much of the cleanup debris. Amec Foster Wheeler[63] reported that *"A flat lying area in the north-western part of the site has largely been infilled with demolition and related wastes from the disaster clean-up operations following Hurricane Ivan in 2004. It originally comprised areas of open water arising from previous marl abstraction".* There is some uncertainty regarding the exact location and boundaries of this, and other areas within the GTLF and various names have been used for them in different reports. Figure 9.3 suggests that the 'Hurricane Ivan Fill Area' (HIFA) extends over most of the land to the west of the Main Landfill Area, but Figure 9.4 (which is assumed to be based on subsequent clarification of waste locations) suggests that wastes were only deposited in the northern half of the HIFA shown in Figure 9.3. Based on the apparent infilling of a marl extraction pit (water filled) between 2004 and 2005, it seems likely that Hurricane Ivan debris was used to infill this excavation and that the HIFA is limited to that indicated in Figure 9.4 rather than Figure 9.3. **All of the proposed ISWMS footprint appears to lie outside of the HIFA.**

The area immediately south of the HIFA is not labelled on Figure 9.4, but Amec Foster Wheeler [64] reported that during Site visits 2014-2015, scrap metal and tyres were stockpiled in this area. Consequently, within this report we have referred to this area as the 'Old Scrap and Tyre Stockpile Area" (OSTSA). **Apart from parts Area 1 (Residual Waste Landfill and Hydrated Lime and Bottom Ash Storage Areas), most of the proposed ISWMS footprint appears to lie predominantly outside of the OSTSA.**

Amec Foster Wheeler[65] also reported that *"An arsenic contaminated waste containment pit, which comprises a small geomembrane lined and capped area; is located in the eastern part of the Hurricane Ivan in-fill. Amec Foster Wheeler understands that this contains ash from the burning of treated timber waste arising from the post Hurricane Ivan clean up. The ash is reported to have a high arsenic content due the insectides/fungicides [sic] originally used to treat the timber. No construction records were made available for this area but there are some marker posts indicating its position which were observed on the ground".* Different documents refer to this pit by a variety of names; in Figure 9.3 it is labelled as the 'Arsenic Containment Pit', and in Figure 9.4 as the 'Arsenic Fill Site'. Within this report, we have adopted the term "Arsenic Containment Cell".

Figure 9.4 also shows the anticipated expansion of the Main Landfill Area on to the "NW Extension Area" in order to accommodate wastes received prior to the completion of the ISWMS. **The Arsenic Containment Cell will lie within the ISWMS footprint (Area 1) and will be located beneath the proposed Residual Waste Landfill.**

To the south of the Arsenic Containment Cell areas lies the 'Equipment Storage Area' Figure 9.3. In relation to this area, Amec Foster Wheeler[66] reported that "*Both operational and redundant site plant is stored on a flat stoned area in the southern part of the site. The operational plant includes excavators, a refuse compactor and hook lift trucks. Skips and shipping containers are also stored in this area. There are a number of steel sheeted buildings used variously for the storage of materials (*e.g., *aluminium cans), the storage of equipment (*e.g., *a bailer) and for plant maintenance*". Figure 9.4 refers to these buildings as the "Recycling Compound".

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61 Amec Foster Wheeler, *Landfill Site Environmental Review Task 1: Environmental Investigations and Risk Assessments,* 2016a, *National Solid Waste Management Strategy for the Cayman Islands,* 2016c

62 Amec Foster Wheeler, *National Solid Waste Management Strategy for the Cayman Islands,* 2016c

63 Amec Foster Wheeler, *Landfill Site Environmental Review Task 1: Environmental Investigations and Risk Assessments,* 2016a

64 Amec Foster Wheeler, *Landfill Site Environmental Review Task 1: Environmental Investigations and Risk Assessments,* 2016a, *National Solid Waste Management Strategy for the Cayman Islands,* 2016c

65 Amec Foster Wheeler, *Landfill Site Environmental Review Task 1: Environmental Investigations and Risk Assessments,* 2016a

66 Amec Foster Wheeler, *National Solid Waste Management Strategy for the Cayman Islands,* 2016c

Also in this area, both Figure 9.3 and Figure 9.4 identifies a 'Oil and Hazardous Waste Storage Area' but there is a discrepancy in the exact location of this facility between the two. Amec Foster Wheeler[67] noted that this area consisted of:

– *"A waste oil storage area. Waste oils and fuels are stored within a concrete surfaced and bunded hard standing where they are tested and segregated before being pumped into larger shipping tanks prior to export for subsequent off-island recycling or treatment;*
– *Covered and fenced hazardous waste storage compound. This is used for the storage of hazardous waste such as paints and household chemicals. These are subsequently transferred off-island for treatment/disposal; and*
– *On-Site laboratory used for the testing of waste oils and chemicals delivered to the site"*.

In any case, the majority of Area 1 coincides with the ESA and OHWSA, but most of the other areas of the proposed ISWMS footprint appear to lie outside of these areas.

[67] Amec Foster Wheeler, *National Solid Waste Management Strategy for the Cayman Islands,* 2016c

Figure 9.3 ***Boundary and layout of the George Town Landfill according to Amec Foster Wheeler***[68]

Figure 9.4 *Layout of the George Town Landfill according to GHD (2020)*[69]

[68] Amec Foster Wheeler, *Landfill Site Environmental Review Task 1: Environmental Investigations and Risk Assessments,* 2016a

[69] GHD. *George Town Landfill: Remediation Options Report.* For: DECCO Consortium, Revision: 2, Dated 28th May 2021

9.6.1 Current leachate emissions

Monitoring for the CIG-DEH[70] includes sampling leachate taken from a "*Ditch at west side of working face*" (Figure 9.5).

EHL[71] present metal concentration data for 2016-2020 (Table 9.6), which demonstrate that both arsenic and chromium consistently exceed Florida Cleanup Standards. Such temporal trends were not presented for other parameters, but data for the leachate sample analysed in 2020 are summarised in Table 9.7. These values are substantially higher than corresponding data for ground and surface water samples.

Figure 9.5 Surface water sampling locations, including the leachate sampling point located on the west of the main landfill[72]

[70] EHL. *Cayman Island's Landfill Report Summary.* 2020
[71] EHL. *Cayman Island's Landfill Report Summary.* 2020
[72] EHL. *Cayman Island's Landfill Report Summary.* 2020

Table 9.6 Metal concentrations (ug/L) in samples collected at the leachate collection point over a 4-year period. Concentrations that exceed the relevant Florida Cleanup Standard are highlighted (extracted from Table 14 in EHL 2020)

Analyte	Florida GW Reg 1	Leachate		
		2016	2019	2020
Arsenic	**10**	27	79	90
Barium	**2000**	130	120 J	160
Cadmium	**5**	<DL	1.1	0.3 J
Chromium	**100**	190	320 J	120
Cobalt	**140**	8.1	21 J	9.4
Copper	**1000**	54	420	110
Lead	**15**	12	68	16
Nickel	**100**	66	<DL	57
Selenium	**50**	1.7 J	1.6 J	<DL
Silver	**100**	<DL	0.75 J	0.15 J
Vanadium	**49**	77	37	15
Zinc	**5000**	60	<DL	200

Notes: "J" indicates "Result is less than the RL but greater than or equal to the Method Detection Limit (MDL) and the concentration is an approximate value.

Table 9.7 Summary of analytical data (excluding metals) for a leachate sample collected in 2020[73]

Analyte	Concentration	Analyte	Concentration
Biological oxygen demand (BOD)	**<MDL**	Petroleum Hydrocarbons*	**<MDL**
Chemical oxygen demand (COD)	1300 mg/L	Total Organic Carbon (TOC)	470 mg/L
Nitrate - nitrite	16 mg/L	Acetone	9.7 µg/L
Nitrite	11 mg/L	Phenol	3.0 µg/L
Total Kjeldahl Nitrogen	490 mg/L	Toluene	1.0 µg/L
Total Nitrogen	510 mg/L	Ethylbenzene	0.54 µg/L
Total Phosphorus	1.9 mg/L	Xylene	0.82 µg/L
pH	8.1	Naphthalene	2.0 µg/L
Sulphate	5.5 mg/L	Endosulphan 1	0.042 µg/L
Ammonia	350 mg/L	Delta BHC	0.025 µg/L
Unionised ammonia	25 mg/L	Faecal Coliform bacteria	69100 mpn/100 ml
Total hardness	1800 mg/L		

Notes: MDL= Method Detection Limit, Petroleum hydrocarbons were analysed using the Total Petroleum Hydrocarbon Criteria Working Group (TPHCWG) method

[73] EHL, *Cayman Island's Landfill Report Summary*, 2020

9.6.1.1 Current gas and vapour emissions

The "*gas probes*" generally showed emissions typical of landfill gas (~50 – 60 percent methane, ~25 – 45 percent carbon dioxide and ≤ two percent oxygen). More detailed laboratory analysis of these gases generally showed an absence of carbon monoxide, ethane, ethylene, propane and propene at any location; hydrogen was only detected at a single location. Hydrogen sulphide was present at all locations (0.46-2,300 ppm). A number of non-methane volatile organic compounds (NMVOC) were present at more than three of the locations including:

– 1,2,4-Trimethylbenzene;
– 1,3,5-Trimethylbenzene;
– 2-Butanone (MEK);
– Acetone;
– Benzene;
– Carbon disulphide;
– Ethylbenzene;
– *m, p* and *o*-Xylenes;
– Methylene Chloride;
– Styrene; and
– Toluene.

In contrast, a single round of flux box measurements showed no detectable methane emissions from the landfill surface.

Further surveys, including monitoring of GP1, occurred in September 2016 by Amec Foster Wheeler[74] and in April 2018 by Wood[75]. However, GP1 is located in older wastes and methane concentrations equivalent to less than one percent v/v were recorded on both occasions. These surveys included monitoring the surface emission of methane; the results of the most recent survey is presented in Figure 9.7.

Due to the unlined nature of the GTLF, subsurface lateral migration of landfill gases and vapours from the landfill does represent a potential risk to the ISWMS but, given the elevated nature of much of the GTLF, the distance between the active (North Mound) area of the GTLF and ISWMS facilities, the existing and planned installation of an active gas management system within the North Mound of the GTLF and the presence of the RWL between the North Mound and the remainder of the ISWMS facilities, the likelihood of any meaningful subsurface migration from the GTLF to the ISWMS facilities is considered to be minimal.

[74] Amec Foster Wheeler, *Technical note: George Town Landfill Site: Surface Emissions Survey September 2016,* 2017a
[75] Wood, *Technical note: George Town Landfill Site: Surface Emissions Walkover Survey,* 2018

Figure 9.6 Location of the "gas probes" installed by Amec Foster Wheeler[76]

[76] Amec Foster Wheeler, *Landfill Site Environmental Review Task 2: Environmental Investigations Interpretative Report,* 2016b

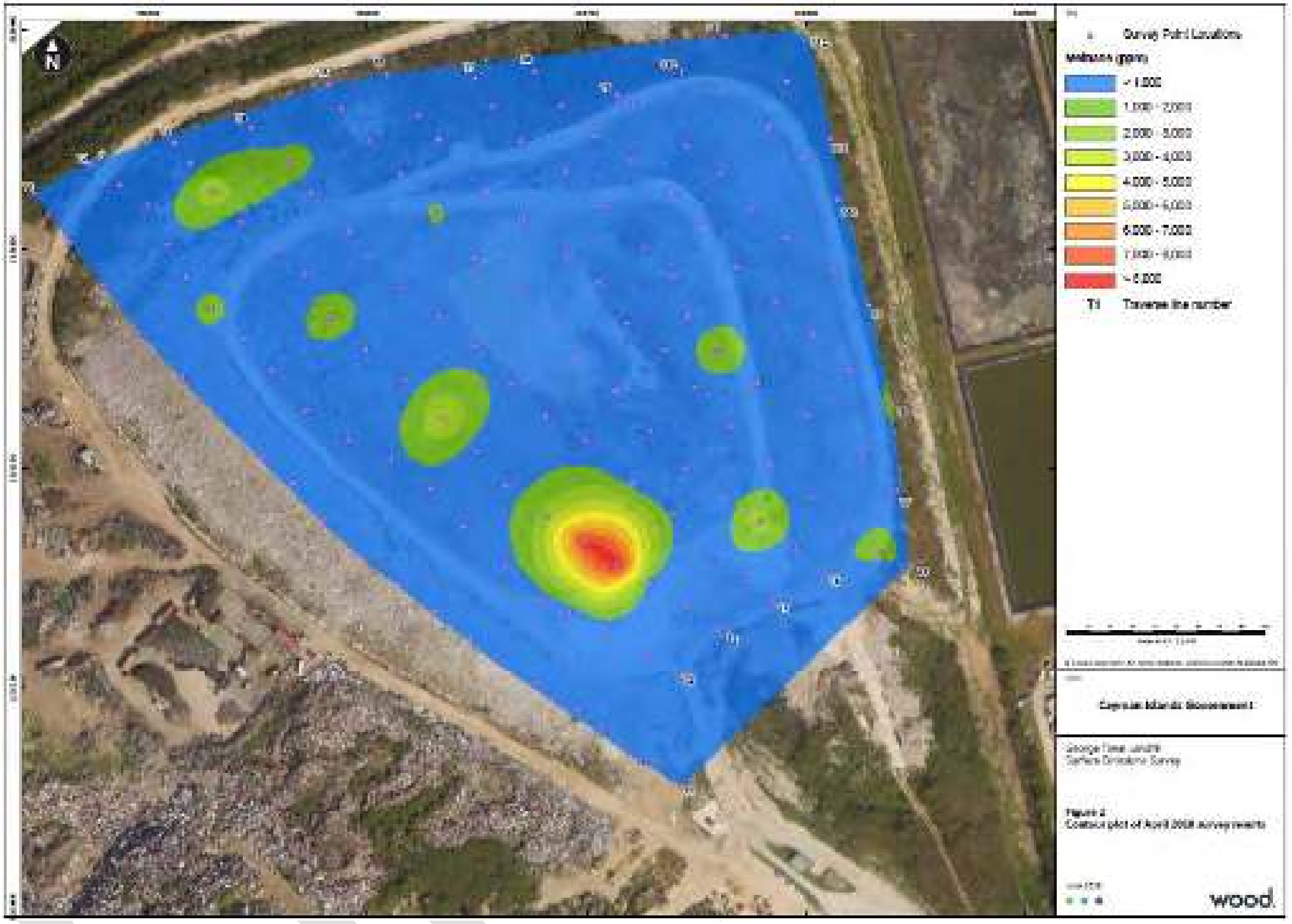

Figure 9.7 ***Results of a survey of methane surface emissions at the Main Landfill Area of the George Town Landfill***[77]

[77] Wood, *Technical note: George Town Landfill Site: Surface Emissions Walkover Survey*, 2018

9.6.2 Future of the GTLF

The waste management strategy for the Islands[78]outlined the inadequacies and non-sustainability of contemporary waste management practices on each island, including the GTLF on Grand Cayman.

The current GTLF generally operates on outdated 'dilute and disperse' principles and lacks most environmental mitigations commonly applied to modern landfill facilities in the US, UK and other developed countries. For example, Cardno ENTRIX[79] report that it lacks "*a basal liner, leachate collection and disposal system, and master stormwater treatment and disposal system".* As a result, leachate emissions have been "*identified by local regulators as one of the main sources of contamination to North Sound"*[80] and Amec Foster Wheeler[81] identified this as a substantial driver for the ISWMS development.

The waste management strategy[82] anticipates the closure of the GTLF but states that it "*is expected to continue to be in operation while the new Integrated Solid Waste Management System is developed and implemented through the procurement and construction of alternative waste management facilities. During this time the footprint of the site will continue to expand*".

A number of options for the remediation and restoration of the GTLF have been proposed[83], including landfill mining and capping options. A review of these options[84] concluded "*that a landfill cap with an active landfill gas management system is required to be provided over the North Mound to reduce its impact on the surrounding environment, but is not required for the older, less active South Mound*".

As part of the pre-commencement works on the ISWMS project, the northern half of the North Mound (Phase 1) has already been capped and that landfill gas extraction wells have been installed **(Appendix 9.A [Land Quality Assessment – Appendix A])**. Extraction of gas from these wells will supply, in part, the Landfill Gas Facility as part of the ISWMS. However, landfilling will continue to expand westwards (Phase 2) while the ISWMS is constructed, before this area is also capped and gas extraction installed **(Appendix 9.A [Land Quality Assessment – Appendix A])** leading up to and immediately following commencement of the ISWMS operations.

9.7 Current Baseline: geoenvironmental

9.7.1 Satellite imagery timeline

Satellite imagery presented within Google Earth Pro (Figure 9.8) suggests that the entire ISWMS Site was undeveloped and heavily vegetated prior to September 2004, with the exception of small areas along the margins of the Site that were already utilised as roadways and compounds associated with the adjacent GTLF. The Site has been progressively cleared from the north since this time.

– The northern third of the site was initially cleared between September 2004 and November 2005, presumably in the aftermath of Hurricane Ivan (see Section 9.6). The Hurricane Ivan Fill Area, Old Scrap and Tyre Stockpile Area and Arsenic Containment Pit (see Section 9.6) are clearly visible by November 2005.
– The land immediately to the south of this was cleared and excavated between December 2005 and February 2007, when ponds and open water is present in this area. This was presumably to provide daily cover for the landfill (see Section 9.6).
– However, this area had been infilled and levelled by March 2008 when the 'Equipment Storage Area' (see Section 9.6) begins to be evident. The 'Oil and Hazardous Waste Storage Area' (see Section 9.6) has been added by March 2013.

[78] Amec Foster Wheeler, *National Solid Waste Management Strategy for the Cayman Islands,* 2016c
[79] Cardno ENTRIX, *Grand Cayman Waste Management Facility Draft Environmental Statement,* 2013
[80] Cardno ENTRIX, *Grand Cayman Waste Management Facility Draft Environmental Statement,* 2013
[81] Amec Foster Wheeler, *National Solid Waste Management Strategy for the Cayman Islands,* 2016c
[82] Amec Foster Wheeler, *National Solid Waste Management Strategy for the Cayman Islands,* 2016c
[83] Amec Foster Wheeler, *National Solid Waste Management Strategy for the Cayman Islands,* 2016c
[84] GHD, *George Town Landfill: Remediation Options Report,* 2021b

– The remainder of the Site remains undeveloped and heavily vegetated until 2020-21 when extensive site clearance, but no development, becomes evident.

Figure 9.8 Selected satellite images between Sept 2004 and Jan 2021 obtained from Google Earth Pro[85] showing the development of the Site over time. The approximate boundary of the ISWMS Site is outlined. Images not to scale.

9.7.2 Known or potential sources of contamination

Based on the available information, contamination within the proposed ISWMS footprint is most likely to be associated with historic waste handling and disposal activities including those at the GTLF. However, the risks from such contamination are likely to vary at different areas of the ISWMS.

The known or potential sources of contamination associated with each area of the Site are outlined below.

9.7.2.1 Area 1

As discussed in Section 9.6, it seems likely that disposal of Hurricane Ivan debris was limited to the HIFA, which is outside the footprint Area 1. However, the disposal of wastes beneath this area prior to 2004 cannot be discounted.

Based on the currently proposed Master Plan (Figure 9.1) it is assumed that the footprint of Area 1 will include some or all of the following potential sources of contamination. The potential contaminants that may be anticipated are summarised in Figure 9.7.

9.7.2.1.1 Old Scrap and Tyre Stockpile Area (OSTSA)

Satellite imagery from 2005 and 2007 (Figure 9.8) clearly shows apparent mounds of a grey material within the OSTSA. Such mounds are less distinct in subsequent images and it is unclear if these mounds are scrap/tyres or remaining hurricane debris. However, Amec Foster Wheeler[86] have reported that during site visits in 2014-2015, scrap metal and tyres were stockpiled in this area (Figure 9.9 Storage of scrap metals and tyres presumed to be at the Old Scrap and Tyre Stockpile Area

Consequently, it seems unlikely, but possible, that wastes (including hurricane debris) are present beneath the OSTSA.

GHD has not been provided with a full description of the source and nature of the scrap metal stored in the OSTSA, nor of any depollution process applied prior to stockpiling, so it is possible that the stockpiles may have contaminated the underlying ground.

Figure 9.9 Storage of scrap metals and tyres presumed to be at the Old Scrap and Tyre Stockpile Area[87]

[85] Image © 2021 Maxar Technologies
[86] Amec Foster Wheeler, *Landfill Site Environmental Review Task 1: Environmental Investigations and Risk Assessments,* 2016a, *National Solid Waste Management Strategy for the Cayman Islands,* 2016c
[87] Amec Foster Wheeler, *National Solid Waste Management Strategy for the Cayman Islands,* 2016c

9.7.2.1.2 Arsenic Containment Cell

The damage caused by Hurricane Ivan resulted in large amounts of debris, which included natural vegetation and wooden timber. It is understood that this was collected together at a number of Debris Sites around Grand Cayman[88] and burnt and/or used to produce mulch. It is understood that the debris included timber treated with preservatives, including chromated copper arsenate (CCA). Subsequent analysis showed that the ash was marginally not suitable to be left at the various debris sites or for reuse[89].

GHD understands that the ash from all the Debris Sites (~4,133 cubic yards (3160 cubic meters) in total) was ultimately disposed of in a custom-build cell within the GTLF Site. This is designated as the Arsenic Containment Pit in Figure 9.3, but elsewhere is referred to as various names including the 'ash pit' or 'ash disposal cell' (etc.); the term Arsenic Containment Cell has been adopted within this report. Design drawings suggest that it is:

- Built upon the underlying "solid rock" but surrounded by "existing waste";
- 100 ft (30.5 m) wide by 250 ft (76.2 m) long;
- Sunk to a depth of ~6 ft (1.8 m) below ground and is mounded to a height of ~12 ft (3.6 m) above ground;
- Enclosed (top and bottom) within an engineered containment system including drainage layer and composite liner; and
- Covered in a seeding layer and vegetation.

It is assumed the cell contains leachate retained within the liner, but there is no current sampling or leachate recovery wells or system. GHD understands that it has also been suggested that arsine gas may be present within the cell.

9.7.2.1.3 Equipment Storage Area (including the OHWSA)

The timeline presented in Figure 9.8 clearly indicates that extraction activities (presumably borrow pits for the extraction of marl for daily cover at the GTLF) occurred in this area after 2005 but that surface levels had been reinstated prior to 2008. This required the infilling of the void areas. GHD is not aware of any details of the nature and source of these fill materials, which may have consisted of wastes.

9.7.2.1.3.1 Equipment Storage Area

This area has a diverse usage, including the storage of current and redundant vehicles, plant and equipment, storage of certain separated waste streams and equipment maintenance.

9.7.2.1.3.2 Oil and Hazardous Waste Storage Area

This consists of two separate compounds; one for waste oils and fuels and one for hazardous waste (e.g., paints and household chemicals).

Amec Foster Wheeler[90] reported that ground water in a monitoring borehole MW16 between western canal and the Waste Oil Storage Area "*was seen to be visually contaminated with black oils"*. The location of MW16 is shown in Figure 9.11. Amec Foster Wheeler[91] also quote the Department of Environmental Health (DEH) as stating "*significant hydrocarbon release occurred from the waste oil storage area in 2004 as a consequence of the tidal surge associated with Hurricane Ivan overtopping the containment bund*". This is understood to have contaminated the perimeter canal, which was subsequently remediated.

Similar releases from the hazardous waste storage area may not have been visible and so cannot be excluded.

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[88] CIRO, *Memorandum: Environmental tests carried out at hurricane debris sites,* 2005
[89] CIRO, *Memorandum: Environmental tests carried out at hurricane debris sites,* 2005
[90] Amec Foster Wheeler, *National Solid Waste Management Strategy for the Cayman Islands,* 2016c
[91] Amec Foster Wheeler, *Landfill Site Environmental Review Task 2: Environmental Investigations Interpretative Report,* 2016b

Figure 9.10 Bunded Waste Oil Storage Area at the GTLF (After Figure 3.2 in Amec Foster Wheeler[92])

Figure 9.11 Location of groundwater monitoring wells at the GTLF (After Figure 1 in EHL[93])

92 Amec Foster Wheeler, *National Solid Waste Management Strategy for the Cayman Islands,* 2016c
93 EHL, *Cayman Island's Landfill Report Summary,* 2020

Table 9.8 Summary of the potential sources and associated contaminants identified within, and adjacent to, the Study Area, which have been considered within this Land Quality Assessment

Area	Potential source	Potential contaminants
Within the Study Area		
Old Scrap and Tyre Stockpile Area	Any fill or buried wastes[a] (including hurricane debris)	• Metals • Combustion products, including polyaromatic hydrocarbons (PAHs) and dioxins • Asbestos • Landfill/Ground gases
	Subsequent waste storage[a] (including scrap and tyres)	• Metals • Hydrocarbons, including polyaromatic hydrocarbons (PAHs) • Asbestos
Arsenic Containment Cell	Ash material within the cell.	• Metals, especially arsenic and chromium and copper • Combustion products, including polyaromatic hydrocarbons (PAHs) and dioxins • Asbestos • Arsine gas
Equipment Storage Area	Any fill materials (including wastes)[a]	• Metals • Combustion products, including polyaromatic hydrocarbons (PAHs) and dioxins • Asbestos • Landfill/Ground gases
	Storage of vehicles, plant and equipment	• Metals • Hydrocarbons, including polyaromatic hydrocarbons (PAHs)
	Maintenance activities.	• Metals • Hydrocarbons, including polyaromatic hydrocarbons (PAHs) • Paints and solvents etc.
Oil and Hazardous Waste Storage Area	Any fill materials (including wastes)[a]	• Metals • Combustion products, including polyaromatic hydrocarbons (PAHs) and dioxins • Asbestos • Ground gases
	Waste oil store	• Hydrocarbons, including polyaromatic hydrocarbons (PAHs) • Organic vapours
	Hazardous waste store	• Hydrocarbons, including polyaromatic hydrocarbons (PAHs) • Paints and solvents etc. • Pesticides • Polychlorinated biphenyls (PCBs) • Organic vapours

Area	Potential source	Potential contaminants
Adjacent offsite areas		
George Town Landfill	Landfilled wastes	• Leachate • Landfill/Ground gases • Organic vapours

Notes: The potential composition of such wastes has not been determined and so the range of likely contaminants cannot be delineated with any degree of certainty.

9.7.2.2 Area 2

Based on the currently proposed master plan (Figure 9.1) it is assumed that the footprint of Area 2 lies outside the boundary of the existing GTLF. Satellite imagery (Figure 9.8) suggests that this area remained heavily vegetated until late 2020/early 2021 when Area 2 was cleared of vegetation. However, a limited geotechnical site investigation of this area was undertaken in November and December 2020[94]. This identified "*Topsoil 'Marl' fill and municipal waste mix*" present at multiple locations across Area 2. APEC[95] report that "*Aerial imagery indicates the area was used as a landfill sometime between the 1970s and 1980s. The 1994 aerial photography shows the site as being covered. This is consistent with an environmental assessment report prepared in 1991 by Post, Buckley, Schuh and Jernigan Inc. (PBSJ) which refers to landfilled waste on an adjacent property not owned by CI Government*".

The available information indicates that, while undeveloped, historical waste disposal did occur in this area before it was overgrown with vegetation. The nature, volume and extent of wastes present, and contamination associated with it, is not known. Equally, the gas generation potential of such wastes remains unknown, but is expected to be minimal due to the age and nature of the deposited waste.

9.7.2.3 Area 3

The proposed location of the CUC substation is isolated from all other ISWMS components and lies to the north beyond the North Canal (Figure 9.1). The timeline presented in Figure 9.8 clearly indicates this area remained vegetated and undisturbed until at least 2021. Consequently, contamination is not anticipated in this area, although the disposal of wastes beneath this area prior to 2004 cannot be completely discounted.

9.7.2.4 Area 4

The proposed location of the Landfill Gas Facility (LGF) is isolated from all other ISWMS components and lies adjacent to the current wastewater treatment plant. The LGF lies within the footprint of the "Old Landfill" Figure 9.3 or "South Mound" Figure 9.4. The "Old Landfill" is believed to have been reduced by burning and so is "*likely to comprise ash towards the base"* (Section 9.6.2). Consequently, some level of contamination is expected in this area, but GHD is not aware of any site investigation data that presents data relating to the ground conditions and contaminant concentrations.

9.7.2.5 Sources of contamination - baseline conclusions

The entire ISWMS footprint, with the possible exception of Area 3, is known or suspected to be on land affected by landfill or waste disposal activities. In addition to any geotechnical hazards posed by potential buried wastes, it is possible that contamination may be encountered, but the significance of such contamination cannot be determined in the absence of suitable and sufficient soil analysis data (Section 9.7.3.6). In addition to any buried wastes, Area 1 is known to have been affected by releases from the OHWSA and potentially other activities in this area.

[94] APEC, *Grand Cayman Proposed Integrated Solid Waste Management Facility: Energy Recovery Facility -Geotechnical Investigation and Report,* 2021

[95] APEC, *Grand Cayman Proposed Integrated Solid Waste Management Facility: Energy Recovery Facility -Geotechnical Investigation And Report,* 2021

9.7.3 Available soil analysis data

Although a substantial amount of ground and surface water data (including limited amounts of sediment sampling) are available for the GTLF Site, little or no soil analysis data is available relevant to the proposed footprint of the ISWMS.

9.7.3.1 Area 1

Amec Foster Wheeler[96] describe limited soil monitoring conducted by CIG-DEH (the "DEH Data") who collected samples "*from surface soils adjacent to some of the MW monitoring point locations. Forty datasets are available for the period 2011-2013*". Three of these samples were from within Area 1 and a further four relate to the HIFA and, while not directly relevant to Area 1 may be indicative of similar conditions (Table 9.9). All the available analysis data for these locations are presented in Table 9.11 for inorganic contaminants, Table 9.12 for PCBs and Table 9.13 for various pesticides. The relevance of this data and any other data to each area of the Site is discussed below.

Table 9.9 Locations at which surface soil samples have been collected by DEH. Each location has been allocated to the relevant part of the Site. Locations that are within the likely footprint of the ISWMS are highlighted in bold

Location	Part of Site	Location	Part of Site
SW1	(Location unknown)	**MW9**	**HIFA (outside ISWMS)**
SW2	Main landfill area	**MW9 B**	**HIFA (outside ISWMS)**
SW3	**HIFA (outside ISWMS)**	MW10	Old Landfill
SW7	(Location unknown)	MW11	Main landfill area
SW12	**Hazardous waste storage Area**	MW12	Main landfill area
Drain 1	(Location unknown)	MW13	Old Landfill
Drain 2	(Location unknown)	**MW14**	**Arsenic containment cell and OSTSA**
MW1	(Location unknown)	**MW15**	**Arsenic containment cell and OSTSA**
MW1 B	(Location unknown)	**MW17**	**HIFA (outside ISWMS)**
MW5	Main landfill area	MW18	Main landfill area
MW8	Main landfill area		

9.7.3.1.1 Old Scrap and Tyre Stockpile Area (OSTSA)

The soils at the OSTSA are poorly characterised. However, all the DEH surface soil data presented in Table 9.11, Table 9.12 and Table 9.13 are relevant to the OSTSA except for that for SW12. This includes four locations from the HIFA located further north and outside the footprint of Area 1 (Table 9.9).

With respect to inorganic contaminants, Table 9.11 suggests that there are no substantial risks to human health or ground water from the current surface soils in this area. The exceedances of the $CCTL^{comm}$ for arsenic mainly relate to results apparently subject to inexplicably high LoDs. Only one sample above the relevant LoD marginally exceeds the $CCTL^{comm}$ (see Section 9.8.3.6).

PCBs (seven congeners only) were not detected above the LoD in any sample (Table 9.12). However, the LoDs used were all more than an order of magnitude greater than the $CCTL^{comm}$, meaning that no conclusions can be drawn regarding PCB risks in relation to the surface soils in this area.

Samples were also tested for a range of pesticides (Table 9.13). The only pesticide detected above the relevant LoD was endrin (two samples only) and the concentrations detected did not exceed the $CCTL^{GW}$. However, the LoDs for nine of the pesticides exceeded the relevant CCTL and so no conclusions can be drawn regarding these compounds in surface soils in this area.

[96] Amec Foster Wheeler, *Landfill Site Environmental Review Task 2: Environmental Investigations Interpretative Report,* 2016b

In addition to the DEH data, Amec Foster Wheeler[97] reports that "*Seventeen samples of surface soil were collected from across the Hurricane Ivan fill area[98] for asbestos analysis. No asbestos was detected in any of the samples*".

It should be noted that this surface sampling does not demonstrate that contamination (including asbestos) is not present within any underlying fill/wastes.

9.7.3.1.2 Arsenic Containment Cell

The cell contains ash from the burning of Hurricane Ivan debris at various sites across the island. Prior to disposal, sampling of ash from several sites found that the mean arsenic concentration was 65.4 mg/kg (n=13) and as a result was not suitable to be left at the various debris sites or for reuse[99]. The ash analysis data is presented in Table 9.10.

In addition to total concentrations, leachability was also determined as TCLP (SW-846 Test Method 1311: Toxicity Characteristic Leaching Procedure) and SPLP (SW-846 Test Method 1312: Synthetic Precipitation Leaching Procedure). The mean leachate concentration of arsenic was 0.24 mg/l (n=13) and 0.03 mg/l (n=2), respectively[100].

Table 9.10 Concentrations (mg/kg) of various metals in samples of ash created by the burning of Hurricane Ivan debris at various sites on Grand Cayman[101]. The mean and standard deviation for each metal is also shown.

	TOTAL METALS (mg/kg)					
	As	Ba	Cd	Cr	Pb	Hg
Ash Samples collected 31 Jan 2005						
JW-1/BURN PITS	71.6	94.6	0.66	74.1	117	0.084
JW-2/NNW-E MAIN PILE	30.4	29.1	0.43	27.3	51.8	0.1
JW-3/SE MAIN PILE	21.7	25.5	0.48	21.4	93.6	0.083
JW-4/NNW-SE MAIN PILE	34.6	30.5	0.4	41.3	31	0.084
SP-1/WEST SIDE LAKES	141	81.2	0.73	79.2	5450	0.08
SP-2/CHAS POWELL SITE	42.4	56	0.49	47.5	93.9	0.093
SN-1/BERM N OF LAKE: E SECT	146	89.5	0.69	81.5	76	0.099
SN-2/BERM N OF LAKE:CTR SECT.	48	50	0.46	57.3	36	0.096
SN-3/PILE NW OF LAKE	39.1	35.2	1.2	53.7	87.8	0.14
NW-1/RIGHT OF ENTRANCE	36.1	56.2	0.55	44.8	88.6	0.087
NW-2/LEFT OF ENTRANCE	43.9	95.9	1	49	122	0.087
Ash Samples collected 3 March 2005						
Frank Sound - Ash from Mulch produced by MC	98.6	44.4	0.81	74.1	148	0.082
Ash Samples collected 7 and 8 April 2005						
Sweetwater Palms - Ash	96.9	406	1.3	74.7	1230	0.084
Mean	**65.4**	**84.2**	**0.7**	**55.8**	**586.6**	**0.1**
SD	**41.3**	**94.4**	**3.2**	**21.4**	**1392.4**	**3.3**

Apart from this pre-disposal data, the material in the Arsenic Containment Cell is poorly characterised. However, the surface soil data for MW14 and MW15 (Table 9.11, Table 9.12, and Table 9.13) is relevant to the characterisation of the surface soils in this area.

97 Amec Foster Wheeler, *Landfill Site Environmental Review Task 2: Environmental Investigations Interpretative Report,* 2016b
98 This is assumed to include the OSTSA.
99 CIRO, *Memorandum: Environmental tests carried out at hurricane debris sites,* 2005
100 CIRO, *Memorandum: Environmental tests carried out at hurricane debris sites,* 2005
101 CIRO, *Memorandum: Environmental tests carried out at hurricane debris sites,* 2005

With respect to inorganic contaminants, the available data (Table 9.11) suggest that there are no substantial risks to human health or ground water from the current surface soils in this area. The exceedances of the $CCTL^{comm}$ for arsenic in this area relate to results apparently subject to inexplicably high LoDs (see Section 9.7.3.5).

The seven PCB congeners analysed were not detected above the LoD in any sample, however, the LoDs used were all more than an order of magnitude greater than the $CCTL^{comm}$, meaning that no conclusions can be drawn regarding PCB risks in relation to the surface soils in this area.

Samples were also tested for a range of pesticides (Table 9.13). The only pesticide detected above the relevant LoD was endrin (one sample only) and the concentrations detected did not exceed the $CCTL^{GW}$. However, the LoDs for nine of the pesticides exceeded the relevant CCTL and so no conclusions can be drawn regarding these compounds in surface soils in this area.

It should be noted that this surface sampling does not demonstrate that contamination (including asbestos) is not present within the ash within the cell, but we understand that current plans involve constructing the RWL over the existing cell, and so the ash will not be disturbed or exposed.

9.7.3.1.3 Equipment Storage Area (including the Oil and Hazardous Waste Storage Area)

Although oil contamination has been observed in the vicinity of the Waste Oil storage Area (Section .9.7.2.1.3), the soil in this area is poorly characterised. The only available data relevant to this area is for surface soil samples collected from SW12 (Table 9.11, Table 9.12, and Table 9.12)

With respect to inorganic contaminants, the available data (Table 9.11) suggests that there are no substantial risks to human health or ground water from the current surface soils in this area. The exceedances of the $CCTL^{comm}$ for arsenic in this area relate to results apparently subject to inexplicably high LoDs (see Section 9.7.3.5).

The seven PCB congeners analysed were not detected above the LoD in any sample (Table 9.12). However, the LoDs used were all more than an order of magnitude greater than the $CCTL^{comm}$, meaning that no conclusions can be drawn regarding PCB risks in relation to the surface soils in this area.

Samples were also tested for a range of pesticides (Table 9.13). No pesticides were detected above the relevant LoD in this area. However, the LoDs for nine of the pesticides exceeded the relevant CCTL and so no conclusions can be drawn these compounds in surface soils in this area.

It should be noted that this surface sampling does not demonstrate that contamination (including asbestos) is not present below the surface in this area.

9.7.3.2 Area 2

No soil quality data was identified in relation to Area 2.

9.7.3.3 Area 3

No soil quality data was identified in relation to Area 3.

9.7.3.4 Area 4

No soil quality data was identified in relation to Area 4.

9.7.3.5 Background arsenic concentrations

Arsenic occurs naturally in soils at varying concentrations in different geographic regions and, in some areas, natural concentrations can exceed risk-based assessment criteria where such background concentrations have not been considered in the derivation of such criteria.

Little information has been identified in the scientific literature regarding the levels of naturally occurring arsenic in the Cayman Islands. The only information identified is in an ICENS[102] report, but we are aware that additional studies have been conducted. ICENS[103] reported that background arsenic concentrations "*ranged from 11 to 85 µg/g (median, 28.8 µg/g;* mean *38.6 µg/g*)", but it is unclear on how many samples this is based on.

As 1 ug/g is equivalent to 1 mg/kg, this suggests that most Cayman soils will exceed the $CCTL_{Comm}$ for arsenic of 12 mg/kg (Florida DoEP, 2005). It should be noted that the CCTL are derived using a target lifetime excess cancer risk level of 1.0E-6 and the value for arsenic assumes a bioaccessibility of 0.33. In any future risk assessment in relation to arsenic in soils, this background concentration and the applicability of the CCTL for arsenic for use in the Cayman Islands should be considered.

9.7.3.6 Soil analysis – baseline conclusions

Minimal and poor quality soil analysis data is available with respect to Area 1. The data available does not suggest that substantial contamination will be encountered in this area but there remains considerable uncertainty.

No data has been identified relating to Areas 2, 3 and 4 and so no conclusions can be supported with respect to the levels of soil contamination that may be present in these areas, the risks these represent, nor the need for any mitigation measures.

9.7.4 Available gas data

Although gas data is available for the adjacent GTLF, no specific data relevant to the ISWMS site (Areas 1,2,3 or 4) has been identified.

No historical gas monitoring data for the GTLF is available prior to 2015,[104] but subsequent gas monitoring has been undertaken. Amec Foster Wheeler describes six "*gas probes*", one of which (GP6) is very close to the OSTSA (Figure 9.6) and could indicate the potential for gas migration towards Areas 1 and 2. However, Amec Foster Wheeler[105] only present summary monitoring data (Section 9.6.2) and it is not possible to establish the gas fluxes measured in GP6 specifically. Further monitoring of the landfill mound was also undertaken in September 2016 by Amec Foster Wheeler[106] and in April 2018 by Wood[107]. However, access to GP6 was obstructed on both occasions and no monitoring was possible.

The results of the latest methane surface emission survey (Figure 9.7) suggest that the emissions outside of the main GTLF will be low (<one percent methane). This does not mean that subsurface migration cannot occur but, as noted in Section 9.6.1.1, the likelihood of any meaningful migration from the GTLF to the ISWMS facilities is considered to be minimal.

9.7.4.1 Gas data – baseline conclusions

The GTLF is known to be generating landfill gas and given the absence of a basal liner, lateral migration of gases from the GTLF could affect the ISWMS. However, the likelihood of any meaningful subsurface migration from the GTLF to the ISWMS facilities is considered to be minimal.

Additionally, given that the North Canal, which is likely to prevent lateral gas migration, appears to lie between the GTLF and Area 3, this area is considered unlikely to be affected by ground gases.

Area 4 is to be located on the 'Old Landfill' to the south of the GTLF. No gas data relevant to this area has been identified. However, it is assumed that the gas generation potential of any buried wastes in this area will be minimal

102 ICENS, *Report on the Analysis of Arsenic in Nail clippings, Soil, food, and Water Samples from the Cayman Islands,* 2015
103 ICENS, *Report on the Analysis of Arsenic in Nail clippings, Soil, food, and Water Samples from the Cayman Islands,* 2015
104 Amec Foster Wheeler*, Landfill Site Environmental Review Task 2: Environmental Investigations Interpretative Report,* 2016b
105 Amec Foster Wheeler*, Landfill Site Environmental Review Task 2: Environmental Investigations Interpretative Report,* 2016b
106 Amec Foster Wheeler, *Technical note: George Town Landfill Site: Surface Emissions Survey September 2016,* 2017a
107 Wood, *Technical note: George Town Landfill Site: Surface Emissions Walkover Survey,* 2018

and that the landfill gas facility (Area 4) will be designed to be intrinsically safe and to be minimally staffed, and so the risks are likely to be minimal.

9.7.5 Future baseline

No factors were identified that, in the absence of the ISWMS project proceeding, would materially alter the baseline conditions outlined above. Changes to the management practices at the GTLF could conceivably increase or decrease the potential for landfill gas migration on to the ISWMS site but, again, the likelihood of any meaningful migration from the GTLF to the ISWMS facilities is considered to be minimal.

Table 9.11 Inorganics: Existing surface soil analysis presented by Amec Foster Wheeler (Appendix D in 2016b) relating to sample locations within the footprint of the ISWMS

Contaminant	unit	$CCTL^{comm}$	$CCTL^{GW}$	SW3			SW12			MW9			MW9B		MW14		MW15	MW17
				2010	2011	2013	2010	2011	2013	2010	2011	2013	2010	2011	2013	2011	2013	2011
Antimony	mg/kg	370	54	3.9 <MDL	3 <MDL	2.3 (<MDL)	2.1 <MDL	2.5 <MDL	2 <MDL	4.6 <MDL	2.4 <MDL	2.4 <MDL	2.4 <MDL	2 <MDL	2 <MDL	2.2 <MDL	1.9 <MDL	2.2 <MDL
Arsenic	mg/kg	12	None set	3.9 <MDL	3 <MDL	4.5 <MDL	2.1 <MDL	5.4	20 <MDL	4.6 <MDL	3.1	4.8 <MDL	2.4 <MDL	13	20 <MDL	9.7	19 <MDL	3.2
Barium	mg/kg	130000	16000	5.4	7.9	12	1.2	3.9	9.9 <MDL	16	9.3	9.8	11	2.4	23	22	12	9
Beryllium	mg/kg	1400	630	0.78 <MDL	0.6 <MDL	0.45 <MDL	0.42 <MDL	0.5 <MDL	0.4 <MDL	0.93 <MDL	0.48 <MDL	0.48 <MDL	0.49 <MDL	0.41 <MDL	0.4 <MDL	0.44 <MDL	0.37 <MDL	0.45 <MDL
Cadmium	mg/kg	1700	75	0.97 <MDL	0.75 <MDL	0.57 <MDL	0.52 <MDL	0.62 <MDL	0.5 <MDL	1.2 <MDL	0.6 <MDL	0.6 <MDL	0.61 <MDL	0.51 <MDL	0.49 <MDL	0.55 <MDL	0.47 <MDL	0.56 <MDL
Chromium	mg/kg	470	380	10	14	19	3.4	18	25	19	10	13	12	6.6	39	27	21	9.1
Cobalt	mg/kg	42000	None set	1.9 <MDL	1.5 <MDL	1.1 <MDL	1.0 <MDL	1.2 <MDL	0.99 <MDL	2.3 <MDL	1.2 <MDL	1.2 <MDL	1.2 <MDL	1.0 <MDL	1.4 <MDL	1.7	0.93 <MDL	1.1 <MDL
Copper	mg/kg	89000	None set	4.9 <MDL	3.7 <MDL	4.9	2.6 <MDL	3.1 <MDL	4.5	9	14	8.3	9	4.3	68	40	21	5.5
Iron	mg/kg	None set	None set	1600	2200	4000	310	2900	4800	3300	1800	2200	2400	4000	8000	9000	3600	2200
Lead	mg/kg	1400	None set	2.7	3.9	8	1.0 <MDL	2.1	3.6	8.1	35	21	13	3.1	120	90	12	11
Magnesium	mg/kg	None set	None set	2900	1800	3300	67000	64000	72000	3700	10000	9500	6100	6400	39000	8900	2700	5900
Nickel	mg/kg	35000	1300	7.8 <MDL	6.0 <MDL	4.5 <MDL	4.2 <MDL	5.0 <MDL	5.7	9.3 <MDL	4.8 <MDL	4.8 <MDL	4.9 <MDL	4.1 <MDL	8	8.1	3.7 <MDL	4.5 <MDL
Selenium	mg/kg	11000	52	4.9 <MDL	3.7 <MDL	2.8 <MDL	2.6 <MDL	3.1 <MDL	2.5 <MDL	5.8 <MDL	3.0 <MDL	3.0 <MDL	3.0 <MDL	2.5 <MDL	2.5 <MDL	2.7 <MDL	2.3 <MDL	2.8 <MDL
Silver	mg/kg	8200	170	1.9 <MDL	1.5 <MDL	1.1 <MDL	1.0 <MDL	1.2 <MDL	0.99 <MDL	2.3 <MDL	1.2 <MDL	1.2 <MDL	1.2 <MDL	1.0 <MDL	0.99 <MDL	1.1 <MDL	0.93 <MDL	1.1 <MDL
Thallium	mg/kg	150	28	4.9 <MDL	3.7 <MDL	2.8 <MDL	2.6 <MDL	3.1 <MDL	2.5 <MDL	5.8 <MDL	3.0 <MDL	3.0 <MDL	3 <MDL	2.5 <MDL	2.5 <MDL	2.7 <MDL	2.3 <MDL	2.8 <MDL
Vanadium	mg/kg	10000	9800	6.9	6.6	9.2	2.1	13	14	9.6	5.1	5.7	6.3	7.5	13	18	8.7	5.7
Zinc	mg/kg	630000	None set	9.4	9.5	26	2.9	9.4	21	78	9600	2600	1100	24	390	150	84	51
Mercury	mg/kg	17	21	0.041 <MDL	0.03 <MDL	0.044	0.035	0.068	0.06	0.053 <MDL	0.035	0.04	0.024 <MDL	0.024	0.056	0.12	0.05	0.024
Boron	mg/kg	430000	None set		28	26		110	9.9 <MDL		26	23		10 <MDL	21	16	25	16
Cyanide, Total	mg/kg	11000	8		0.79 <MDL	0.6 <MDL		2.5 <MDL	0.49 <MDL		0.66 <MDL	0.61 <MDL		0.52 <MDL	0.49 <MDL	0.59 <MDL	0.48 <MDL	0.56 <MDL
Sulphate	mg/kg	None set	None set		1600	1500		520 <MDL	100 <MDL		140 <MDL	780		110 <MDL	1000 <MDL	120 <MDL	2200	120 <MDL

Notes: Data that was reported as being below the relevant Method Detection Limit (MDL) are indicted; actual concentrations could be lower. The lowest relevant Contaminant Cleanup Target Levels for human health (CCTLcomm) and groundwater (CCTLGW) has been used for risk screening. Samples that exceed the lower of the two CCTL have been highlighted.

Table 9.12 Polychlorinated Biphenyls (PCBs): Existing surface soil analysis presented by Amec Foster Wheeler (Appendix D in 2016b) relating to sample locations within the footprint of the ISWMS

Contaminant	unit	CCTL^{comm}	CCTL^{GW}	SW3			SW12			MW9			MW9B		MW14		MW15	MW17
				2010	2011	2013	2010	2011	2013	2010	2011	2013	2010	2011	2013	2011	2013	2011
PCB-1016	mg/kg	2.6	170		54 <MDL	40 <MDL		170 <MDL	33 <MDL		44 <MDL	40 <MDL		36 <MDL	33 <MDL	39 <MDL	67 <MDL	38 <MDL
PCB-1221	mg/kg	2.6	170		110 <MDL	80 <MDL		340 <MDL	67 <MDL		90 <MDL	82 <MDL		72 <MDL	67 <MDL	79 <MDL	140 <MDL	77 <MDL
PCB-1232	mg/kg	2.6	170		54 <MDL	40 <MDL		170 <MDL	33 <MDL		44 <MDL	40 <MDL		36 <MDL	33 <MDL	39 <MDL	67 <MDL	38 <MDL
PCB-1242	mg/kg	2.6	170		54 <MDL	40 <MDL		170 <MDL	33 <MDL		44 <MDL	40 <MDL		36 <MDL	33 <MDL	39 <MDL	67 <MDL	38 <MDL
PCB-1248	mg/kg	2.6	170		54 <MDL	40 <MDL		170 <MDL	33 <MDL		44 <MDL	40 <MDL		36 <MDL	33 <MDL	39 <MDL	67 <MDL	38 <MDL
PCB-1254	mg/kg	2.6	170		54 <MDL	40 <MDL		170 <MDL	33 <MDL		44 <MDL	40 <MDL		36 <MDL	33 <MDL	39 <MDL	67 <MDL	38 <MDL
PCB-1260	mg/kg	2.6	170		54 <MDL	40 <MDL		170 <MDL	33 <MDL		44 <MDL	40 <MDL		36 <MDL	33 <MDL	39 <MDL	67 <MDL	38 <MDL

Notes: Data that was reported below the relevant limit of detection is presented in bold. The lowest relevant Contaminant Cleanup Target Levels for human health (CCTLcomm) and groundwater (CCTLGW) has been used for risk screening. Samples that exceed the lower of the two CCTL have been highlighted.

Table 9.13 Pesticides: Existing surface soil analysis presented by Amec Foster Wheeler (Appendix D in 2016b) relating to sample locations within the footprint of the ISWMS

Contaminant	unit	CCTL^{comm}	CCTL^{GW}	SW3			SW12			MW9			MW9B		MW14		MW15	MW17
				2010	2011	2013	2010	2011	2013	2010	2011	2013	2010	2011	2013	2011	2013	2011
4,4'-DDD	mg/kg	22	58			2 <MDL			1.7 <MDL			2.1 <MDL			1.7 <MDL		3.4 <MDL	
4,4'-DDE	mg/kg	15	180			2 <MDL			1.7 <MDL			2.1 <MDL			1.7 <MDL		3.4 <MDL	
4,4'-DDT	mg/kg	15	110			2 <MDL			1.7 <MDL			2.1 <MDL			1.7 <MDL		3.4 <MDL	
Aldrin	mg/kg	0.3	2			2 <MDL			1.7 <MDL			2.1 <MDL			1.7 <MDL		3.4 <MDL	
alpha-BHC	mg/kg	0.6	0.003			2 <MDL			1.7 <MDL			2.1 <MDL			1.7 <MDL		3.4 <MDL	
beta-BHC	mg/kg	2.4	0.010			2 <MDL			1.7 <MDL			2.1 <MDL			1.7 <MDL		3.4 <MDL	
Chlordane (technical)	mg/kg	14	96			20 <MDL			17 <MDL			21 <MDL			17 <MDL		34 <MDL	
delta-BHC	mg/kg	490	2			2 <MDL			1.7 <MDL			2.1 <MDL			1.7 <MDL		3.4 <MDL	
Dieldrin	mg/kg	0.3	0.020			2 <MDL			1.7 <MDL			2.1 <MDL			1.7 <MDL		3.4 <MDL	
Endosulfan I	mg/kg	7600	38			2 <MDL			1.7 <MDL			2.1 <MDL			1.7 <MDL		3.4 <MDL	
Endosulfan II	mg/kg	7600	38			2 <MDL			1.7 <MDL			2.1 <MDL			1.7 <MDL		3.4 <MDL	
Endosulfan sulfate	mg/kg	7600	38			2 <MDL			1.7 <MDL			2.1 <MDL			1.7 <MDL		3.4 <MDL	
Endrin	mg/kg	510	10			2 <MDL			1.7 <MDL			2.1 <MDL			1.7 <MDL		3.4 <MDL	
Endrin aldehyde	mg/kg	510	10			3.5			1.7 <MDL			2.1 <MDL			1.7 <MDL		7.8	
Endrin ketone	mg/kg	510	10			2 <MDL			1.7 <MDL			2.1 <MDL			1.7 <MDL		3.4 <MDL	
gamma-BHC (Lindane)	mg/kg	2.5	0.090			2 <MDL			1.7 <MDL			2.1 <MDL			1.7 <MDL		3.4 <MDL	
Heptachlor	mg/kg	1.0	230			**2** <MDL			**1.7** <MDL			**2.1** <MDL			**1.7** <MDL		**3.4** <MDL	
Heptachlor epoxide	mg/kg	0.5	6			**2** <MDL			**1.7** <MDL			**2.1** <MDL			**1.7** <MDL		**3.4** <MDL	
Methoxychlor	mg/kg	8800.0	1600			**2** <MDL			**1.7** <MDL			**2.1** <MDL			**1.7** <MDL		**3.4** <MDL	
Toxaphene	mg/kg	4.5	310	1		**200** <MDL			**170** <MDL			**210** <MDL			**170** <MDL		**340** <MDL	

Notes: Data that was reported below the relevant limit of detection is presented in bold. The lowest relevant Contaminant Cleanup Target Levels for human health (CCTL^{comm}) and groundwater (CCTL^{GW}) has been used for risk screening. Samples that exceed the lower of the two CCTL have been highlighted.

9.8 Conceptual site model

BS EN ISO 21365 defines a Conceptual Site Model (CSM) as a "*synthesis of all relevant information about a potentially contaminated site with interpretation as necessary and recognition of uncertainties. The description relies on the concept, of "source-migration pathway-receptor linkages" (sometimes termed «contaminant linkages») that are, or might be, present.*"

9.8.1 Land contamination (CSM)

This CSM relates to the ISWMS as a whole (Areas 1, 2 and 4 only[108]) and summarises the identified potential pollutant linkages, which each consist of a source/contaminant, pathway and receptor.

The receptors relevant to this assessment are identified in Section 9.4.1.1. The potential sources of contamination identified with respect to Area 1 (Table 9.8) are assumed to also be relevant to Areas 2 and 3. The potential pathways considered to be relevant to this assessment are:

1. Direct ingestion of soils and dusts; and / or
2. Inhalation of soil-derived dusts by individuals while outdoors; and / or
3. Inhalation of tracked-back soil-derived dust in onsite buildings; and / or
4. Direct contact with buildings, building materials and infrastructure; and / or
5. Contaminant migration due to surcharging of historic arsenic waste pit with new RWL; and / or
6. Contaminant migration via windblown dust, flooding or surface runoff.

The consumption of tainted food produce (including fruit, vegetables, meat and other animal products) is not considered a viable pathway at a waste treatment and disposal facility, as it is assumed that no such produce will be farmed on-Site.

It should be noted that the assessment of risks to ground and surface waters is outside the scope of this assessment and so the related pathways have not been listed.

Gases and vapours are considered in Section 9.8.2.

Table 9.14 Potential pollutant linkages relevant to non-gaseous contaminants displayed as a matrix showing the pathways (referenced by number) that link each contaminant with the various receptors.

	Site staff, construction workers and visitors (human health)	ISWMS infrastructure	Surrounding land users e.g.,. residential, commercial/industrial, schools (human health)
Metals including arsenic	1,2,3,5	4	2, 5
Polyaromatic hydrocarbons (PAHs)	1,2,3,5	4	2, 5
Dioxins etc.	1,2,3,5	4	2, 5
Asbestos	2,3,5	4	2, 5
Hydrocarbons (including fuels)	1,2,3,5	4	2, 5
Polychlorinated Biphenyls (PCBs)	1,2,3,5	4	2, 5
Pesticides	1,2,3,5	4	2, 5
Paints and solvents	1,2,3,5	4	2, 5

108 The current information suggests that land contamination is unlikely to affect Area 3 as it has apparently not been used for waste disposal operations and is isolated from gas migrating from the GTLF.

9.8.2 Ground gas and vapours (gCSM)

There are two principal sources of ground gases; migration from main GTLF to Areas 1, 2 and 4[8] and gas generated in the underlying naturally occurring soils (i.e., "peat") or any anthropogenic wastes and made ground *etc.* Risk relating to gas generation within the underlying calcareous strata is considered unlikely and has not been considered.

As outlined in Section 9.6, the GTLF is primarily a landraise with only limited amounts of wastes below ground level. This, together with the shallow groundwater table (Section 9.5.3), will limit any lateral migration to the surface (approx. 3.3 ft [1 m] bgl) soils. Although landfill gas can dissolve and migrate within groundwater, this is considered unlikely to occur to a significant extent given the configuration of the GTLF. Lateral gas migration is only likely to be of concern where pressure-driven advective flow occurs but, again, as described in Section 9.6.1.1, the likelihood of any meaningful migration from the GTLF to the ISWMS facilities is considered to be minimal; being mitigated by the landfill gas collection system **(Appendix 9.A [Land Quality Assessment – Appendix A])** already installed at the currently capped North Mound (Phase 1) and to be installed the ongoing westward expansion (Phase 2), along with the presence of the lined and capped RWL between the GTLF and the remainder of the ISWMS facilities.

With respect to gas generation immediately beneath Areas 1, 2, 3 and 4:

– Area 1 is the RWL and landfill gas generated in this area is unlikely to be of concern;
– There is some evidence of buried wastes in Area 2 but these are understood to be historical and of limited depth and so the gas generation potential of these materials is assumed to be low;
– There is currently no evidence of any materials likely to generate gas beneath Area 3; and
– Although Area 3 is the location of the "old landfill" and so buried wastes are anticipated it is understood that these wastes were generally burnt prior to burial and so their gas generation potential is considered to be low.

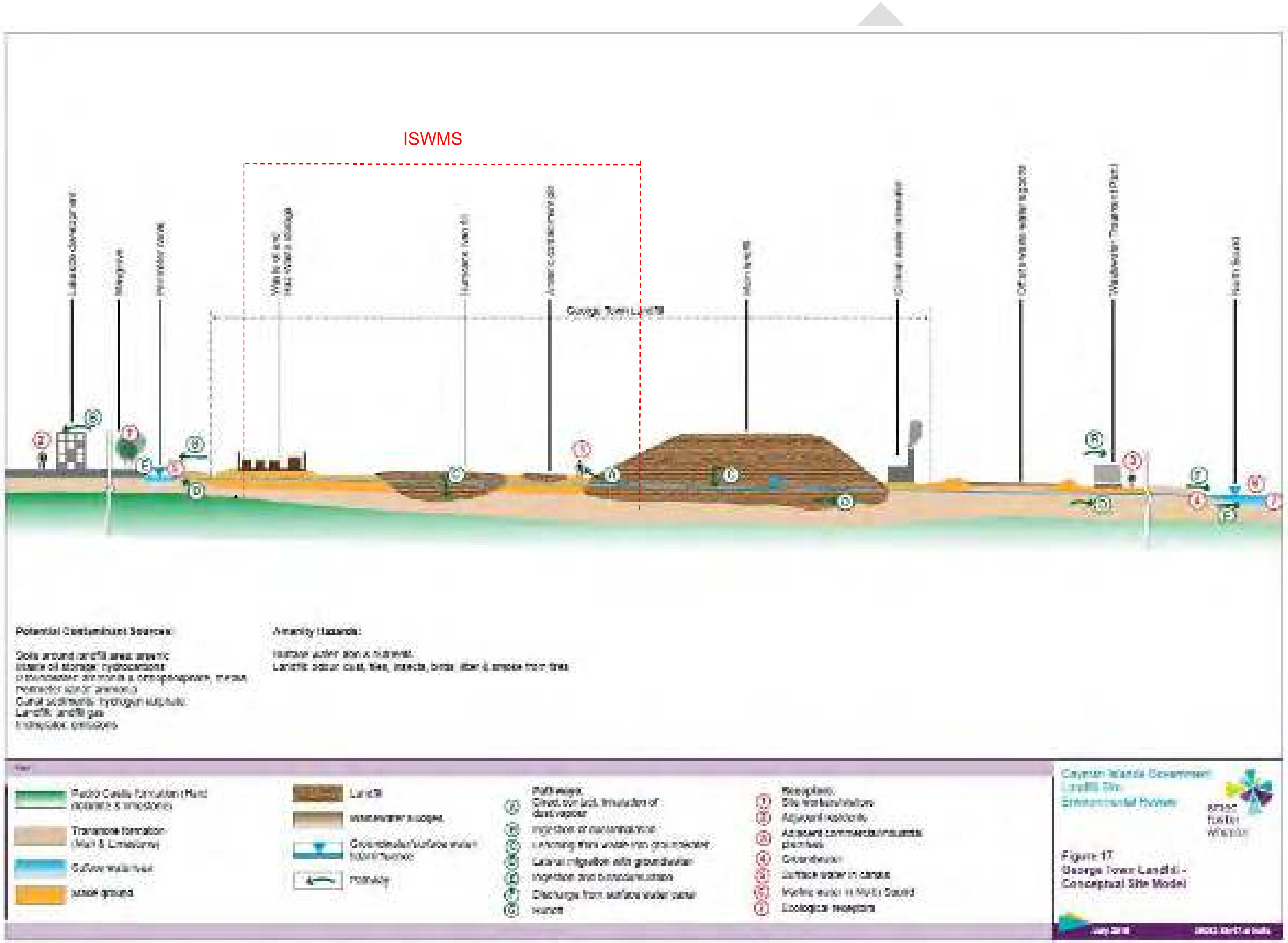

Figure 9.12 Conceptual Site Model – illustrative cross section with the approximate extent of the ISWMS facilities shown[109]

109 Amec Foster Wheeler, *Landfill Site Environmental Review Task 2: Environmental Investigations Interpretative Report,* 2016b

9.9 Impact assessment: Geotechnical

The likely significant land quality effects related to the geotechnical environment identified both in the ToR and during the assessment are provided in Table 9.15.

Table 9.15 Likely significant land quality effects (Geotechnical) that are recommended for assessment

Activity	Effect	Receptor
All phases (construction, operation and decommissioning) – Site activities	Existing waste surface layer, which is not suitable to support the proposed development.	ISWMS infrastructure
All phases (construction, operation and decommissioning) - Site activities	Karst features in subsurface such as sinkholes and caves that are unable to adequately support the proposed development leading to geotechnical instability.	Site staff, construction workers and visitors (human health) ISWMS infrastructure
All phases (construction, operation and decommissioning) - seismic/tectonic events	The Cayman Islands sit in an active seismic zone. Earthquakes and tsunamis are significant potential hazards.	Site staff, construction workers and visitors (human health) ISWMS infrastructure

9.9.1 Impact assessment

The geotechnical hazards can be listed in the following order in terms of their economic impact on the proposed development starting from less severe to most severe.

1. Waste layer, which is deemed unsuitable for support of the proposed development.
2. The Bluff Formation limestone or alternatively improved ground are considered the only suitable foundation supporting stratum.
3. The location of the Site in a high seismic zone.

All three of the above geotechnical hazards have been assessed in the absence of mitigation, as provided in Table 9.16.

Table 9.16 Assessment of potential geotechnical effects in relation to the ISWMS

Activity	Receptor	Sensitivity	Magnitude	Significance	Rationale
Development	**ISWMS infrastructure**	**Medium**	**Medium**	**Medium**	**The waste layer has a low bearing capacity. This is considered a Significant Effect.**
Construction on shallow foundations on Ironshore Formation	**Site staff, construction workers and visitors (human health)**	**Medium**	**Medium**	**Medium**	**Geotechnical instability could pose a risk to all on-Site persons. This is considered a Significant Effect.**
	ISWMS infrastructure	**Medium**	**Medium**	**Medium**	**Shallow cavities in Ironshore Formation may result in foundation collapse. This is considered a Significant Effect.**
Construction of piled foundations in bedrock of the Bluff Formation	**Site staff, construction workers and visitors (human health)**	**Medium**	**Medium**	**Medium**	**Geotechnical instability could pose a risk to all on-Site persons. This is considered a Significant Effect.**
	ISWMS infrastructure	**Medium**	**Medium**	**Medium**	**Cavities in limestone could cause loss of cement being poured to form cast-in-place piles. This is considered a Significant Effect.**
Operation of facility	**Site staff, construction workers and visitors (human health)**	**Medium**	**High**	**High**	**Cayman island seismicity could damage new structures, which could pose a risk to all on-Site persons. This is considered a Significant Effect.**
	ISWMS infrastructure	**Medium**	**High**	**High**	**Cayman island seismicity could damage new structures. This is considered a Significant Effect.**

Notes: All potentially significant effects are highlighted in bold

9.9.2 Summary of findings

As identified in Table 9.16, potentially significant impacts related to the ground conditions and geological setting of Grand Cayman have been identified in the absence of appropriate mitigation. As discussed in Section 9.11.1, these potentially significant impacts can be reasonably mitigated for the ISWMS Site.

9.10 Impact assessment: Geoenvironmental

9.10.1 Imported fill

GHD are aware that fill (e.g., soils or aggregates) will need to be imported during the construction of ISWMS, particularly to Area 3.

In many countries, importing recycled soils and aggregates (e.g., crushed concrete and demolition arisings) can represent sources of new contamination at development sites. Recycled aggregate, in particular, can be contaminated with asbestos where all asbestos-containing materials were not removed prior to demolition.

However, GHD have been informed by ReGen that any imported aggregates will be of virgin quarried stone as recycled aggregate is not currently available on the island. Indeed, one of the objectives of ISWMS is to establish a market for recycled secondary aggregate on the island as a more sustainable alternative to quarried stone. GHD also assume that any imported soils will also be uncontaminated and suitable for their intended use.

Consequently, it has been assumed that any imported fill will not pose any contamination risks and so such sources have not been considered within this impact assessment. Notwithstanding the above, it is recommended that the construction phase plan include suitable sampling and testing requirements for all imported soils and aggregates to provide auditable evidence of their quality and suitability.

9.10.2 Embedded measures

The currently proposed layout, design and operation of the ISWMS is described in Chapter 4 and appears to have already taken some consideration of potential land contamination risks, explicitly or otherwise. Some of these proposed mitigation measures are outlined in more detail in the sections below.

9.10.2.1 Area 1

Area 1 coincides with a number of known potential sources of contamination and is at greatest risk from gas migration associated with the adjacent GTLF but, in general, also represents the least sensitive uses assuming that the residual waste landfill and other open air storage areas have minimal above ground buildings or structures with enclosed unventilated voids in which gases may accumulate.

9.10.2.1.1 Medical Waste Facility

According to Chapter 4, "*The Medical Waste Facility will be constructed to receive, store and process medical waste, and occasional other wastes such as expired currency and confiscated illicit drugs and other combustible materials not suited for treatment at the ERF*". The Medical Waste Facility building will be open sided with a roof to protect the equipment beneath, which will help to mitigate any potential landfill gas risks.

9.10.2.1.2 Residual Waste Landfill (RWL)

According to Chapter 4, "t*he RWL will be an engineered facility with a composite liner, leachate containment, leachate treatment, environmental controls and monitoring*". It will be designed, constructed and/or operated in line with relevant modern US standards, which should include procedures to manage leachate, dusts, odours and landfill gas as covered by:

– Florida Administrative Code No. 62-701.340: General Criteria for Landfills

– Florida Administrative Code No. 62-701.400: Landfill Construction
– Florida Administrative Code No. 62-701.500: Landfill Operation Requirements
– Florida Administrative Code No. 62-701.600: Landfill Final Closure

The nature of the residual waste (principally post-combustion residues from the ERF) will limit its leachability and putrescibility. Additionally, the containment provided by the RWL basal / capping liners and accompanying leachate treatment and landfill gas management systems will further ensure that any leachate or landfill gas emissions are appropriately mitigated.

9.10.2.2 Area 2

Area 2 represents probably the most sensitive land uses at the ISWMS, including administration and maintenance buildings and public access areas. However, it is also located farther from the GTLF than Area 1 and so is shielded to a greater or lesser degree from any potential leachate or gas migration. However, although satellite imagery suggest Area 2 may be previously undeveloped, virgin land, initial investigations[110] suggest some degree of earlier waste disposal may be present in this area.

9.10.2.2.1 Energy Recovery Facility (ERF)

According to Chapter 4, "t*he ERF will be a state of the art controlled combustion (mass burn) facility that will render combustible, non recyclable waste to an inert ash and reduce the volume of incoming waste by 90 percent*":

– "*Advanced air pollution control (APC) and continuous emissions monitoring (CEM) systems will ensure that ERF emissions are able meet current and future standards and not pose an adverse effect to the environment*" minimising the risks from any aerial deposition.
– The ERF will generate two residual waste streams; bottom ash (Section 0) and air pollution control residues (APCR); "*The bottom ash will be managed via the proposed Bottom Ash Recycling Facility. The APCR and boiler ash will be stabilised with cement and / or pozzolan by means of a pan mixer at the ERF and thereafter discharged to a concrete mixer truck for transfer to and disposal at the proposed RWL*".
– It is anticipated that cooling will use abstracted groundwater "*from an array of three 425 ft deep borehole wells beneath the ISWMS Site. Once passed (non-contact) through the condensers, the 'spent' cooling water will then be returned to groundwater using a further array of three 725 ft deep discharge wells.*" This arrangement, involving physically separated primary and secondary cooling circuits, minimises the risk of the released cooling water being contaminated.

9.10.2.2.2 Green Waste Facility

According to Chapter 4, the facility "*will receive and process source segregated Yard Waste and will store the resulting compost and mulch products for onward resale into the Cayman marketplace*" and will operate to recognised standards (i.e., Resale secondary Yard Waste materials – Florida Administrative Code FAC 62 709.550). Achieving such standards should necessitate adequate quality control procedures with respect to the contamination of the received green wastes.

9.10.2.2.3 Green Waste Processing Facility

According to Chapter 4, the facility "*will receive and process source segregated Yard Waste and will store the resulting compost and mulch products for onward resale into the Cayman marketplace*" and will operate to recognised standards (i.e., Resale secondary Yard Waste materials – Florida Administrative Code FAC 62 709.550). Achieving such standards should necessitate adequate quality control procedures with respect to the contamination of the received green wastes.

[110] APEC, *Grand Cayman Proposed Integrated Solid Waste Management Facility: Energy Recovery Facility -Geotechnical Investigation and Report,* 2021

9.10.2.2.4 Construction and Demolition Waste Processing Facility

According to Chapter 4, the facility "*will allow for the recycling, recovery and diversion of construction and demolition wastes into aggregates, scrap metals and combustible material (using a shredder for bulky materials) for energy production in the ERF*". It will be located away from sensitive receptors and be designed, constructed and/or operated in line with relevant modern standards.

9.10.2.2.5 Bottom Ash Processing Facility

According to Chapter 4, the facility "*will be designed to process bottom ash from the ERF into a recovered aggregate which is suitable for use on the Cayman Islands and recovered ferrous and non ferrous metals that can be recycled through overseas markets for those materials*". The facility will be enclosed to provide complete containment to reduce dust emissions during operations. It will be designed, constructed and/or operated in line with relevant modern standards.

9.10.2.2.6 Abandoned and End of Life / Scrap Metal Processing Facility

According to Chapter 4, the facility will "*allow for the recycling, recovery and diversion of vehicles that have been abandoned or surpassed their useful life, as well as the processing of bulky scrap metals*". ELVs "*will be received, inspected, stripped of batteries, catalytic converters, airbags, tyres, etc. before being depolluted of all coolants, oils, and fuels to allow the recyclable components of the vehicles to be separated for re-use*". It will be designed, constructed and/or operated in line with relevant modern standards.

9.10.2.2.7 Materials Recycling Facility (MRF)

According to Chapter 4, the facility "*will be constructed to allow for the diversion and recovery of dry mixed recyclables (DMR) from Contract Waste in Grand Cayman and the Sister Islands; receiving, processing, baling and/or storing DMR for onward resale into local and off island recycling markets*". An indoor area will allow storage of baled "weather-sensitive DMR (e.g., baled paper and card, or UV sensitive baled plastic)", all other materials will be stored in bales outside or in shipping containers.

9.10.2.2.8 Household Waste Recycling Centre (HWRC)

According to Chapter 4, this "*will be the public's central drop-off point for recyclable/non-recyclable household waste, including specialist waste items such as hazardous household wastes*" and will "*comprise two distinct areas: a covered, single level re-use centre and an open, split level recycling centre close to the Project Site main entrance*". The HWRC will be fully concreted, with the re-use operations taking place under cover of the roofed building structure.

9.10.2.3 Area 3

Area 3 consists solely of the **CUC substation**. According to Chapter 4, this "*will be a pre-fabricated building(s) with specialized switchgear for connecting to the grid"* and "*The typical occupancy will be 1-2 people for monitoring and service"*. Area 3 will also require the importation of fill materials to provide adequate flood protection and vehicle access.

Area 3 is located to the north of the North Canal, which should isolate it from any contaminant or gas migration from the GTLF. Furthermore, this area is not suspected to have been subject to previous contaminative activities (e.g., waste disposal activities), although no data exists to confirm this.

9.10.2.4 Area 4

Area 4 consists solely of the **Landfill Gas Facility (LFG)**. According to Chapter 4, the LGF "*will be constructed to allow for the capture and destruction of LFG from the North Mound of the GTLF*" and "*Landfill gas will be extracted from the GTLF using a conventional gas extraction system of vertical wells bored into the landfill site, operating under slight negative pressure*". Depending on the location and design of the extraction system, the LGF should reduce or eliminate the potential for gas migration from the GTLF affecting other elements of the ISWMS. It will be designed, constructed and/or operated in line with Florida Administrative Code No. 62 701.530: Gas Management Systems.

The gas collection system for the currently capped North Mound (Phase 1) and proposed gas collection system for the ongoing Western Expansion (Phase 2) is presented in **(Appendix 9.A [Land Quality Assessment – Appendix A])**. This shows the location of each extraction well and an estimate of their zone of influence. The design suggests that negative pressure could be established within the deepest areas of waste, but that this may not extend to the shallower sloping sides of the landfill, including those adjacent to Area 1.

9.10.2.5 Construction Environmental Management Plan (CEMP)

According to Chapter 4, a CEMP will be prepared prior to any construction activities. This will define the specific environmental mitigation measures to be applied in order to demonstrate application of the relevant pollution prevention Legislation and Good Industry Practice.

It is currently intended that:

– The use of locally available material in construction will be maximized (including C&D waste).
– Extents of the existing arsenic pit will be carefully defined and marked out and thereafter prepared to receive the overlying RWL.

It should be noted that, prior to construction, further geotechnical investigations and surveys are scheduled in order to "*provide detailed geological and geotechnical information for layers of made ground (which will be used mainly for road design), peat and unconsolidated limestone and characteristics of the underlying Dolostone bedrock (which will be used mainly for foundation design)*". It is recommended that these investigations also consider the nature and extent of any contamination and, in particular, the gas generation and migration potential of any underlying madeground (including buried wastes).

9.10.3 Impact assessment

Due to the current unsustainable design and practices at the GTLF and resulting effects on soil (and groundwater) quality, it is likely that the construction of the ISWMS will result in net environmental benefits. However, there is the potential for shorter-term land contamination effects during the construction, operation and residual effects following the ultimate decommissioning of the ISWMS. These effects have been assessed in the following sections.

The potential for land contamination (metals, PAHs and possibly dioxins *etc.*) to arise as a result of unintentional fires associated with the storage of combustible wastes at various parts of the ISWMS has not been considered. The risk of such fires, together with the proposed mitigation measures, has been considered in Chapter 4.

9.10.3.1 Area 1

Area 1 is adjacent to the GTLF and represents the current location of the OSTSA, Arsenic Containment Cell, Equipment Storage Area and OHWSA, which are potential sources of contamination. The potential land quality effects of the proposed development on the relevant receptors (Section 9.4.1.1) identified during this assessment are summarised in Table 9.17 and the significance of these, in the absence of mitigation, is assessed in Table 9.18.

Table 9.17 ***Potential geoenvironmental effects identified in relation to Area 1. This area is primarily the proposed as the location of the Residual Waste Landfill (RWL), but also the Bottom ash storage and Medical waste facilities.***

Activity	Effect	Receptor
Construction Phase		
Disturbance, exposure and spread of existing contamination (including buried wastes) within the Old Scrap and Tyre Stockpile Area	Exposure (and potential spread) of contaminated soils at the Site surface and release of runoff, dusts, gases and vapours	• Site staff, construction workers and visitors (human health) • Surrounding land users (human health) e.g., residential, commercial/industrial, schools • (ground and surface water is outside scope of this report and discussed elsewhere)
Disturbance of existing contamination within the Arsenic Containment Cell (current plans involve constructing the RWL over the existing cell and so disturbance should be minimised)	Exposure (and potential spread) of contaminated soils at the site surface and release of runoff, dusts, gases and vapour	• Site staff, construction workers and visitors (human health) • Surrounding land users (human health) e.g., residential, commercial/industrial, schools • (ground and surface water is outside scope)
Disturbance of existing contamination within the Equipment Storage Area, particularly the Oil and Hazardous Waste Storage Area (*NB*: oil contamination has been observed in this area)	Exposure (and potential spread) of contaminated soils at the site surface and release of runoff, dusts, gases and vapour	• Site staff, construction workers and visitors (human health) • Surrounding land users (human health) e.g., residential, commercial/industrial, schools • (ground and surface water is outside scope)
Construction involving composite liner and capping	Impervious footprint has the potential to modify the current gas migration regime, increasing gas migration	• Surrounding land users (human health) e.g., residential, commercial/industrial, schools
Operational Phase		
Spillage or release of wastes during storage, transport or placement prior to capping	Exposure (and potential spread) of contaminated soils at the site surface and release of runoff, dusts, gases and vapour	• Site staff, construction workers and visitors (human health) • Surrounding land users (human health) e.g., residential, commercial/industrial, schools • (ground and surface water is outside scope)
Failure of landfill cap (e.g., due to flawed engineering, extreme weather events or sea-level rise)	Ingress of rainwater resulting in uncontrolled releases of leachate to the surrounding ground, and the escape of any accumulated gases and vapours	• Site staff, construction workers and visitors (human health) • Surrounding land users (human health) e.g., residential, commercial/industrial, schools • (ground and surface water is outside scope)
Failure of the composite liner (e.g., due to flawed engineering, extreme weather events or sea-level rise)	Ingress of groundwater and uncontrolled releases of leachate and contaminants to the surrounding ground	• Site staff, construction workers and visitors (human health) • Surrounding land users (human health) e.g., residential, commercial/industrial, schools • (ground and surface water is outside scope)

Activity	Effect	Receptor
Medical waste incinerator is anticipated to be diesel-fired	Leaks and spillages from the diesel storage and distribution system could affect the underlying soils (and ground water)	• Site staff, construction workers and visitors (human health) • ISWMS infrastructure • (ground and surface water is outside scope)
Storage and maturation of ERF Bottom ash	Release of contaminants in leachate and dusts leading to contamination of local soils	• Site staff, construction workers and visitors (human health) • (ground and surface water is outside scope)
Inappropriate disposal of additional wastes during emergency situations (e.g., hurricane or earthquake debris)	The composition of such wastes is unknown but may result in unsuitable materials being interred that could result in unforeseen leachate and gas/vapour issues that could affect the surrounding ground	• Site staff, construction workers and visitors (human health) • ISWMS infrastructure • Surrounding land users (human health) e.g., residential, commercial/industrial, schools • (ground and surface water is outside scope)

Notes: 1. No distinction has been made between the construction, operation and decommissioning phases of the RWL, as the construction and operation of a landfill occur concurrently and the landfill is not intended to be decommissioned, although it will be capped, restored and managed in the long-term.

Table 9.18 Significance assessment of potential geoenvironmental effects in relation to Area 1. All potentially significant effects are highlighted in bold.

Activity	Effect	Receptor	Sensitivity	Magnitude	Significance	Rationale
Construction Phase						
Disturbance, exposure and spread of existing contamination (including buried wastes) within the Old Scrap and Tyre Stockpile Area	Exposure (and potential spread) of contaminated soils at the site surface and release of runoff, dusts, gases and vapours	**Site staff, construction workers and visitors (human health)**	**Medium**	**Medium**	**Medium**	**Depending on the contaminants encountered the consequences could be substantial (e.g., asbestos or other carcinogens), but this is not likely to occur. However, some risks (particularly to construction workers) may require some degree of mitigation (Section 9.11.2). Until suitable and sufficient site investigation data is available, this is considered a potential Significant Effect**
		Surrounding land users (human health) e.g., residential, commercial/industrial, schools	High	Negligible	Low	The low contaminant mobility likely to be associated with such weathered wastes, mean it is very unlikely that off-Site effects will occur that are greater than those to on-Site receptors. Considered not to be significant.
Disturbance of existing contamination within the Arsenic Containment Cell (current plans involve constructing the RWL over the existing cell and so disturbance should be minimised)	Exposure (and potential spread) of contaminated soils at the site surface and release of runoff, dusts, gases and vapour	Site staff, construction workers and visitors (human health)	Medium	Medium	Medium	Arsenic, and chromium, (which are both potentially carcinogenic) are known to be present but no disturbance of these materials is proposed. Considered not to be significant.
		Surrounding land users (human health) e.g., residential, commercial/industrial, schools	High	Low	Medium	It is very unlikely that off-Site effects will occur that are greater than those to on-Site receptors. Considered not to be significant.
Disturbance of existing contamination within the Equipment Storage Area, particularly the Oil and Hazardous Waste Storage Area (NB oil contamination has been observed in this area)	Exposure (and potential spread) of contaminated soils at the site surface and release of runoff, dusts, gases and vapour	**Site staff, construction workers and visitors (human health)**	**Medium**	**Low**	**Medium**	**Oil contamination is known to exist and will need to be addressed. Although serious health effects are considered unlikely, some risks (particularly to construction workers) may require some degree of mitigation (Section 9.11.2). Until suitable and sufficient site investigation data is available, this is considered a potential Significant Effect**
		Surrounding land users (human health) e.g., residential,	High	Low	Medium	There have been no reported off-Site affects from the currently identified oil contamination. It is unlikely that any off-Site

Activity	Effect	Receptor	Sensitivity	Magnitude	Significance	Rationale
		commercial/industrial, schools				effects will occur if all on-Site receptors are protected. Considered not to be significant.
Construction involving composite liner and capping may modify the landfill gas migration	Impervious footprint has the potential to modify the current gas migration regime, increasing gas migration	Surrounding land users (human health) e.g., residential, commercial/industrial, schools	High	Low	Medium	The likelihood of landfill gas migration to Area 1 from the GTLF is considered to be minimal. It is considered unlikely that gas risks to surrounding properties would be increased. Considered not to be significant.
Operational Phase						
Spillage or release of wastes during storage, transport or placement prior to capping	Exposure (and potential spread) of contaminated soils at the site surface and release of runoff, dusts, gases and vapour	Site staff, construction workers and visitors (human health)	Medium	Medium	Medium	Some minor releases are likely during the 25 year operation. However, the operational standards are likely to ensure that only suitable materials are placed in the landfill and that any exposure of onsite workers is controlled. Considered not to be significant due to these inherent controls
		Surrounding land users (human health) e.g., residential, commercial/industrial, schools	High	Low	Medium	The relatively inert nature of the materials to be landfilled and the existing controls (which should include dust management), should mean that there is no significant risk to the health of off-Site receptors.
Failure of landfill cap (e.g., due to flawed engineering, extreme weather events or sea-level rise)	Ingress of rainwater resulting in uncontrolled releases of leachate to the surrounding ground, and the escape of any accumulated gases and vapours	Site staff, construction workers and visitors (human health)	Medium	Low	Medium	The relatively inert nature of the materials to be landfilled (solidified APCR etc.) should minimise the risk from leachable or volatile contaminants. The proposed construction standards should ensure that the cap is robust and installed to the required standard, and this EIA will consider potential Climate Change effects. Not considered significant
		Surrounding land users (human health) e.g., residential, commercial/industrial, schools	**High**	**Medium**	**High**	**The spread of landfill wastes could have serious affects over a large area. Although serious health effects are considered unlikely, some risks (particularly to construction workers) may require some degree of mitigation (Section 9.11.2). Until suitable and sufficient site investigation data is**

Activity	Effect	Receptor	Sensitivity	Magnitude	Significance	Rationale
						available, this is considered a potential Significant Effect
Failure of the composite liner (e.g., due to flawed engineering, extreme weather events or sea-level rise)	Ingress of groundwater and uncontrolled releases of leachate and contaminants to the surrounding ground	Site staff, construction workers and visitors (human health)	Medium	Low	Medium	The relatively inert nature of the materials to be landfilled (solidified APCR etc.) should minimise the risk from leachable or volatile contaminants. The proposed construction standards should ensure that the cap is robust and installed to the required standard, and this EIA will consider potential Climate Change effects. Not considered significant.
		Surrounding land users (human health) e.g., residential, commercial/industrial, schools	High	Low	Medium	Given the nature of the proposed landfill contents, any resulting leachate is unlikely to pose any serious off-Site risks. Not considered significant
Medical waste incinerator is anticipated to be diesel-fired (leaks)	Leaks and spillages from the diesel storage and distribution system could affect the underlying soils (and ground water)	Site staff, construction workers and visitors (human health)	Low	Low	Low	Release of limited volumes of relatively low toxicity fuels are unlikely to be significant at a waste management facility and there is unlikely to be any critical ISWMS infrastructure in Area 1 that may be affected (e.g., drinking water pipes)
		ISWMS infrastructure	Low	Low	Low	
Storage and maturation of ERF Bottom ash	Release of contaminants in leachate and dusts leading to contamination of local soils	Site staff, construction workers and visitors (human health)	Low	Low	Low	Significant affects are considered unlikely given the nature of the activities in Area 1
Inappropriate disposal of additional wastes during emergency situations (e.g., hurricane or earthquake debris	The composition of such wastes is unknown but may result in unsuitable materials being interred that could result in unforeseen	Site staff, construction workers and visitors (human health)	Medium	Low	Medium	Although such an event is foreseeable during the ISWMS operational period, it is not certain. Substantial affects were not reported following the uncontrolled burial of Hurricane Ivan debris. The landfill construction and existing occupational health controls etc. should prevent or minimise any onsite exposures. Not considered Significant

Activity	Effect	Receptor	Sensitivity	Magnitude	Significance	Rationale
	leachate and gas/vapour issues that could affect the surrounding ground	Surrounding land users (human health) e.g., residential, commercial/industrial, schools	High	Low	Medium	Although possible, given the landfill construction, it is unlikely that sufficient leachate or gases would be released to substantially affect any of the ISWMS infrastructure on Area 2 and could easily be detected via subsequent monitoring. Not considered significant.

9.10.3.2 Area 2

The potential land quality effects of the proposed development on the relevant receptors identified during this assessment are summarised in Table 9.19 and the significance of these, in the absence of mitigation, is assessed in Table 9.20.

Historically, waste incinerators are known to have been associated with downwind land contamination as a result of atmospheric deposition, including dioxins and heavy metals. However, according to Chapter 4 the design of the ERF is described as *"a state-of-the-art controlled combustion (mass burn) facility"* with "*Advanced air pollution control (APC) and continuous emissions monitoring (CEM) systems will ensure that ERF emissions are able meet current and future standards and not pose an adverse effect to the environment". Consequently, stack emissions from the ERF are been considered to be a potential operational source of land contamination.*

The potential for the handling of APC residues to generate hazardous dusts that could contaminate local soils or of inadequate stabilisation has also not been considered. This risk, together with the proposed mitigation measures, is assessed in Chapter 4.

Table 9.19 Potential geoenvironmental effects identified in relation to Area 2. There is some evidence that all or parts of this area may have been subject to historical waste disposal but is the proposed location for most other components of the ISWMS, including the Energy Recovery Facility.

Activity	Effect	Receptor
Construction Phase		
Disturbance, exposure and spread of buried wastes and associated contamination	Exposure (and potential spread) of contaminated soils at the site surface and release of runoff, dusts, gases and vapours	• Site staff, construction workers and visitors (human health) • Surrounding land users (human health) e.g., residential, commercial/industrial, schools
Releases and spillages of polluting materials and wastes during construction	Contamination of the underlying clean soils	• Site staff, construction workers and visitors (human health) • Surrounding land users (human health) e.g., residential, commercial/industrial, schools
Foundation and piling activities	Creation of migration pathways, including for ground gas and vapour migration	• Site staff, construction workers and visitors (human health) • ISWMS infrastructure
Construction of building and hardstanding	Impervious footprint has the potential to modify the current gas migration regime, increasing off-Site migration.	• Surrounding land users (human health) e.g., residential, commercial/industrial, schools
Operational Phase		
Storage and treatment of wastes contaminated with hazardous materials (e.g., Energy Recovery Facility, Green Waste Facility, Construction and Demolition Waste Facility, End of Life Vehicle Facility, Materials Recycling Facility and Household Waste Recycling Centre)	Contamination of underlying soils by non-aqueous phase liquids (e.g., oils), soluble contaminates in leachate/runoff or accumulation of contaminated dusts	• Site staff, construction workers and visitors (human health) • ISWMS infrastructure
	Inadequate management of contaminated surface water runoff leading to contamination of nearby soils	• Site staff, construction workers and visitors (human health) • ISWMS infrastructure • Surrounding land users (human health) e.g., residential, commercial/industrial, schools

Activity	Effect	Receptor
Storage and treatment of construction and demolition wastes contaminated with hazardous materials including asbestos-containing materials	Accumulation of contamination /asbestos fibres in underlying soils and potentially released and spread during treatment and onward during reuse as aggregate.	• Site staff, construction workers and visitors (human health) • ISWMS infrastructure
Vehicle and plant fuel storage It is anticipated that oil-based fuels will be stored on-Site.	Leaks and spillages from fuel storage and distribution system could affect the underlying soils (and ground water)	• Site staff, construction workers and visitors (human health) • ISWMS infrastructure
Leachate and runoff from the windrows at the Green Waste facility	Leading to contamination (including pesticides) of the underlying and surrounding soils	• Site staff, construction workers and visitors (human health) • ISWMS infrastructure
Potential return of geothermal cooling water (non-contact)	Reinjection of contaminated cooling water leading to contamination of the soils surrounding the injection point/soakaway	• Site staff, construction workers and visitors (human health) • ISWMS infrastructure
Vehicle operation and on-Site maintenance	Spillages and leaks of fuels, hydraulic fluids, coolants and waste oils *etc.* affecting underlying soils, particularly at maintenance and waste storage areas	• Site staff, construction workers and visitors (human health) • ISWMS infrastructure
Flooding or inundation due to extreme weather events or sea-level rise	Spread of wastes and contamination in floodwater/runoff leading to affects on soils beneath Area 2 and surrounding land	• Site staff, construction workers and visitors (human health) • ISWMS infrastructure • Surrounding land users (human health) e.g., residential, commercial/industrial, schools
Decommissioning Phase		
Uncontrolled decommissioning and disposal of plant and equipment containing hazardous materials	Release of hazardous materials (including dusts gases and vapours) into the underlying ground	• Site staff, construction workers and visitors (human health) • Surrounding land users (human health) e.g., residential, commercial/industrial, schools

Notes: 1. Ground and surface water is outside of Land Quality scope and therefore not considered as receptors

Table 9.20 Significance assessment of potential geoenvironmental effects in relation to Area 2. All potentially significant effects are highlighted in bold.

Activity	Effect	Receptor	Sensitivity	Magnitude	Significance	Rationale
Construction Phase						
Disturbance, exposure and spread of existing contamination (particularly buried wastes) in the underlying soils	Exposure (and potential spread) of contaminated soils at the site surface and release of runoff, dusts, gases and vapours	**Site staff, construction workers and visitors (human health)**	**Medium**	**Medium**	**Medium**	**Depending on the contaminants encountered the consequences could be substantial (e.g., asbestos or other carcinogens), but this is not likely to occur. However, some risks (particularly to construction workers) may require some degree of mitigation (Section 9.11.2). Until suitable and sufficient Site investigation data is available, this is considered a potential Significant Effect**
		Surrounding land users (human health) e.g., residential, commercial/industrial, schools	High	Low	Medium	The poor contaminant mobility likely to be associated with such weathered wastes, mean it is very unlikely that off-Site effects will occur that are greater than those to on-Site receptors. Considered not to be significant
Releases and spillages of polluting materials and wastes during construction	Contamination of the underlying soils	Site staff, construction workers and visitors (human health)	Medium	Low	Medium	Some releases are likely, but are unlikely to be sufficient in scale to be significant. Considered not to be significant
		Surrounding land users (human health) e.g., residential, commercial/industrial, schools	High	Low	Medium	It is less likely for there to be any effects for off-Site receptors. Not considered significant

Activity	Effect	Receptor	Sensitivity	Magnitude	Significance	Rationale
Foundation and piling activities	Creation of migration pathways, including for ground gas (e.g., from underlying alluvium and/or migration from GTLF) and vapour migration	Site staff, construction workers and visitors (human health)	Medium	Medium	Medium	While there is some uncertainty about the potential gas risk, it is likely that any migration from the GTLF will negligible and the gas generation potential of the underlying soils will be low. Based on the nature of the development, the gas risk is thus considered to be low.and so is not considered a potentially Significant effect
		ISWMS infrastructure	Medium	Medium	Medium	While there is some uncertainty about the potential gas risk, it is likely that any migration from the GTLF will negligible and the gas generation potential of the underlying soils will be low. Based on the nature of the development, the gas risk is thus considered to be low.and so is not considered a potentially Significant effect
Construction of building and hardstanding	Impervious footprint has the potential to modify the current gas migration regime, increasing offsite migration.	Surrounding land users (human health) e.g., residential, commercial/industrial, schools	High	Low	Medium	In the absence of adequate Site investigation data and gas risk assessment, it is possible that off-Site gas migration from the GTLF could occur. However, due to the landfill gas extraction system, this is considered unlikely and so is not considered a potentially Significant effect
Operational Phase						
Storage and treatment of wastes contaminated with hazardous materials (e.g., Energy Recovery Facility, Green Waste Facility, Construction and Demolition Waste Facility, End of Life Vehicle Facility, Materials Recycling Facility and	Contamination of underlying soils by non-aqueous phase liquids (e.g., oils), soluble contaminates in leachate/runoff or accumulation of contaminated dusts	Site staff, construction workers and visitors (human health)	Medium	Medium	Medium	Although some hazardous materials may be stored and treated, these should be identified and managed using appropriate occupational controls etc. Not considered significant
		ISWMS infrastructure	Medium	Low	Medium	Although possible, any affects are unlikely to have serious effects on the function or safety of infrastructure. Not considered significant
	Inadequate management of contaminated	Site staff, construction workers and visitors (human health)	Medium	Low	Medium	Given existing occupational H&S controls, exposure via surface water runoff is unlikely to be of concern. Not considered significant

Activity	Effect	Receptor	Sensitivity	Magnitude	Significance	Rationale
Household Waste Recycling Centre)	surface water runoff leading to contamination of nearby soils	ISWMS infrastructure	Medium	Low	Medium	Likely runoff concentrations are unlikely to have serious effects on the function or safety of infrastructure. Not considered significant
		Surrounding land users (human health) e.g., residential, commercial/industrial, schools	High	Low	Medium	If not sufficiently mitigated, contaminated runoff could affect more sensitive off-Site receptors. In the absence of detailed drainage and runoff treatment plans, this is not considered a potential Significant Effect
Storage and treatment of construction and demolition wastes contaminated with hazardous materials including asbestos-containing materials	Accumulation of asbestos fibres in underlying soils and potentially released and spread during treatment and onward during reuse as aggregate.	**Site staff, construction workers and visitors (human health)**	**Medium**	**Low**	**Medium**	**Some C&D materials will contain asbestos and it is becoming apparent that they may also be tainted by other sorbed contaminants. Adequate control measures will be required (*e.g.,* periodic testing and occupational hygiene monitoring). Considered a potential Significant Effect**
		ISWMS infrastructure	Medium	Negligible	Low	Compared to Site staff, effects of infrastructure are likely to be negligible. Not considered significant
Vehicle and plant fuel storage	Leaks and spillages from fuel storage and distribution system could affect the underlying soils (and ground water)	Site staff, construction workers and visitors (human health)	Medium	Low	Medium	The volume of fuel stored is likely to be minimal and the health risks for diesel are not substantial. Not considered significant
		ISWMS infrastructure	Medium	Negligible	Low	Not considered significant
Leachate and runoff from irrigation of the windrows at the Green Waste facility	Leading to contamination (including pesticides) of the underlying and surrounding soils	Site staff, construction workers and visitors (human health)	Medium	Low	Medium	The leachate is unlikely to have substantial toxicity but due to the long-term operation, adequate consideration of leachate management is required. However, this is not considered a significant effect
		ISWMS infrastructure	Medium	Low	Medium	No substantial effects on infrastructure are anticipated. Not considered significant

Activity	Effect	Receptor	Sensitivity	Magnitude	Significance	Rationale
Potential return of geothermal cooling water (non-contact)	Reinjection of contaminated cooling water leading to contamination of the soils surrounding the injection point/soakaway	Site staff, construction workers and visitors (human health)	Medium	Negligible	Low	"No contact" design minimises any risks. Not significant
		ISWMS infrastructure	Medium	Low	Medium	"No contact" design minimises any risks. Not significant
Vehicle operation and on-Site maintenance	Spillages and leaks of fuels, hydraulic fluids, coolants and waste oils *etc.* affecting underlying soils, particularly at maintenance and waste storage areas	Site staff, construction workers and visitors (human health)	Medium	Low	Medium	Even if vehicle maintenance does occur on-Site, spillages should be minimal and volumes limited. Not significant
		ISWMS infrastructure	Medium	Low	Medium	No substantial effects on infrastructure are anticipated. Not considered significant
Flooding or inundation due to extreme weather events or sea-level rise	Spread of wastes and contamination in floodwater/runoff leading to affects on soils beneath Area 2 and surrounding land	Site staff, construction workers and visitors (human health)	Medium	Low	Medium	The likely affects are unlikely to substantially raise the existing risks from the working environment. Not considered significant
		ISWMS infrastructure	Medium	Low	Medium	Th contamination risks to infrastructure unlikely to affect function or safety. Not significant
		Surrounding land users (human health) e.g., residential, commercial/industrial, schools	**High**	**Medium**	**High**	**The spread of landfill wastes could have serious affects over a large area. Although serious health effects are considered unlikely, some risks (particularly to construction workers) may require some degree of mitigation (Section 9.11.2). Until suitable and sufficient site investigation data is available, this is considered a potential Significant Effect**

Activity	Effect	Receptor	Sensitivity	Magnitude	Significance	Rationale
Decommissioning Phase						
Uncontrolled decommissioning and disposal of plant and equipment containing hazardous materials	Release of hazardous materials (including dusts gases and vapours) into the underlying ground	Site staff, construction workers and visitors (human health)	Medium	Medium	Medium	The incorporation of hazardous materials into the fabric or the accumulation of hazardous waste residues, could pose a risk to those undertaking demolition. However, such risks apply to all demolition and are not unusual. Not considered significant
		Surrounding land users (human health) e.g., residential, commercial/industrial, schools	High	Low	Medium	If on-Site hazards are managed, off-Site risks should be minimal. Not considered significant

9.10.3.3 Area 3

The current information suggests that land contamination is unlikely to affect Area 3 as it has apparently not been used for waste disposal operations and is isolated from gas migrating from the GTLF. Thus, the potential land quality effects of the proposed development on the relevant receptors are limited to those summarised in Table 9.21 and the significance of these, in the absence of mitigation, is assessed in Table 9.22.

Table 9.21 Potential geoenvironmental effects identified in relation to Area 3 (CUC substation). No underlying contamination or landfill gas migration is anticipated in this area.

Activity	Effect	Receptor
Construction Phase		
Releases and spillages of polluting materials and wastes during construction	Introducing new contamination, which may become mobile, resulting in contaminated soils being present at the Site surface and release of runoff, dusts, gases and vapours.	• Site staff, construction workers and visitors (human health) • Surrounding land users (human health) e.g., residential, commercial/industrial, schools
Operational Phase		
None identified	None identified	None identified
Decommissioning Phase		
Uncontrolled decommissioning and disposal of plant and equipment containing hazardous materials	Release of hazardous materials (including dusts gases and vapours) into the underlying ground	• Site staff, construction workers and visitors (human health) • Surrounding land users (human health) e.g., residential, commercial/industrial, schools

Notes: 1. Ground and surface water is outside of Land Quality scope and therefore not considered as receptors

Table 9.22 Significance assessment of potential geoenvironmental effects in relation to Area 3 (CUC substation). All potentially significant effects are highlighted in bold.

Activity	Effect	Receptor	Sensitivity	Magnitude	Significance	Rationale
Construction Phase						
Releases and spillages of polluting materials and wastes during construction	Contamination of the underlying clean soils	Site staff, construction workers and visitors (human health)	Medium	Low	Medium	Some releases are likely but are unlikely to be sufficient in scale to be significant. Considered not to be significant
		Surrounding land users (human health) e.g., residential, commercial/industrial, schools	High	Low	Medium	It is less likely that any effects will affect off-Site receptors. Not considered significant
Decommissioning Phase						
Uncontrolled decommissioning and disposal of plant and equipment containing hazardous materials	Release of hazardous materials (including dusts gases and vapours) into the underlying ground	Site staff, construction workers and visitors (human health)	Medium	Medium	Medium	The incorporation of hazardous materials into the fabric or the accumulation of hazardous waste residues, could pose a risk to those undertaking demolition. However, such risks apply to all demolition and are not unusual. Not considered significant.
		Surrounding land users (human health) e.g., residential, commercial/industrial, schools	High	Low	Medium	If on-Site hazards are managed, off-Site risks should be minimal. Not considered significant.

9.10.3.4 Area 4

The Landfill Gas Facility is to be located on the 'Old Landfill' but there is considerable uncertainty regarding both the contamination levels associated with any buried wastes and the degree of landfill gas generation in this vicinity. The potential land quality effects of the proposed development on the relevant receptors identified during this assessment are summarised in Table 9.23 and the significance of these, in the absence of mitigation, is assessed in Table 9.24.

Table 9.23 Potential geoenvironmental effects identified in relation to Area 4 (Landfill Gas Facility). This area is located on or near the 'Old Landfill'.

Activity	Effect	Receptor
Construction Phase		
Disturbance, exposure and spread of existing contamination (particularly buried wastes) in the underlying soils	Exposure (and potential spread) of contaminated soils at the Site surface and release of runoff, dusts, gases and vapours	• Site staff, construction workers and visitors (human health) • Surrounding land users (human health) e.g., residential, commercial/industrial, schools
Releases and spillages of polluting materials and wastes during construction	Contamination of the underlying clean soils	• Site staff, construction workers and visitors (human health) • Surrounding land users (human health) e.g., residential, commercial/industrial, schools
Foundation and piling activities	Creation of migration pathways, including for ground gas and vapour migration	• Site staff, construction workers and visitors (human health) • ISWMS infrastructure
Construction of building and hardstanding	Impervious footprint has the potential to modify the current gas migration regime, increasing off-Site migration.	• Surrounding land users (human health) e.g., residential, commercial/industrial, schools
Operational Phase		
None identified	None identified	None identified
Decommissioning Phase		
Uncontrolled decommissioning and disposal of plant and equipment containing hazardous materials	Release of hazardous materials (including dusts gases and vapours) into the underlying ground	• Site staff, construction workers and visitors (human health) • Surrounding land users (human health) e.g., residential, commercial/industrial, schools

Notes: 1. Ground and surface water is outside of Land Quality scope and therefore not considered as receptors

Table 9.24 Assessment of potential geoenvironmental effects in relation to Area 4 (Landfill Gas Facility). All potentially significant effects are highlighted in bold.

Activity	Effect	Receptor	Sensitivity	Magnitude	Significance	Rationale
Construction Phase						
Disturbance, exposure and spread of existing contamination (particularly buried wastes) in the underlying soils	Exposure (and potential spread) of contaminated soils at the site surface and release of runoff, dusts, gases and vapours	**Site staff, construction workers and visitors (human health)**	**Medium**	**Medium**	**Medium**	**Depending on the contaminants encountered the consequences could be substantial (e.g., asbestos or other carcinogens), but this is not likely to occur. However, some risks (particularly to construction workers) may require some degree of mitigation (Section 9.11.2). Until suitable and sufficient site investigation data is available, this is considered a potential Significant Effect**
		Surrounding land users (human health) e.g., residential, commercial/industrial, schools	High	Low	Medium	The poor contaminant mobility likely to be associated with such weathered wastes, means it is very unlikely that off-Site effects will occur that are greater than those to on-Site receptors. Considered not to be significant
Releases and spillages of polluting materials and wastes during construction	Contamination of the underlying soils	Site staff, construction workers and visitors (human health)	Medium	Low	Medium	Some releases are likely but are unlikely to be sufficient in scale to be significant. Considered not to be significant
		Surrounding land users (human health) e.g., residential, commercial/industrial, schools	High	Low	Medium	It is less likely that any effects will affect off-Site receptors. Not considered significant
Foundation and piling activities	Creation of migration pathways, including for ground gas (e.g., from underlying alluvium and/or migration from GTLF) and vapour migration	Site staff, construction workers and visitors (human health)	Medium	Medium	Medium	While there is some uncertainty about the potential gas risk, it is likely that any migration from the GTLF will negligible and the gas generation potential of the underlying soils will be low. Based on the nature of the development, the gas risk is thus considered to be low.and so is not considered a potentially Significant effect
		ISWMS infrastructure	Medium	Medium	Medium	While there is some uncertainty about the potential gas risk, it is likely that any migration from the GTLF will negligible

Activity	Effect	Receptor	Sensitivity	Magnitude	Significance	Rationale
						and the gas generation potential of the underlying soils will be low. Based on the nature of the development, the gas risk is thus considered to be low and so is not considered a potentially Significant effect
Construction of building and hardstanding	Impervious footprint has the potential to modify the current gas migration regime, increasing offsite migration.	Surrounding land users (human health) e.g., residential, commercial/industrial, schools	High	Low	Medium	The gas generation potential of buried wastes in Area 4 is expected to be low. Not considered significant.
Decommissioning Phase						
Uncontrolled decommissioning and disposal of plant and equipment containing hazardous materials	Release of hazardous materials (including dusts gases and vapours) into the underlying ground	Site staff, construction workers and visitors (human health)	Medium	Medium	Medium	The incorporation of hazardous materials into the fabric or the accumulation of hazardous waste residues, could pose a risk to those undertaking demolition. However, such risks apply to all demolition and are not unusual. Not considered significant.
		Surrounding land users (human health) e.g., residential, commercial/industrial, schools	High	Low	Medium	If on-Site hazards are managed, off-Site risks should be minimal. Not considered significant

9.10.4 Potential risk management options

Until sufficient Site investigation data is available regarding the levels of soil contamination present, the need for, and specification of, any risk management options (i.e*.,* remediation) cannot be ascertained. However, given the nature of the development it is likely that substantial concentrations of contamination would need to be present before any risks would be considered unacceptable (i.e., remediation warranted)[111]. This is likely to limit the scope of any remediation required.

If risk management is required, an options appraisal exercise will be needed to identify the most appropriate remediation option or combination of options. The selection of the wide range of potential options will depend on a variety of factors, including:

– Cost (including on-island availability);
– Available timescale;
– Nature of the contamination:
  - Organic or inorganic (including biodegradability);
  - Gross or light contamination; and
  - Localised or widespread.
– Nature of the receptor(s) at risks:
  - Human health or infrastructure[112]; and
  - On-Site or offsite

Given the pollutant linkages outlined in the CSM (Section 9.8) and the low sensitivity of the development, it is likely that relatively low-risk and low-complexity remediation options would be appropriate. For example:

– Most risks to construction workers could be addressed by avoiding disturbance of heavily contaminated areas or, where necessary, adopting appropriate occupational hygiene practices (i.e*.,* suitable welfare facilities, appropriate PPE and, if needed, respiratory protection).
– Most risks to site staff and visitors (i.e., on-Site human health) and surrounding land users (i.e*.,* off-Site human health) could be addressed through targeted excavation to a limited depth and disposal in the RWL, changes to the layout of hardstanding and building footprints to avoid or cover the contamination and/or application of a layer of clean capping (i.e., soils, aggregates or hardstanding).
– Most risks to "ISWMS infrastructure" could be addressed by modifying its design/specification (e.g., specifying contaminant-resistant concrete for in-ground structures, or contaminant resistant drinking water pipe materials).
– Risks to from ground gases and vapours would be limited to internal voids and spaces within buildings and structures and could be addressed through adequate consideration during foundation design (e.g., specifying naturally or mechanically ventilated sub-slab voids, gas and vapour membranes within foundations and/or gas alarms).

9.10.5 Summary of findings

An assessment of the significance of each of the potential geoenvironmental effects identified with respect to Area 1 is presented in Table 9.18. In the absence of adequate site investigation data, this identified the following potentially significant effects.

1. Contamination (particularly buried wastes) associated with the OSTSA affecting the health of Site staff, construction workers and visitors;

[111] In addition to any requirement to mitigate harmful effects from contamination, remediation could also be required for aesthetic (*e.g.,* odour) or geotechnical reasons.
[112] The need for soil remediation could also be driven by risks to ground or surface waters, but such risks are considered elsewhere.

2. Contamination (particularly buried wastes) associated with the Equipment Storage Area, particularly the OHWSA, affecting the health of Site staff, construction workers and visitors; and
3. Failure of the RWL cap (e.g., due to flawed engineering, extreme weather events or sea-level rise) leading to the spread of landfill contents over a wide area affecting the health of surrounding land users (e.g., residential, commercial/industrial, schools).

An assessment of the significance of each of the potential geoenvironmental effects identified with respect to Area 2 is presented in Table 9.20. In the absence of adequate site investigation data, this identified the following potentially significant effects:

1. Contamination (particularly buried wastes) exposed during site development affecting the health of Site staff, construction workers and visitors;
2. Storage and treatment of construction and demolition wastes contaminated with hazardous materials (including asbestos-containing materials) affecting the health of Site staff, construction workers and visitors; and
3. Flooding or inundation due to extreme weather events or sea-level rise resulting in the spread of wastes/contamination across a wide area affecting the health of surrounding land users (e.g., residential, commercial/industrial, schools).

An assessment of the significance of each of the potential geoenvironmental effects identified with respect to Area 3 (CUC substation) is presented in Table 9.22. No potentially significant effects were identified.

An assessment of the significance of each of the potential geoenvironmental effects identified with respect to Area 4 (Landfill Gas Facility) is presented in Table 9.24. In the absence of adequate site investigation data, this identified the following potentially significant effects:

1. Contamination (particularly buried wastes) exposed during site development affecting the health of Site staff, construction workers and visitors;

9.11 Mitigation Measures

9.11.1 Geotechnical

9.11.1.1 Geotechnical features of the exiting Formations

The poor bearing capacity of the man-made surficial layer and/or of peaty deposits renders it unsuitable support for the proposed development without mitigation. Development loads must therefore be transferred down to the more competent Ironshore or bedrock of the Bluff Formation. Even if these Formations may be considered suitable to support building foundations, they both present some features that may affect their geotechnical competence as mentioned in the following paragraphs.

9.11.1.1.1 Ironshore Formation

According to APEC[113], the Ironshore Formation (*Marl*) is cemented by calcite and can be described as a weak limestone rock in which interbedded layers of cemented and non-cemented material can be found.

The Standard Penetration Test (SPT) performed in this Formation provides generally low blow counts (N values) and does not adequately describe the physical properties of the 'marl'. These low values are often associated with the breaking of the cementation of the 'marl' during the SPT sampling, giving the impression of loose soil.

It is worth noting that the cemented nature of the 'marl' sustains small voids within the Ironshore Formation, in particular at the interface zone with Bluff Formation. The dimensions of these voids are not mentioned in the available documents. The presence of such voids may affect the stability of shallow footings founded into this Formation.

[113] APEC. *Grand Cayman Proposed Integrated Solid Waste Management Facility: Energy Recovery Facility -Geotechnical Investigation and Report*, Status: Draft Final, Dated Mar 2021, Ref: 17015

9.11.1.1.2 Bluff Formation

Numerous cavities were found in this Formation mainly in the Cayman and Brac Formations. The eventual presence of such cavities at shallow depth beneath the tip of deep foundations (piles) may cause a loss of bearing capacity in case of cavity collapse.

9.11.1.2 Supplemental geophysical investigation

In order to mitigate the risk that a foundation system (either shallow or deep) interfere with any eventual cavity, supplemental geophysical investigations are recommended. Among the techniques, Electrical Resistivity Tomography (ERT), Hydro-Tisar or Refraction seismic Tomography are the most relevant. They may all allow for the cavity mapping down to a reasonable depth. Using the resulting maps to better define proposed structures limits may help mitigating the risk that a cavity impacts the foundations stability.

These investigation techniques may not be readily available in Cayman and involve mobilization from overseas. The required technical staff and equipment to perform a geophysical investigation is relatively limited (two persons and medium size truck for the equipment).

9.11.1.3 General geotechnical recommendations

As previously mentioned, both of the existing Ironshore and Bluff Formations may serve as a bearing stratum for the proposed development. Depending on the surficial inappropriate man made deposit thickness in the proposed development footprint, and eventually on the geophysical cavity mapping (see Section 9.11.1.2), the use of both shallow and deep foundation systems could be considered. Note that the foundation type to be considered should be designed to resist the seismic forces discussed in Section 9.5.4 in accordance with applicable building codes.

9.11.1.3.1 Shallow foundations (column and strip footings)

9.11.1.3.1.1 Areas with limited man-made deposit thickness

In the areas where the surficial man-made deposit is limited, the man-made deposit should first be entirely removed in the whole building footprint down to the Ironshore Formation.

The exposed Ironshore Formation surface should then be carefully inspected, and any cavity/void/crack should be filled using either compacted granular material of concrete.

A geotextile should be spread on the exposed Ironshore Formation (to prevent any loss of the soil particles).

An engineering fill should then be constructed above the geotextile up to the proposed structure foundations and slab levels. The use of geogrids may also be required depending on the subgrade conditions.

9.11.1.3.1.2 Areas with higher man-made deposit thickness

In the areas where the Bluff Formation is deeper, ground improvement techniques should be considered to allow for the use of shallow foundation systems. These techniques require generally specific equipment that are not available in the Islands. Among these methods, vibro-compaction, controlled modulus columns (CMCs) and Geopiers seem to be applicable techniques for the proposed development. The choice of the most suitable technique and its design should be done by an experienced ground improvement contractor.

9.11.1.3.2 Deep foundations (piles)

It is understood that the use of cast-in-place piles is quite common on the island. It should be noted that loss of concrete installed through the vuggy Ironshore Formation and honeycombed Bluff Limestone could be quite significant. Steel casings set in the bedrock can be used to mitigate the loss of concrete but will not mitigate the risk that a cavity be present at shallow depth beneath the pile tip. Geophysical mapping of the cavities may help in mitigating this risk.

In any case, if the use of deep foundations system is considered, the floor slab should imperatively be structural, i.e., supported by foundation elements transferring the loads to the Bluff Formation (by means of piles, micro piles, grade beams etc.).

9.11.1.4 Significance evaluation considering geotechnical mitigation measures

Table 9.25 Assessment of potential geotechnical effects in relation to the ISWMS with the application of mitigation measures

Activity	Receptor	Sensitivity	Magnitude	Mitigation	Magnitude (considering mitigation)	Significance (considering mitigation)	Rationale
Development	ISWMS infrastructure	Medium	Medium	Development loads transferred down to Ironshore or bedrock of the Bluff Formation.	Low	Medium	The low bearing capacity of the waste layer is mitigated by the transfer of development loads to the Ironshore or bedrock of the Bluff Formation. This is not considered a Significant Effect.
Construction on shallow foundations on Ironshore Formation	Site staff, construction workers and visitors (human health)	Medium	Medium	Installation of geotextile and geogrids, if needed	Low	Medium	The presence of geotextile and geogrids will prevent the occurrence of sinkholes in the engineered fill and minimize the risk of foundation damage and loss of capacity. This is not considered a Significant Effect.
	ISWMS infrastructure	Medium	Medium		Low	Medium	
Construction of piled foundations in bedrock of the Bluff Formation	Site staff, construction workers and visitors (human health)	Medium	Medium	Map cavity locations via supplemental geophysical investigations to better define the limits of proposed structures.	Low to Negligible	Medium to Low	Geotechnical instability is reduced by avoiding cavity locations in the bedrock of the Bluff Formation. This is not considered a Significant Effect.
	ISWMS infrastructure	Medium	Medium		Low to Negligible	Medium to Low	
Operation of facility	Site staff, construction workers and visitors (human health)	Medium	High	ISWMS facilities and foundation systems will be designed to resist seismic forces in accordance with applicable building codes. Application of the measures above will also contribute to mitigation of structural seismic response.	Low	Medium	ISWMS facilities and foundation systems will be designed to withstand Cayman Island seismicity in accordance with applicable building codes. Application of the measures above to transfer development loads down to Ironshore or bedrock of the Bluff Formation, install geotextile and geogrids on Ironshore Formation (if needed), and map cavity locations in bedrock of the Bluff Formation will also contribute to mitigation of structural seismic response. This is not considered a Significant Effect.
	ISWMS infrastructure	Medium	High		Low	Medium	

Notes: All potentially significant effects are highlighted in bold

9.11.1.5 Summary of findings

As identified in Table 9.25, the potentially significant impacts related to the ground conditions and geological setting of Grand Cayman can be mitigated through the application of appropriate measures. As such, it is considered that there are no significant effects associated with the geotechnical environment in relation to the proposed ISWMS development.

9.11.2 Geoenvironmental

9.11.2.1 Area 1

A number of potentially Significant Effects have been identified with respect to Area 1. In order to mitigate these potential effects, appropriate site investigation activities across Area 1 are needed, which could be combined with any required geotechnical investigation/remediation, to:

– Identify if any waste materials are present and, if so, to determine their characteristics and extent (both lateral and depth);
– Identify any additional sources of contamination; and
– Confirm the concentration of relevant contaminants, particularly in Made Ground, and their extents.

Once this data is available an appropriate generic quantitative risk assessment should be undertaken to reassess the significance of the effects identified and confirm that no other significant effects are indicated.

To ensure that any unacceptable risks are adequately managed, including within the Oil and Hazardous Waste Storage Area, where contaminant concentrations exceed the relevant CCTLs the affected materials will be excavated for stockpiling and subsequent removal to the RWL once the RWL is constructed. Materials below the CCTLs do not pose an unacceptable risk and so no mitigation or remediation of such materials is required.

It is essential that the cap used to seal completed sections of the RWL remains intact into the future; this needs to include consideration of foreseeable changes to the local climate and sea level due to climate change. The RWL is intended to be constructed in a phased manner and capping of the first phase is not anticipated until parts of the landfill have reached final tipping levels. Prior to any capping, checks should be made to ensure that the current design is adequate in light of the latest climate data and modelling and procedures put in place to ensure that the ultimate construction is in line with the agreed design.

9.11.2.2 Area 2

Further potentially Significant Effects have also been identified with respect to Area 2. Mitigation of a number of these also requires additional appropriate site investigation activities across Area 2, which could be combined with any required geotechnical investigation and/or earthworks verification testing, to:

– Identify if any waste materials are present and, if so, to determine their characteristics and extent (both lateral and depth);
– Identify any additional sources of contamination; and
– Confirm the concentration of relevant contaminants, particularly in Made Ground, and their extents.

To ensure that any unacceptable risks are adequately managed, where contaminant concentrations exceed the relevant CCTLs the affected materials will be excavated for stockpiling and subsequent removal to the RWL once the RWL is constructed. Materials below the CCTLs do not pose an unacceptable risk and so no mitigation or remediation of such materials is required. If not already available, a detailed surface runoff management plan should be prepared, which details all areas from which runoff can arise and all locations where surface water contamination may arise. The plan should then propose appropriate and adequate runoff collection and treatment options for the identified runoff. It is recommended that, wherever possible, the principles of Sustainable Urban Drainage Systems[114] should be applied.

9.11.2.3 Area 3

No potentially Significant Effects were identified with respect to Area 3.

9.11.2.4 Area 4

A number of potentially Significant Effects have been identified with respect to Area 4. In order to mitigate these potential effects, appropriate site investigation activities across Area 4 are needed, which could be combined with any required geotechnical investigation, to:

– Identify if any waste materials are present and, if so, to determine their characteristics and extent (both lateral and depth);
– Identify any additional sources of contamination; and
– Confirm the concentration of relevant contaminants, particularly in Made Ground, and their extents.

To ensure that any unacceptable risks are adequately managed, where contaminant concentrations exceed the relevant CCTLs the affected materials will be excavated for stockpiling and subsequent removal to the RWL once the RWL is constructed. Materials below the CCTLs do not pose an unacceptable risk and so no mitigation or remediation of such materials is required.

9.12 Conclusions

9.12.1 Geotechnical

A review of the Site geology and geotechnical conditions show that the relatively flat Site is located in a high seismic zone and is covered with historical landfill waste material mixed with marl underlain by cemented coral deposits known as Ironshore Formation. These two stratigraphic units are underlain by the Bluff Formation limestone available at a depth of 13 to 20 ft (4 to 6 m) below the existing grades. The groundwater table is at approximately 0 ft AMSL.

The surficial man-made deposit is considered unsuitable for support foundation loads without mitigation. The use of shallow foundation and conventional slab on grade will require the complete removal of the surficial man-made deposit and the construction of an engineered fill from the Ironshore Formation up the grades. Depending on the exposed Ironshore deposit surface deposit and the information provided by geophysical investigation (if available), geotextile and geogrid may be required to prevent loss of soil particles (geotextiles) and increase the fill rigidity (geogrids).

The Bluff Formation limestone although relatively strong is karstic and is characterized by a honeycombed surface, frequent cavities, and voids. Cast-in-place concrete piles is a preferred foundation option on the island. These can be used for the proposed development. To prevent a loss of concrete in the karstic features, steel casings may be used.

In order to mitigate the risk that proposed structure foundations interfere with the cavities noted in both the Ironshore and Bluff Formations, a geophysical mapping of these cavities recommended. Using these maps to better define the limits of the proposed structure will help limiting the risk that a foundation footing of a pile tip be affected by a cavity.

The development must be designed for the seismic forces in accordance with the applicable building codes.

Potentially significant impacts from the proposed ISWMS development related to the ground conditions and geological setting of Grand Cayman can be mitigated through the application of appropriate measures. Specifically, the geotechnical assessment determined the following for the proposed development:

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[114] Woods Ballard B, Wilson S, Udale-Clarke H, Illman S, Scott S, Ashley R, & Kellagher R. *C753 - The SuDs Manual*. 2015. CIRIA: London, UK. Accessed from https://www.ciria.org/ItemDetail?iProductCode=C753&Category=BOOK&WebsiteKey=3f18c87a-d62b-4eca-8ef4-9b09309c1c91

– The low bearing capacity of the existing waste surface layer is mitigated by the transfer of development loads to the Ironshore or bedrock of the Bluff Formation and is therefore considered not to be a significant effect.
– The installation of geotextile and geogrids (as required) on Ironshore Formation will prevent the occurrence of sinkholes in the engineered fill and minimize the risk of foundation damage and loss of capacity and is therefore considered not to be a significant effect.
– Geotechnical instability is reduced by avoiding cavity locations in the bedrock of the Bluff Formation and is therefore considered not to be a significant effect.
– ISWMS facilities and foundation systems will be designed to withstand Cayman Island seismicity, therefore the potential effect of seismic activity on the proposed development is considered not to be significant.

9.12.2 Geoenvironmental

Construction and operation of the ISWMS is expected to result in net environmental benefits in the long-term compared to the unsustainable design and impacts to soil (and groundwater) quality of the current GTLF.

The footprint of the ISWMS can be considered as four areas with differing development histories and future landuse profiles:

– Area 1 is within the current GTLF boundary and has a known history of waste treatment and disposal activities, including stockpiling of scrap metal and tires and the storage of waste oils and hazardous wastes. This area has also been subject to the extraction of underlying marl, but the extent of this extraction is unknown.
– Area 2 is outside the boundary of the GTLF. Although it has no recorded development history, limited Site investigation activities have indicated the presence of buried wastes of some or all of this Area.
– Area 3 is within the current GTLF boundary but beyond the North Canal and no historical waste activities are believed to have affected this area.
– Area 4 is within the current GTLF boundary and is located in the vicinity of the original 'Old Landfill' or South Mound. The composition of the wastes in this landfill and their gas generation potential are not well characterised.

A thorough review of all the available information did not identify any significant Site investigation data (for example, buried waste locations, contaminant concentrations or ground gas monitoring) that would form the basis for establishing current baseline conditions (geoenvironmental) and allow a quantitative assessment of any land quality risks. Such site investigation data is needed prior to construction of the Project.

However, the available information did allow a qualitative assessment of the potential land quantity risks. Based on the current proposed design (Chapter 4), a variety of potential environmental effects associated with the construction, operation and decommissioning of the ISWMS have been identified. A number of these effects have been assessed as potentially Significant Impacts.

Appropriate mitigation measures for these potentially Significant Impacts have been recommended, many of which are predicated on the collection of sufficient site investigation data to allow the current levels and extent of any contamination to be ascertained and the ground gas regime characterised, or the pre-emptive excavation of heavily contaminated materials to the RWL. Given the nature of the ISWMS development, it is likely that any pre-existing wastes present will not result in unacceptable levels of contamination. Finally, procedures should be established to ensure that imported fill materials do not contain sufficient hazardous materials, which pose risk to construction workers.

10. Landscape and Visual

10.1 Purpose

GHD Limited was retained by ReGen and the Cayman Islands Government (CIG) as approved by the Environmental Assessment Board (EAB) to undertake a landscape and visual assessment (LVIA) as part of the Environmental Impact Assessment (EIA) for the proposed Integrated Solid Waste Management System (ISWMS, Project). The LVIA consist of two related assessments that assess effects of the construction and operation of the proposed ISWMS on the landscape, concentrating upon effects on the landscape and townscape character, and effects upon the views and visual amenity of people who live, undertake recreational activities, work and/or travel through the area around the proposed ISWMS on the western side of Grand Cayman. This chapter provides a summary of the Seascape and Landscape Visual Considerations Report carried out for the Project. The complete report is provided as **Appendix 10.A (Seascape and Landscape Visual Considerations Report).**

10.2 Methodology

10.2.1 Standards and guidance

This LVIA chapter has been prepared within the spirit and intent of the ISWMS Terms of Reference (ToR) however the methodology slightly deviates from the GLVIA guidance below due to the visual impact specialists not attending site and artistic impressions being provided using a non-standard methodology:

– *Guidelines for Landscape and Visual Impact Assessment, 3rd Edition (Landscape Institute and Institute of Environmental Management & Assessment, 2013)* ('GLVIA3')

10.2.2 Study area

The LVIA study area (the 'study area') extends 3 miles (4.8 kilometres [km]) which was rounded up to five km from the ISWMS site boundary (Figure 10.1). This study area has been used for the purposes of data collection and the subsequent assessment has been defined to ensure that the LVIA concentrates upon receptors that are most likely to be significantly affected by the proposed ISWMS.

The study area accords with best practice, as set out in Sections 5.2 and 6.2 in GLVIA3, as well as the principle of proportionality set out in paragraph 3.16: "*The level of detail provided should be that which is reasonably required to assess the likely significant effects. It should be appropriate and proportional to the scale and type of development and the type and significance of the landscape and visual effects likely to occur.*"

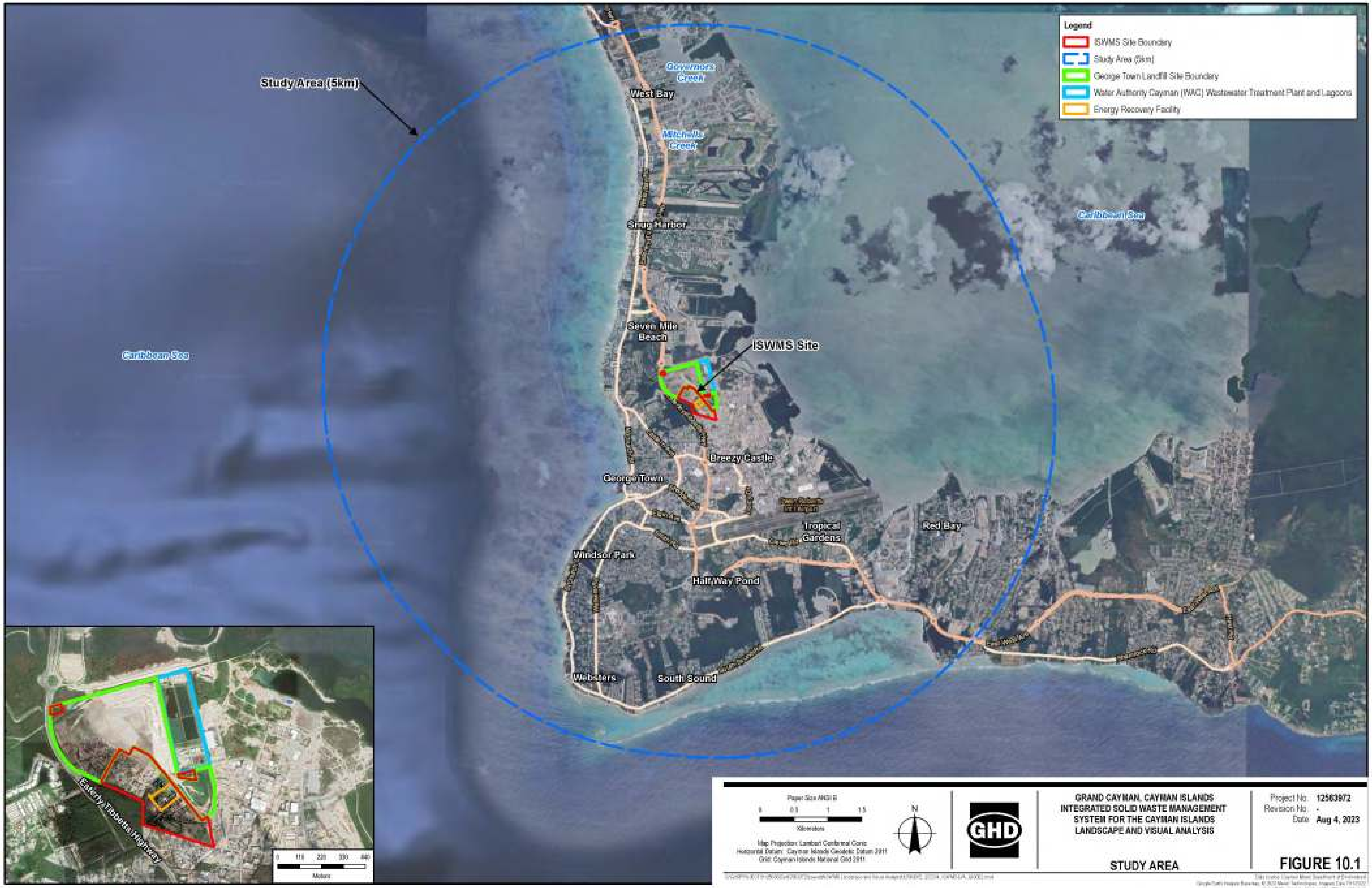

Figure 10.1 Landscape and visual study area

10.2.3 Existing landscape and visual environment

10.2.3.1 Review of legislation and policy

A review of key planning designations, policies and guidance was undertaken in relation to landscape and visual amenity within the study area. The emphasis of the review was to identify elements outlined within legislation, policy and planning documents relevant to landscape and visual character and identity of the study area.

10.2.3.2 Desktop analysis

Existing data was gathered and reviewed for the Project, including the following landscape and visual resources:

– Project design information and site photographs
– Land use and vegetation maps
– Aerial imagery, Google Earth and Google Street View

Using this data, a preliminary assessment of the landscape and visual environment was undertaken to inform the site inspection. Due to the data availability constraints, topographical data was unable to be obtained.

10.2.3.3 Zone of Theoretical Visibility assessment

Zone of theoretical visibility (ZTV) mapping is computer-generated analysis which identifies land from which it is theoretically possible to view the components of the Project.

Separate ZTV maps have not been calculated for the project due to the lack of available terrain data. Based upon desktop studies which emphasise the flat topography of western Grand Cayman, it is highly likely that a ZTV calculated using bare earth digital terrain data would extend across all the land and sea within the study area, due to the low-lying topography and long views.

The proposed ISWMS will potentially be visible as the stack has a height of up to 158 feet (48.1 metres [m]) above ground level (AGL) and will likely be the tallest component in the study area. The Energy Recovery Facility (ERF) has heights of between 124 feet (37.8 metres) AGL for the boiler house and 110 feet (33.4 metres) AGL for the waste bunker. These are likely to be the tallest and therefore the most visible components within the overall proposed project.

The data gathering methodology has been restricted to a desk study utilising a variety of websites, including:

– Visitcaymanislands.com – identification of principal tourist destinations in western Grand Cayman;
– En.wikipedia.org – general information and details of National Trust properties;
– Academic.emporia.edu – information on geology and topography;
– Brahmsonline.kew.org/cayman – information on geology and vegetation types;
– Camanabay.com – information upon tourist development and associated landscape planting in western Grand Cayman;
– Familyvacationcritic.com – for information on the height and accessibility of the Camana Bay Observation Tower;
– Review of baseline information in Final EIA Terms of Reference for a Cruise Ship Berthing Terminal; and
– Review of aerial photography:
  - Imagery dated 21 November 2018 from Google Earth Pro; and
  - Updated imagery from Bing Maps and Google Maps.

10.2.3.4 Site inspection

A site inspection was undertaken by GHD staff the week of April 17, 2023. The purpose of the inspection was to:

– Inspect the site and appreciate views to / from sensitive visual receivers

– Inspect publicly accessible locations identified in the desktop study as likely to provide views of the Project
– Identify sensitive visual receiver locations
– Assess the landscape character of the study area and identify landscape sensitivities
– Undertake site photography suitable for viewpoint assessment and photomontage preparation

The coordinates of each viewpoint were recorded during the site inspection.

10.2.3.5 Description of existing seascape, landscape, and visual environment

The description of the existing seascape, landscape and visual environment establishes a baseline against which the project is assessed. An existing conditions assessment was undertaken to determine the existing natural and cultural features within the study area. This includes determination of key seascape, landscape and spatial elements, features, and values. Aspects considered include:

– Land use and built form.
– Landform, topography, and hydrology
– Vegetation
– Views
– Historical features.
– Coastal edge
– Water column depth and qualities
– Seabed geology and form
– Key habitats, features, and species

A visual analysis was also undertaken to establish:

– The key views
– The Projects viewsheds
– Other visual features within the study area

10.2.4 Assessment

10.2.4.1 Landscape character zones

Landscape character considers common landscape zones defined by typical features and characteristics identified during the desktop assessment and site inspection. Defining landscape character zones (LCZs) identifies areas sharing the same homogenous environmental or cultural qualities or pattern such as topography, vegetation, hydrology, land use and settlement, built form scale and character, cultural and recreational characteristics.

This approach has been used to establish the existing landscape character within the study area and to provide a framework for measuring the effects of the Project. This assists in:

– Defining landscape elements that contribute to defining character.
– Defining landscape character attributes.
– Identifying landscape value.

The assessment of the existing environment also considers factors which have influenced landscape change in the past and those that are likely to do so in the future. The landscape character zones are defined in Section 10.6.1.

Landscape value

When defining LCZs, the value attached to the landscape also forms the baseline for which the significance of the assessment is measured. Landscape value looks at designated and undesignated landscapes, and holistically at all the elements such as the environmental, cultural, historical and visual/sensory elements that form the landscape. The value of the landscape from an international, national, local and community level is considered when applying a landscape value. The following factors are taken into consideration[1]:

- Landscape quality
- Scenic quality
- Rarity
- Representativeness
- Conservation value
- Recreation value
- Perceptual aspects/qualities
- Associations

10.2.4.1.1 Seascape character

Seascape character assessment (SCA) has emerged as a method for assessing, characterising, mapping, and describing seascape character. The SCA follows the well-established, process of Landscape Character Assessment (LCA). This is a process of characterising the seascape that currently exists and classifying character areas and types to be used as a baseline for assessment.

Criteria for assessing the value of the landscape and seascape is defined in Section 10.6.

Table 10.1 Seascape value

Landscape value	Definition
High	Seascape character elements in good or above average condition and/or that make a strong positive contribution to landscape character. May include nationally important features.
Medium	Seascape character elements in reasonably good condition and/or that make an average contribution to the local character, which may include locally important landscape features.
Low	Seascape character elements in below average condition and/or that are not particularly distinctive local features.

10.2.4.2 Landscape character effects

Assessment of landscape effects deal with the effect of change and development on landscape as a resource. The concern is with how the Project would affect the elements that make up the landscape, the aesthetic and perceptual aspects of the landscape and its distinctive character. The consideration of potential effects on landscape character is determined based on the sensitivity of the existing landscape and the magnitude of change that is likely to occur.

The sensitivity and magnitude of landscape effects address the following specific criteria:

- Sensitivity of landscape to proposed change is judged on a combination of the landscape value and the landscape susceptibility to change from the type of development proposed (refer Table 10.1 and Table 10.2). A judgement on the level of sensitivity is made and a rating of high, medium, or low applied.
- The magnitude of change to landscape character is based on the size or scale of change, the geographical extent of effects, and the duration and reversibility of effects (refer Table 10.3). It also depends on the loss, change or addition of any feature to the existing landscape. It is based on the part of the landscape character zone which is likely to be effected to the greatest extent by the Project.

An assessment is made on the overall level of significance in relation to the existing conditions (refer to Section 10.2.4.5).

[1] Natural England, Scottish Natural Heritage and Countryside Council. *Landscape Character Assessment Guidance*. 2011

Table 10.2 Landscape susceptibility to change

Landscape susceptibility	Definition
High susceptibility to change	The type of development proposed could have a detrimental effect on the landscape character, condition or value. Mitigation measures are unlikely to reduce the effects of the change.
Medium susceptibility to change	Any change caused by the type of development would be unlikely to have a significant adverse effect on the landscape character, condition or value that could not be mitigated.
Low susceptibility to change	Development of this type is unlikely to have an adverse effect on the landscape character, condition or value. Mitigation measures would be effective in neutralising adverse effects.

Table 10.3 Magnitude of change criteria (landscape)

Rating	Criteria
High	A substantial/obvious change to the landscape character due to total loss of, or change to, elements, features or characteristics of the landscape. Would cause a landscape to be permanently changed and its quality diminished.
Medium	Discernible changes in the landscape character due to partial loss of, or change to elements, features or characteristics of the landscape, however, has potential to be partly mitigated. The change would be out of scale with the landscape character, and at odds with the local pattern and landform and would leave an adverse effect on the landscape character.
Low	Minor loss or alteration to one or more key landscape character elements, features or characteristics, or the introduction of components that may be new but may not be uncharacteristic within the existing landscape character.
Negligible	Almost imperceptible or no change in the landscape character as there is little or no loss of/or change to the elements, features or characteristics of the landscape.

10.2.4.3 Viewpoint selection

Assessment of visual effects deals with the effects of change and development on the views available to people and their visual amenity. It assesses how the surroundings of individuals or groups of people may be specifically affected by changes in the context and character of views as a result of the change or loss of existing elements of the landscape and/or the introduction of new elements.

Visual receivers have been considered in terms of the views they are likely to obtain from within the study area including consideration of any key vantage points, such as lookouts, where there is particular interest in the view. Visual receivers are identified based on:

– Proximity of the receivers to the Project, as the most affected visual receivers are anticipated to be located closest to the Project, unless located at an elevated vantage point
– Type of receiver, as different viewer types would have different perceptions of the change

Based on the analysis of the existing landscape and visual environment, viewpoint locations were selected for assessment as representative of sensitive visual receiver locations. To best illustrate the likely visual effects of the Project, where appropriate, viewpoint locations chosen for assessment aim to represent a balance of:

– The most sensitive visual receivers
– A range of visual receiver types
– A range of distances from the Project
– A range of view directions towards the Project within the study area

10.2.4.4 Visual assessment

The evaluation of potential effects on visual amenity is based on the sensitivity of the viewpoint (and the visual receiver it represents) to change, and the magnitude of change that is likely to occur. The assessment considers the likely effects of the Project. The level of effects on a view depends on factors such as the extent of visibility, degree of obstruction of existing features, degree of contrast with the existing view, angle of view, duration of view and distance from the Project.

The sensitivity and magnitude of visual effects addresses the following specific criteria:

– The sensitivity of the viewpoint to proposed change considers the importance of the view, its existing scenic qualities and the presence of other existing man-made elements in the view; type of visual receiver and their likely interest in the view; susceptibility of visual receivers to change, and value attached to views.
– The magnitude of change to views and visual amenity considers the size or scale of change; geographical extent of effects, and duration and reversibility of effects (refer to Table 10.5). It also depends on the loss, change or addition of any feature in the field of view of the receiver including an assessment of the level to which the change contrasts with the existing view or expected view of the landscape.

An assessment is made of the overall level of significance in relation to the existing view (refer to Section 10.2.4.5).

Table 10.4 Sensitivity criteria (visual)

Rating	Criteria
High	Occupiers of residential properties, at home or going to or from, with long viewing periods, within proximity to the proposed development; Communities that place value upon the landscape and enjoyment of views of their setting.
Medium	Outdoor workers who have a key focus on their work who may also have intermittent views of the study area; Viewers at schools, or similar, when outdoor play and recreation areas are located within proximity but viewing periods are limited; Occupiers of residential properties with long viewing periods, at a distance from or screened from the study area.
Low	Road users in motor vehicles, trains or on transport routes that are passing through or adjacent to the study area and therefore have short term views; Viewers indoor at their place of work, schools or similar.

Table 10.5 Magnitude of change criteria (visual)

Rating	Criteria
High	A substantial/obvious change to the existing view due to total loss of, or change to, elements, features or characteristics of the view. Would cause a view to be permanently changed and its quality diminished.
Medium	Discernible changes in the existing view due to partial loss of, or change to elements, features or characteristics of the view, however, has potential to be partly mitigated. The change would be out of scale with the existing view and would leave an adverse effect on the view.
Low	Minor loss or alteration to one or more key view elements, features or characteristics, or the introduction of components that may be visible but may not be uncharacteristic within the existing view.
Negligible	Almost imperceptible or no change in the view as there is little or no loss of/or change to the elements, features or characteristics of the view.

10.2.4.5 Significance of effects

The combination of sensitivity and magnitude determines the significance of the effect on the landscape character or representative viewpoint. Refer to Table 10.6 for the matrix used to determine the significance of effects.

Table 10.6 Significance of effect matrix

Sensitivity \ Magnitude of change	High	Medium	Low	Negligible
High	Major (Significant)	Major (Significant)	Moderate (Probably significant)	Minor (Not significant)
Medium	Major (Significant)	Moderate (Probably significant)	Minor (Not significant)	Negligible (Not significant)
Low	Moderate (Probably significant)	Minor (Not significant)	Negligible (Not significant)	Negligible (Not significant)

10.2.4.6 Panorama and photomontage

Visualisations were carried out by subconsultants OLA of 1270 Fulton Street #3, Brooklyn, New York. These are Artistic Impressions only and were included to provide an approximate visual representation of how the ISWMS may appear from selected locations within the study area. Per GLVIA3 guidance, "*any visualisation should reasonably represent the proposal in such a way that people can understand the likely landscape and visual change. The degree of detail shown will typically be relative to the design and / or planning stage that has been reached. Visualisations should assist interested parties in understanding the nature of a proposed development within its context, and its likely effects. Their use as part of an iterative process of assessment and design can help inform sensitive siting, design and primary mitigation, all of which are important considerations in the planning process. Showing the development within its context should help to secure better design at an early stage.*"

10.2.5 Mitigation measures

Mitigation measures were developed in response to the effects identified within Section 10.2.4.5 and Section 10.2.5. Potential mitigation measures would typically include:

- Adopting alternative designs or revisions to the basic engineering and architectural design to prevent and/or minimise negative effects
- Remedial measures such as colour and textural treatment of structural features
- Compensatory measures such as landscape design to compensate for unavoidable negative effects and to attempt to generate long-term positive effects

10.3 Project description

The following section provides a summary of the Project and includes the detail relating to the main visual components that have potential to affect the landscape character and visual amenity of the study area.

10.3.1 The Project site

The Project site covers approximately 30 acres (12.4 hectares [ha]) of land that is partially vacant and undeveloped on the eastern side of the west peninsula of Grand Cayman. The site has been disturbed by previous activities (including landfill) and consequently it contains no naturally occurring features. In common with large parts of Grand Cayman, the Project site has a ground level height that is only a few metres above sea level as a result of the geology of low-lying limestone and dolostone rocks.

10.3.2 The Project

The Project is located on the northern edge of George Town in an area that is zoned 'Heavy Industrial' (HI). It is bounded to the east and south by other HI land-uses comprising a mixture of vacant lots and small-scale industrial businesses such as marine fitters; metal workers and processing of quarried stone. Areas of hardstanding are interspersed with areas of rough grass and patches of scrub vegetation. Immediately north of the site lies George Town Landfill (GTLF). To the west is an area of mangrove and the Esterly Tibbetts Highway, and to the northeast is the Cayman Islands wastewater treatment plant. For complete project details refer to Chapter 4.

10.4 Legislation and policy

The following section provides an overview of relevant legislation and policy objectives relevant to landscape and visual considerations within the study area.

10.4.1 Cayman Islands Constitution Order, 2009

The Cayman Islands Constitution Order of 2009 was developed in order to establish the powers and activities of the legislative, executive, and judicial branches of government, as well as the rights of all citizens. Section 18 of this Constitution provides the basis for the legal protection of the environment, and states the following:

> *Government shall, in all its decisions, have due regard to the need to foster and protect an environment that is not harmful to the health or well-being of present and future generations, while promoting justifiable economic and social development.*
>
> *To this end government should adopt reasonable legislative and other measures to protect the heritage and wildlife and the land and sea biodiversity of the Cayman Islands that –*
>
> *(a) limit pollution and ecological degradation;*
>
> *(b) promote conservation and biodiversity; and*
>
> *(c) secure ecologically sustainable development and use of natural resources.*

10.4.2 Cultural and Natural Heritage Sites

Cultural and Natural Heritage Sites are important resources on Grand Cayman. These heritage site resources include both designated features protected by legislation and features of national or local archaeological, historical, or architectural interest. Based on the type and location of the proposed project the studies for the EIA will focus on terrestrial heritage resources within the Project study area.

Heritage site resources are identified and/or protected under the following legislation:

– National Conservation Act (2013) – Under Part 3 - Conservation of Land, the Cabinet may designate any area of Crown Land or Cayman waters as a "protected area".

– National Trust Act (2010) – National Trust for the Cayman Islands (NTCI) ownership or management of specific sites – Allows the NTCI to protect those sites from offences "for actions which could harm Trust property or otherwise contravene the purposes of the Trust."[2].
– Heritage Register (2010) – Records the Islands' "natural, historic and cultural resources which are recognised and designated by the Council of the National Trust as being nationally significant and worthy of preservation." Entries are predominantly historic homes, civic and religious structures. Listing on the Heritage Register does not afford individual sites legal protection.
– Public Lands Act (2020) – Regulates the use of public land in the public interest.

10.4.3 Local legislation and policy

10.4.3.1 Planning policy

Planning policy is set out by the Cayman Islands Government Central Planning Authority (CPA) and approved by Parliament. The LVIA will consider planning policy which is relevant to the proposed development as summarised in the Development Plan 1997 (being the plan for zoning and physical development of the Cayman Islands).

Extant policy in the Development Plan 1997 is also presently under review. In November 2018, the CPA published, for consultation, a new draft National Planning Framework. As this new policy emerges, the LVIA will, as appropriate, take cognisance of this evolving, new policy.

Building height restrictions

Height restrictions aren't specified within the Industrial zone, however it is anticipated that the ERF will exceed the height of the surrounding built form. The Development and Planning Regulations (Development and Planning Act 2021) Regulation 8.2 stipulates *a maximum permitted height of the building shall not exceed:*

– *one hundred and thirty feet (39.6 m) or ten storeys, in Hotel/Tourism zone 1;*
– *ninety-one feet (27.74 m) or seven storeys, within a General Commercial zone;*
– *sixty-five feet (19.8 m) or five storeys or for Hotel/Tourism zone;*
– *forty feet (12.2 m) or three storeys in a high density Residential zone, and the building shall be so designed that no continuous vertical facade or elevation exceeds twenty-five feet or two storeys in height.*

A review of current planning requirements for maximum heights and compliance of the stack of 48.1 m, the ERF boiler house of 37.8 m and ERF waste bunker of 33.4 m will be included in Chapter 4.

Scenic Shoreline

The Development and Planning Regulations (Development and Planning Act 2021) Regulation 20 - Scenic shoreline, stipulates:

– *It is the duty of the Authority to ensure that the open character of scenic shoreline land is preserved, in particular that of the beaches, and also to safeguard the public's right to use the beaches and to gain access to them through public rights of way.*

10.4.3.2 Waste management policy

Waste management policy for the Cayman Islands is set out in the following key documents:

– National Solid Waste Management Policy for the Cayman Islands (August 2015)
– National Solid Waste Management Strategy for Cayman Islands (2016); and the associated Integrated Solid Waste Management System for the Cayman Islands – Outline Business Case (2016)

[2] Bullings, K., Cayman Islands; National Trust for the Cayman Islands. NATIONAL TRUST LAW (2010 Revision). 2010, October 19

10.5 Existing landscape and visual environment

The following section provides a summary of the existing landscape and visual environment of the study area.

10.5.1.1 Land use and built form

The proposed site is situated within an area of mixed low-density residential neighbourhoods with single-family homes and high-density commercial areas with multi-story buildings. The green spaces within the area are predominantly mangrove forest and woodlands. The immediate surroundings of the proposed site are zoned for industrial or commercial use and feature warehouses, factories, and storage yards.

The landscape of George Town Centre is predominantly characterised by high-density commercial development, including tall buildings, while West Bay Road is the main tourist drive through the tourist district. The ruins of an 18th-century fort and historical architecture, such as the George Town Library and Town Hall, add to the town centre's unique character. Contemporary Caymanian architecture is also present, such as The Harquail Theatre and the Paseo in Camana Bay.

As one moves further away from the city centre, the built form becomes less dense, with lower-rise buildings and more open green spaces. The periphery of the study area is dominated by automotive repair, bodyworks shops and concrete batching plants.

The human programming of the area caters towards tourists and their use of the linear beaches bordering the extent of the study area. Access to recreational green spaces is limited, with small pockets of accessible green areas such as Airport Park and Dart family park. Other facilities within the area include the Truman Bodden Sports Complex, the University of the Cayman Islands, and Grand Cayman's Hospital.

10.5.1.2 Topography and hydrology

The study area is defined by its unique topography and hydrology. A large bay and beach on the west side punctuates the flat terrain. The Ironshore geological formation primarily characterises the area, and the most significant feature is the North Sound Lagoon, located on the eastern side of the study area. It is a reef-protected lagoon covering approximately 34.75 square miles (90 square kilometres), of which the study area covers about half. The lagoon's foreshore is characterised by shallow coral reefs and pockets of established mangrove vegetation.

The topography in the northeast regions of the study area has undergone significant modifications due to the island's evolving landscape and changing land use patterns. Canals and channels have been cut through the island to convert mangrove areas to residential waterfront properties.

10.5.1.3 Vegetation

The study area's vegetation on the west side comprises a mix of modified and remnant habitats. The flat topography is scattered with sparse clusters of palm trees amongst the existing mixed species and mangrove vegetation. Single palm trees and other tree species are used to line the tourist drive along West Bay Road.

The study area's eastern and southern sides are dominated by remnant low-lying coastal mangroves and sedge vegetation, which serve a dual purpose of tidal and flood mitigation while providing essential habitat for local fauna. Palm trees can be spotted growing amidst the mature mangrove vegetation.

The North Sound Lagoon on the zone's eastern side is the island's most significant protected bay. Its fringing mangroves, and seagrass beds serve as critical breeding and nursery habitats for marine fauna. The underwater topography beyond the fringing reef of North Sound Lagoon is characterised by two well-developed spur-and-groove terraces: a shallow terrace reaching a depth of nine meters and a deeper one at fifteen meters. The vegetation and topography of the study area create a unique and valuable ecosystem that needs to be protected and conserved.

10.5.1.4 Key visual features

Based on the desktop review and site inspection, the key visual features in the study area were identified as:

- Views along the coast from West Bay Road's linear tourist drive are a significant visual feature of the district.
- The observation tower at Camana Bay is a striking visual landmark that attracts many tourists and provides elevated views out across the island and coast.
- The ruins of the 18th-century fort on Harbour Drive and Fort Street add historical interest to the streetscape.
- The mix of historic and contemporary architecture includes the George Town Library, Town Hall, The Harquail Theatre, and the Paseo in Camana Bay.
- Caymanian style of zinc-roofed, pastel-painted, wood-boarded cabins with louvred shutters and fretworked porch.
- The new developments in the northern zone, featuring colonial-style masonry buildings and other residential communities, add to the visual landscape.
- The Truman Bodden Sports Complex, The University of the Cayman Islands, Grand Cayman's Hospital, the Government Administration Building, and the National Art Gallery add modern architectural elements to the landscape. The unusual high point of George Town land fill is also a significant visual feature of the local area.

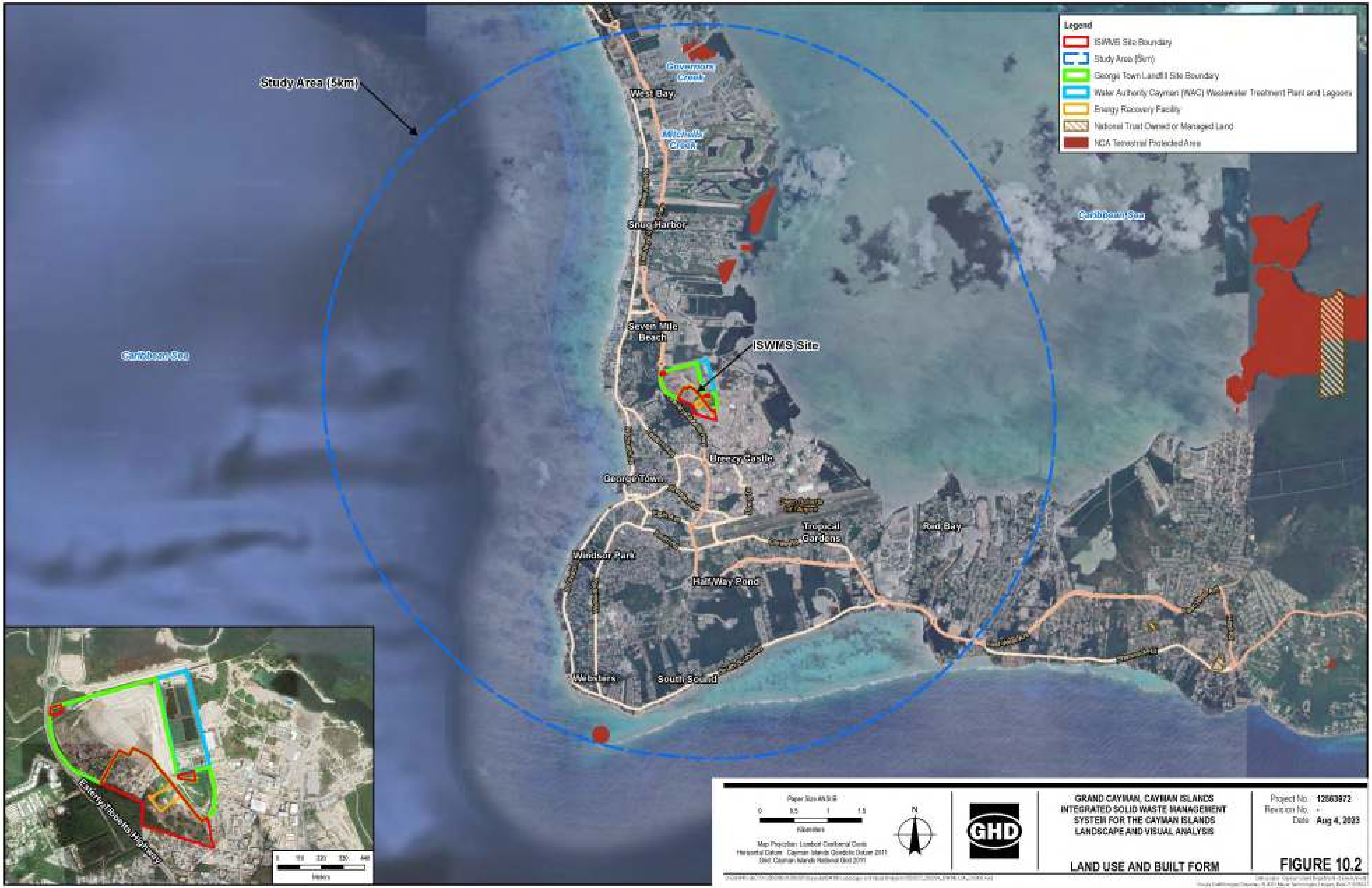

Figure 10.2 Existing land use[3]

[3] Data source: Cayman Island Department of Environment

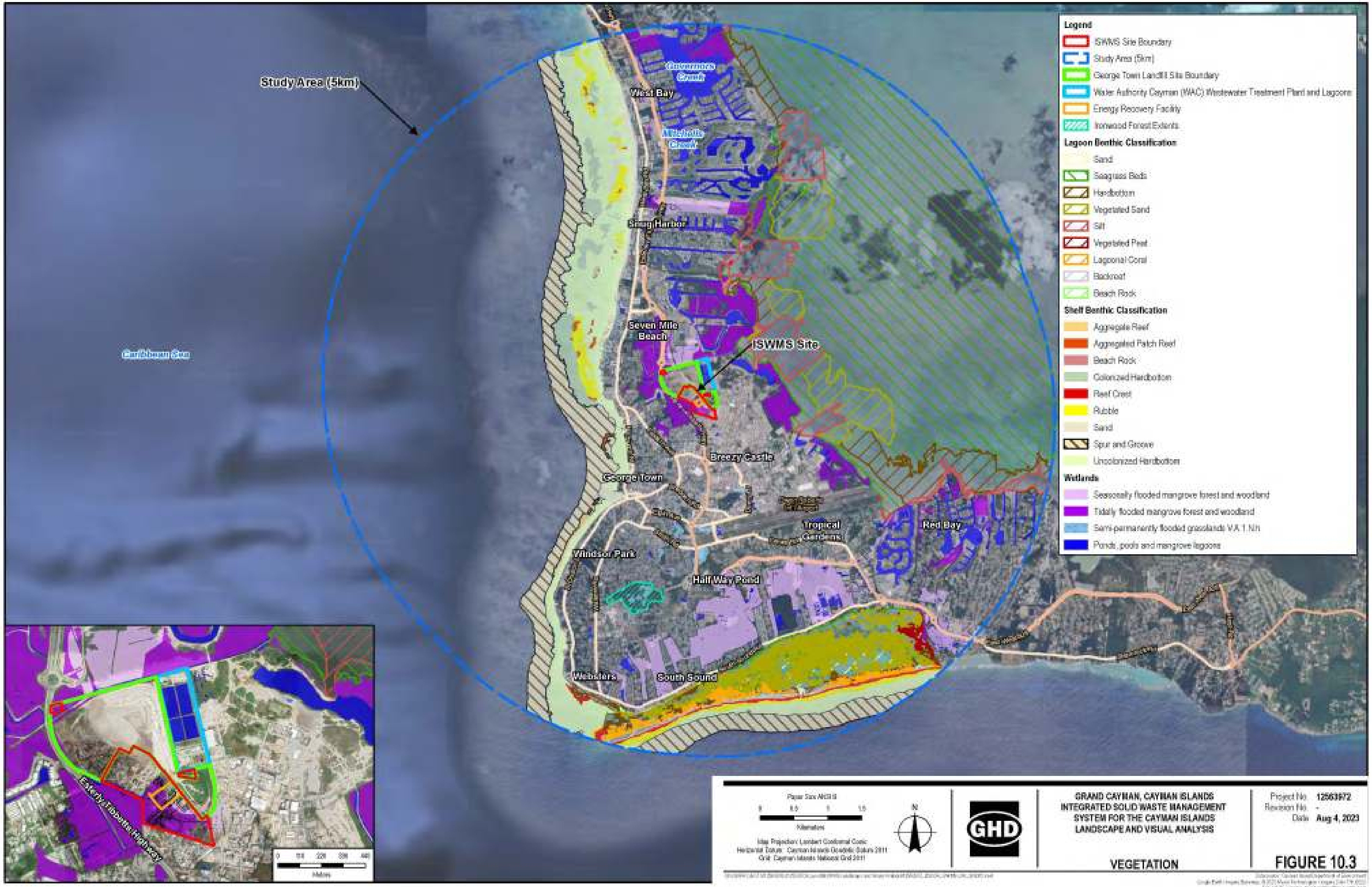

Figure 10.3 Vegetation[4]

[4] Data source: Cayman Island Department of Environment

10.6 Landscape and seascape character assessment

The study area has been classified into five LCZs and SCZs.

These LCZs and SCZs have different associated sensitivities to potential changes as a result of the Project. The sensitivities are discussed below and have informed the assessment.

The five LCZs and SCZs identified are illustrated in Figure 10.4, and are as follows:

- LCZ1: Tourism foreshore and George Town centre
- LCZ2: Industrial, waste and airport
- LCZ3: Residential settlement
- SCZ4: Mangroves and recreation
- SCZ5: Caribbean Sea and North Sound Lagoon

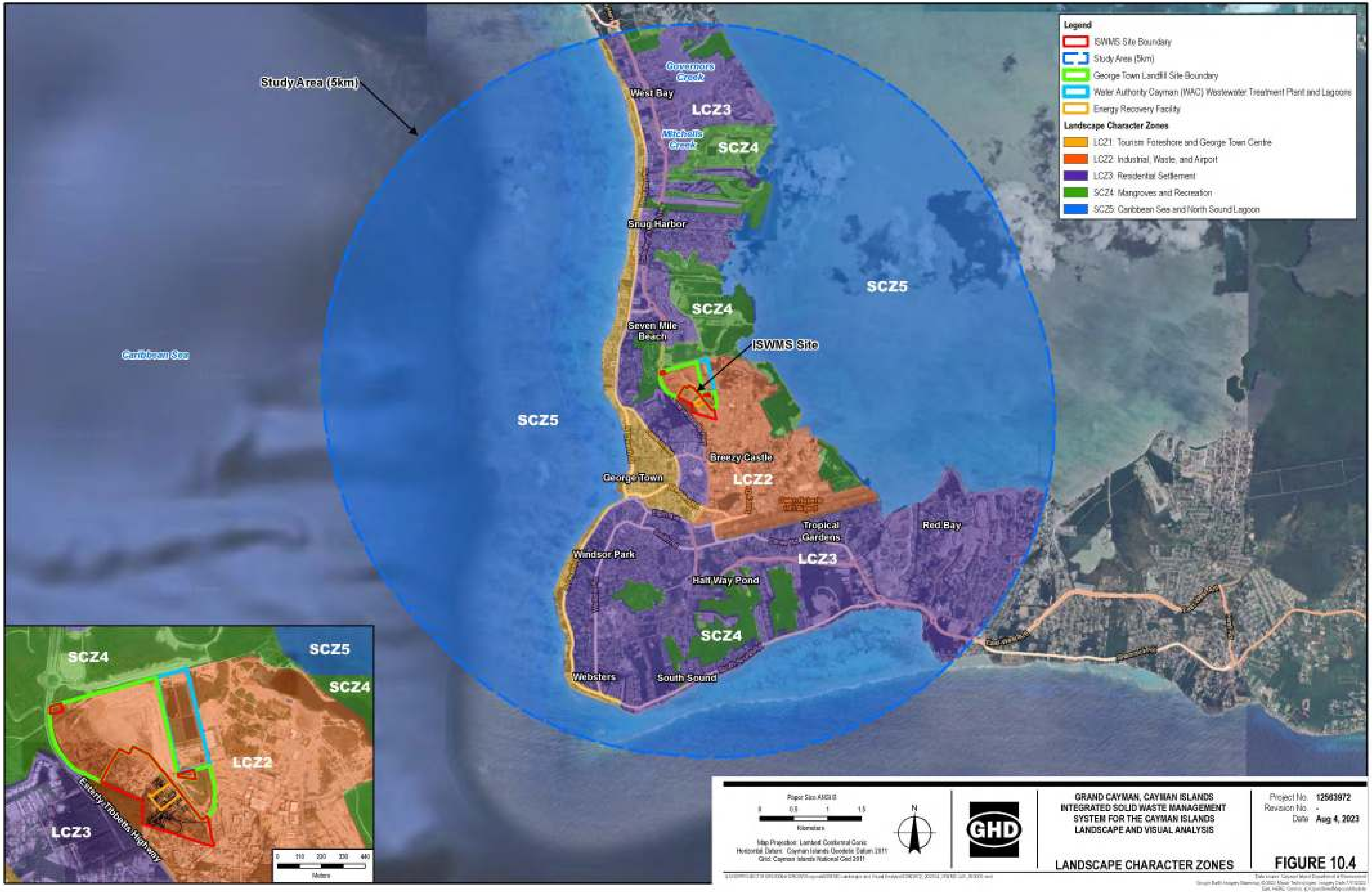

Figure 10.4 Landscape character zones

10.6.1 Landscape character zones

10.6.1.1 Landscape character zone 1: Tourism foreshore and George Town centre

The key features of LCZ1 are described below and illustrated in Photo 10.1 to Photo 10.6. The LCZ1 assessment is outlined in Table 10.7.

Photo 10.1 South Church Street looking west

Photo 10.2 View from Governors Beach looking north east

Photo 10.3 View from within Galleria Plaza looking west

Photo 10.4 South Church Street looking west towards Smiths Barcadere

Photo 10.5 View from Governors Beach looking north

Photo 10.6 View into George Town

Summary of LCZ1

LCZ1 is a designated tourism industry zone with a concentration of tourism activities along the western coastal area. The site's topography is relatively flat, with a foreshore characterised by shallow coral reefs and beaches lined with palm trees and other tree species which provide a scenic backdrop for the linear tourist drive along West Bay Road. The streets' edges feature a mix of hotel buildings with direct beach access interspersed with popular tourist destinations such as eateries, fishing spots, cabana bars, and restaurants, which buffer the land and sea with the cruise ship docking points located just offshore.

George Town Centre, the bustling hub of Grand Cayman Island, is steeped in history, and remnants of the island's past are visible throughout. The Cayman Islands National Museum provides a glimpse into the island's rich heritage, with the building being one of the few surviving nineteenth-century structures on the Islands. Old launching ramp sites of the schooners cut into the bedrock around George Town still exist, while throughout the town centre, a mix of contemporary and historical architecture can be seen. The Paseo in Camana Bay offers a new urbanism development style featuring modern architecture and is home to popular tourist attractions.

Key characteristics of LCZ1 include the following:

– West Bay Road is the main tourist drive and runs through the tourist district.
– The observation tower is a popular tourist attraction in Camana Bay.
– George Town cruise port is a vital link for docking cruise ships.
– Ruins of an 18th-century fort on the corner of Harbour Drive and Fort Street stand as a testament to the island's past.
– The city's historical architecture includes buildings such as the George Town Library and Town Hall.
– Contemporary Caymanian architecture includes buildings such as The Harquail Theatre, the Government Administration Building, and the Paseo in Camana Bay.

Values associated with LCZ1 include:

– The zone is designated for tourism industry with a concentration of tourist activities along the western coastal area, which features beaches and palm trees that provide a backdrop for the linear tourist drive along West Bay Road.
– The George Town Centre is steeped in history, with remnants of the island's past visible throughout. The city features historical architecture, such as the ruins of an 18th-century fort, the George Town Library built-in 1939, and the Peace Memorial Town Hall built-in 1919.
– The Harquail Theatre and the Paseo in Camana Bay offer a new urbanism development style, featuring modern architecture.
– The area is home to popular tourist destinations such as eateries, fishing spots, cabana bars, and restaurants that offer a glimpse into the Caymanian culture.
– The George Town cruise port is a vital link for docking cruise ships, and the Cayman Islands National Museum provides a glimpse into the island's rich heritage, making it a hub for connectivity and cultural exchange.

Character elements make a strong contribution to the local character, including locally important landscape features. LCZ1 therefore has a **High** landscape value.

Table 10.7 LCZ1 assessment

Landscape character zone 1: Tourism foreshore and George Town centre	
Anticipated change to landscape character	The Project site is not in LCZ1. The anticipated change to the landscape character of LCZ1 would be indirect and relate to the modifications of the landscape character in LCZ2. The more prominent elements include an approximately 158 foot (48 metre) high ventilation stack and an enclosed processing facility at heights of between 125 feet (37.8 metres) for the boiler house and 109.6 feet (33.4 metres) for the waste bunker. These are likely to be the tallest and, therefore, the most visible components of the Project, but at and minimum distance of approximately one kilometre from the Project sight, the building height will be mitigated by the existing landscape, with the top of the stack being the most prominent element viewable at various locations throughout LCZ1.
Susceptibility to change	LCZ1 has a **Medium** susceptibility to change. The character is of high value to the tourism industry, which is a large part of the island's economy, any change caused by the type of development would be unlikely to have a significant adverse effect on the landscape character, condition or value that could not be mitigated.
Sensitivity to change	The sensitivity of a landscape is judged on a combination of the landscape value and the landscape's susceptibility to change from the type of proposed development. The sensitivity would be **Medium**, as the landscape value is High and the susceptibility to change is Medium.
Magnitude of change	The magnitude of change would be **Negligible**. There is no change in the landscape character as there is little or no change to the elements, features or characteristics of the landscape.
Significance of effect	The significance of effect would be **Negligible**, as the sensitivity is Medium and the magnitude is Negligible.

10.6.1.2 Landscape character zone 2: Industrial, waste and airport

The key features of LCZ2 are described below and illustrated in Photo 10.7 to Photo 10.12. The LCZ2 assessment is outlined in Table 10.8.

***Photo 10.7** Seymour Road looking toward Supermix in a southwest direction*

***Photo 10.8** Sleepy Hollow drive looking north*

***Photo 10.9** Seymour Road looking northwest*

***Photo 10.10** Taken at Central Laundry looking west towards proposal Site which is visible in background*

***Photo 10.11** Sparkys Drive looking west*

***Photo 10.12** View of airport taken at Crewe Road and Desmond Drive*

Summary of LCZ2

LCZ2 is a designated area for industrial and waste industries as well as the Owen Roberts International Airport located primarily to the east and south of the Project Site. The zone's flat topography is characterised by industrial buildings and warehouses, which vary from automotive to construction. Two of the island's authorities are located within this zone. While there are some smaller undeveloped green sites. Owen Roberts International Airport is about 1.86 miles (3 kilometres) southeast of the George Town centre on the southern side of North Sound Lagoon. The roads in the zone are a mix of sealed and unsealed roads, with some space undergoing redevelopment for industrial businesses. Overall, the area is dominated by large industrial buildings and warehouses, creating an industrial landscape.

Key characteristics of LCZ2 include the following:

– Automotive repair and bodyworks shops along with concrete batching plants form a significant proportion of agency within the zone.
– Water Authority for the island and the Cayman Islands Aviation Authority are located here.
– Comprises sparse inclusions of mixed species vegetation.

Values associated with LCZ2 include:

– LCZ2 plays a vital role in the local economy as a hub for various industries, including automotive shops, cement and concrete refineries, and waste management.
– The zone houses essential infrastructure like the Water Authority and Cayman Islands Aviation Authority, which are crucial for supporting the island's population and industries.
– The industrial businesses within LCZ2 provide job opportunities for the local community and contribute to the island's economic growth.
– Despite being an industrial zone, LCZ2 has some undeveloped green sites that provide ecological benefits like carbon sequestration and habitat for wildlife.
– While not explicitly mentioned in the statement, the history and cultural significance of industrial activities on the island can be considered a value associated with LCZ2.

LCZ2 has a **Low** landscape value rating as the landscape character elements are in below-average condition and are not particularly distinctive local features.

Table 10.8 LCZ2 assessment

Landscape character zone 2: Industrial, Waste and airport	
Anticipated change to landscape character	The Project is located within LCZ2, and while it fits within the function of the designated zone, the height of the facility and its components will be almost three times higher than any other building within this zone, the ventilation stack being the tallest structure on the island.
Susceptibility to change	The Project is located within the industrial zone and on land which has been disturbed by previous waste management activities. Consequently, there are no sensitive landscape elements which could be significantly affected by the construction or operation of the proposed development it therefore has a **Low** susceptibility to change based on any change caused by the type of development would be unlikely to have a significant adverse effect on the landscape character, condition or value that could not be mitigated.
Sensitivity to change	The sensitivity of a landscape is judged on a combination of the landscape value and the landscape's susceptibility to change from the type of proposed development. The sensitivity would be **Low**, as the landscape value is Low and the susceptibility to change is Low.
Magnitude of change	Due to the height of the prosed design with the associated stack being the highest component and therefore being the highest point on the island the magnitude of change would be **High** as the type of development proposed could have a detrimental effect on the landscape character, condition, or value. Mitigation measures are unlikely to reduce the effects of the change due to the height of the associated buildings (125 feet or 37.8 metres and 109.6 feet or 33.4 metres) and ventilation stack (158 feet or 48 metres).
Significance of effect	The significance of effect would be **Moderate**, as the sensitivity is Low and the magnitude is High.

10.6.1.3 Landscape character zone 3: Residential settlement

The key features of LCZ3 are described below and illustrated in Photo 10.13 to Photo 10.18. The LCZ3 assessment is outlined in Table 10.9.

Photo 10.13 North side of Keturah Street looking south

Photo 10.14 East side of Sorrel Drive looking southwest

Photo 10.15 South side of Selkirk Drive looking west

Photo 10.17 South side of Crewe Road looking north

Photo 10.18 East side of Abbey Way looking west

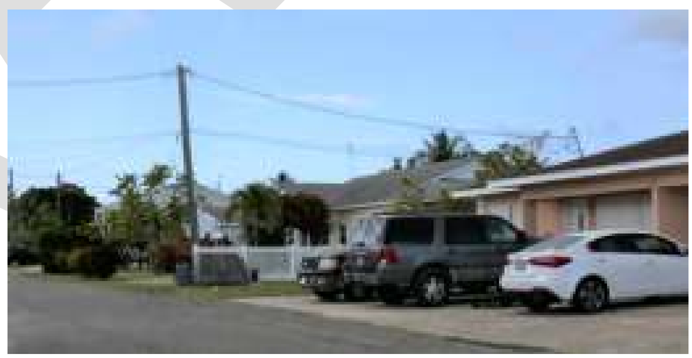

Photo 10.16 West side of Canal Lane looking northeast

Summary of LCZ3

LCZ3 is a mix of low to medium-height buildings and single-family homes - each showcasing unique Caymanian-style architecture from the 19th century. Modern homes have replaced wood with masonry while incorporating a pastel colour scheme. Picturesque palm trees are scattered throughout, sometimes in clusters and occasionally alone. Residential areas are sometimes uniform, while others have winding roads and cul-de-sacs. The northern portion of the zone has new residential developments and numerous community facilities and churches. Large green spaces are scattered throughout the zone.

Key characteristics of LCZ3 include the following:

– Unique Caymanian style of zinc-roofed, pastel-painted, wood-boarded cabins with louvred shutters and fretworked porch.
– New developments underway at the northern portion of the zone, featuring colonial-style masonry buildings and gated communities.
– Location of the Truman Bodden Sports Complex, the leading sports arena of the island.
– Other facilities include the University of the Cayman Islands, Grand Cayman's Hospital, and the National Art Gallery.
– Numerous churches represent the Cayman Islands' religious context.

Values associated with LCZ3 include:

– Unique blend of traditional and contemporary Caymanian architecture, including zinc-roofed, pastel-painted, wood-boarded cabins with louvred shutters and fretworked porches, and masonry buildings with pastel colour schemes.
– The presence of palm trees adds to the residential Zone's picturesque allure.
– Residential facilities are abundant, including the Truman Bodden Sports Complex, The National Art Gallery and numerous churches that represent the religious context of the Cayman Islands.
– Educational and Healthcare Values: Several schools such as the University of the Cayman Islands, St. Ignatius High School, and Cayman Prep & High School, and the Grand Cayman's Hospital are located in the area.

As the environmental, recreational, and educational landscape values make a strong contribution to the local character, LCZ3 has a **High** landscape value rating.

Table 10.9 LCZ3 assessment

Landscape character zone 3: Residential settlement	
Anticipated change to landscape character	The Project is situated beyond LCZ3, and the expected effect on the landscape will vary based on how close residential areas are to it. The ventilation stack is the most noticeable feature, and any efforts to reduce its effect will have a minor effect due to its height. Depending on their location, residents may be able to see the top of the stack from their homes.
Susceptibility to change	The susceptibility to change for LCZ3 is **Medium**, this is due to the height of the ventilation stack exceeding that of any vegetation found in this or any other LCZ. The change caused by the proposed development would be likely to have an adverse effect on the landscape character, condition or value, that could not be mitigated.
Sensitivity to change	The sensitivity of a landscape is judged on a combination of the landscape value and the landscape's susceptibility to change from the type of proposed development. The sensitivity would be **High**, as the landscape value is High and the susceptibility to change is **Moderate**.
Magnitude of change	Based on the height of the Project's buildings and ventilation stack, the magnitude of change for LCZ3 would be **Negligible**. With discernible changes in the landscape character due to partial loss of, or change to elements, features or characteristics of the landscape, however has potential to be partly mitigated by the current vegetation that would help obscure these elements of the Project from a distance. The change would be out of scale with the landscape character, and at odds with the local pattern and landform and would leave an adverse effect on the landscape character. Based on the Project being located in LCZ2, there would be no change to the landscape character of LCZ3. Therefore the magnitude of change would be **Negligible**.
Significance of effect	The significance of effect would be **Minor**, as the Project is not in this landscape character zone.

10.6.1.4 Seascape character zone 4: Mangroves and recreation

The key features of SCZ4 are described below and illustrated in Photo 10.19 to Photo 10.22. The SCZ4 assessment is outlined in Table 10.10.

Photo 10.19 North Sound Gated Community looking east

Photo 10.20 Pinehurst Road looking east

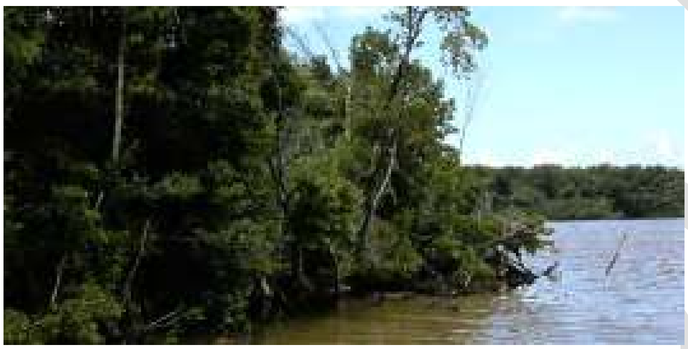

Photo 10.21 North of Blue Lagoon Drive

Photo 10.22 East side of Safehaven Drive looking east

Summary of SCZ4

SCZ4 is defined by the remnant low-lying coastal mangroves and sedge vegetation dominating the study area's eastern and southern sides. These areas serve a dual purpose of tidal and flood mitigation while providing essential habitat for local fauna. Palm trees can be spotted growing amidst the mature mangrove vegetation. The vegetation has undergone modifications as the island has evolved, and the agency across the landscape has changed. The eastern areas have undergone significant changes, with channels and canals being cut through through the island to convert mangrove areas to residential waterfront properties The recreation aspects of this zone are characterised by heavily modified landscapes that serve as golf courses set on the borders of new residential developments set on a canal network, with all other recreational agencies taking place on the beach fronts of the island.

Key characteristics of SCZ4 include the following:

– Small pockets of public green areas, such as Airport Park and Dart family park.
– The public recreational agency taking place is on the beach fronts of the island.
– Private (golf) recreational activities are undertaken in the golf courses.
– Vegetation has undergone modifications.

Values associated with SCZ4 include:

– The unique and important role of the remnant low-lying coastal mangroves and sedge vegetation in tidal and flood mitigation, as well as their essential habitat for local fauna.

– The presence of palm trees growing within the mature mangrove vegetation, adding to the area's biodiversity and visual appeal.
– The history of modifications and changes to the landscape as the island has evolved and the agency across the landscape has changed.
– The blending of recreation aspects with heavily modified landscapes such as golf courses, which are still in harmony with the natural surroundings.
– The existence of small accessible green spaces such as Airport Park and Dart family park, providing pockets of nature for public enjoyment.
– The prominence of beach fronts as the main recreational area on the island.

As the ecological and cultural landscape values make a strong contribution to the local character and overall character of Grand Cayman, SCZ4 has a **High** landscape value rating.

Table 10.10 SCZ 4 assessment

Landscape character zone 4: Mangroves and recreation	
Anticipated change to landscape character	The Project is not located within SCZ4. The approximate distance from the Project is a minimum of 1.2 miles (2 kilometres). At this distance, the anticipated change to view would be negligible; this is due to the height of the stack that would be visible but due to the distance, it would appear blurry and distant, the existing vegetation and buildings that occur between the various locations throughout SCZ4 would also mitigate any significant change to the over character immediately discernible within the zone.
Susceptibility to change	With the Project site being approximately at a minimum 1.2 miles (2 kilometres) away in combination with the height of the Project from this distance, the susceptibility of change would be **Low** as the development of this type is unlikely to have an adverse effect on the landscape character, condition or value. Mitigation measures would be effective in neutralising adverse effects.
Sensitivity to change	The sensitivity of a landscape is judged on a combination of the landscape value and the landscape's susceptibility to change from the type of proposed development. The sensitivity would be **Medium**, as the landscape value is **High** and the susceptibility to change is **Low**.
Magnitude of change	As the Project site not located within this zone, the magnitude of change would be **Negligible**; this is because there is almost imperceptible or no change in the landscape character as there is little or no loss of/or change to the elements, features, or characteristics of the landscape.
Significance of effect	The significance of effect would be **Negligible**, as the sensitivity is Medium and the magnitude is Negligible.

10.6.1.5 Seascape character zone 5: Caribbean Sea and North Sound Lagoon

The key features of SCZ5 are described below and illustrated in Photo 10.23 to Photo 10.26. The SCZ5 effect assessment is outlined in Table 10.11.

Photo 10.23 View from shore toward cruise ship docking point in the Caribbean Sea

Photo 10.24 View from Governors beach out into Caribbean Sea

Photo 10.25 Coast of Blue Lagoon Drive looking northeast into North Sound Lagoon

Photo 10.26 Sorrel Drive looking east into North Sound Lagoon

Summary of SCZ5

SCZ 5 consists of two distinct seascapes that envelop the project site on its eastern and western sides.

Contrasting the eastern seascape is the western seascape, a popular tourist destination catering to the needs of tourists and residents. The deeper sea sections serve as multiple anchor points for cruise ships that are a significant part of the economy of Grand Cayman. This seascape drives the beach topology that the hotels and tourist attractions rely on and creates the buffer zone between land and sea. Key characteristics of SCZ5 include the following:

– 60 percent of the North Sound Lagoon is covered by well-developed beds of *Thallassia testudinum* (Turtle Grass).
– The North Sound Lagoon (eastern side) is a semi-enclosed, shallow lagoon spanning 33 square miles (85 square kilometres) and historically surrounded by mangrove swamps and fringed by an exposed acroporidae reef.
– Designated onshore fishing spaces, coral reefs, and sunken shipwrecks for recreational snorkelling and diving.
– The deeper sea sections of the Western seascape serve as anchor points for cruise ships, a significant part of the Grand Cayman economy.

Values associated with SCZ5 include:

– Ecological importance: The North Sound Lagoon serves as critical breeding and nursery habitat for marine fauna, and the fringing mangroves and seagrass beds are vital for the ecosystem.
– Recreational opportunities: The western seascape offers recreational activities such as snorkelling, diving, and -onshore fishing.

– Economic significance: The western seascape is a popular tourist destination and a significant source of income for the island through cruise ships and hotel establishments.
– Biodiversity: The North Sound Lagoon is surrounded by mangrove swamps and an exposed acroporidae fringing reef, providing a diverse range of habitats for marine life.
– Underwater topography: The North Sound Lagoon has two well-developed spur-and-groove terraces with varying depths, offering unique diving experiences.

Due to the ecological importance, recreational opportunities and economic significance of SCZ5 combined with landscape character elements that are in good or above average condition, SCZ5 has a **High** landscape value rating.

Table 10.11 SCZ5 assessment

Seascape character zone 5: Caribbean Sea and North Sound Lagoon	
Anticipated change to seascape character	The Project is located outside of SCZ5, with the anticipated change to the seascape character being negligible. Although the top of the stack is anticipated to be viewable at varying locations throughout the zone and varying distances, the Project's site and development would have little effect on the landscape character.
Susceptibility to change	The height of the Project's ventilation stack in SCZ5 is the main contributing factor to the classification; the ventilation stack would unlikely be mitigated through vegetation planting; therefore, SCZ5 has a susceptible to a change rating of **High.** This is because although the top of the stack may be viewable at various locations throughout the zone, any change caused by the type of development would be unlikely to have a significant adverse effect on the seascape character, condition or value that could not be mitigated.
Sensitivity to change	The sensitivity of a seascape is judged on a combination of the landscape value and the landscape's susceptibility to change from the type of proposed development. The sensitivity would be **High**, as the seascape value is **High** and the susceptibility to change is **High**.
Magnitude of change	As the Project is not located within this zone, the magnitude of change would be **Very low**; this is because there is almost imperceptible or no change in the landscape character as there is little or no loss to change to the elements, features or characteristics of the seascape.
Significance of effect	The significance of effect would be **Minor**, as the sensitivity is High and the magnitude is Negligible.

10.7 Visual assessment

Based on the existing environment analysis, sensitive visual receivers were identified and viewpoint locations selected for assessment.

With regard to potential receptors, consideration of the nature of the Project and the context within which it will be located (i.e., within an area that is zoned 'Heavy Industrial') has led to the judgement that receptors who may have an increased propensity to experience significant effects are those receptor groups assessed as being of a high or medium sensitivity to change.

Sensitive visual receivers within the Project viewshed include the following:

– Residents in dwellings with views to the Project
– Road users along the Esterly Tibbetts highway, including visitors exiting the National Gallery and the Harquail Cultural Centre
– Local road users of West Bay Road
– Nearby workers from the industrial zone
– Tourists/visitors to outdoor attractions
– People undertaking recreational activities where the focus of the activity involves an appreciation of the landscape or where it is likely that their surroundings have some influence upon their enjoyment (e.g., angling and golfing)
– People travelling through the landscape on roads or at sea

10.7.1 Viewpoint locations

The following section provides a visual assessment of the Project from the following selected representative viewpoint locations as shown in Table 10.12. Refer to Section 10.7.1.1 to 10.7.1.8 for an assessment of the visual effect for each viewpoint location.

Viewpoints have been selected to appropriately represent the most sensitive visual receivers who are in close proximity to the Site, may have prolonged views to the Project or are in LCZs of high value.

Table 10.12 Viewpoint locations

Viewpoint	Location	Description
Viewpoint location 1: National Gallery of the Cayman Islands	National Galley of the Caymans Island	National Galley of the Caymans Island - entry drive intersection with Esterly Tibbetts Highway, looking towards GTLF
Viewpoint location 2: Residential properties on, Brushy Avenue and Woodlake Drive	Brushy Avenue and Woodlake Drive	Residential properties on Brushy Avenue and Woodlake Drive
Viewpoint location 3: Residential properties on Marbel Drive Grand Cayman	Marbel Drive Grand Cayman	Residential properties on Marbel Drive
Viewpoint location 4: Residential properties on Lakeside Villas	Residential properties on Lakeside Villas	Taken in the carpark of Residential properties on Lakeside Villas
Viewpoint location 5: Camana Bay Observation Tower	Camana Bay Observation Tower	Taken from Camana Bay Observation tower at approximately 72 feet (22 metres) above ground level
Viewpoint location 6: Tall residential properties on Seven Mile Beach	Tall residential properties on Seven Mile Beach	Located on Snooze Lane Tall residential properties on Seven Mile Beach taken at approximately 72 feet (22 metres) above ground level

Viewpoint	Location	Description
Viewpoint location 7: Cruise liner	Cruise Liner anchored off Seven Mile Beach	Located approximately 0.43 miles (700 metres) off the coast of Seven Mile Beach
Viewpoint Location 8: North Sound Lagoon	Boat located in the North Sound Lagoon	Located approximately one mile (1.5 kilometres) off the foreshore of the Lagoon.

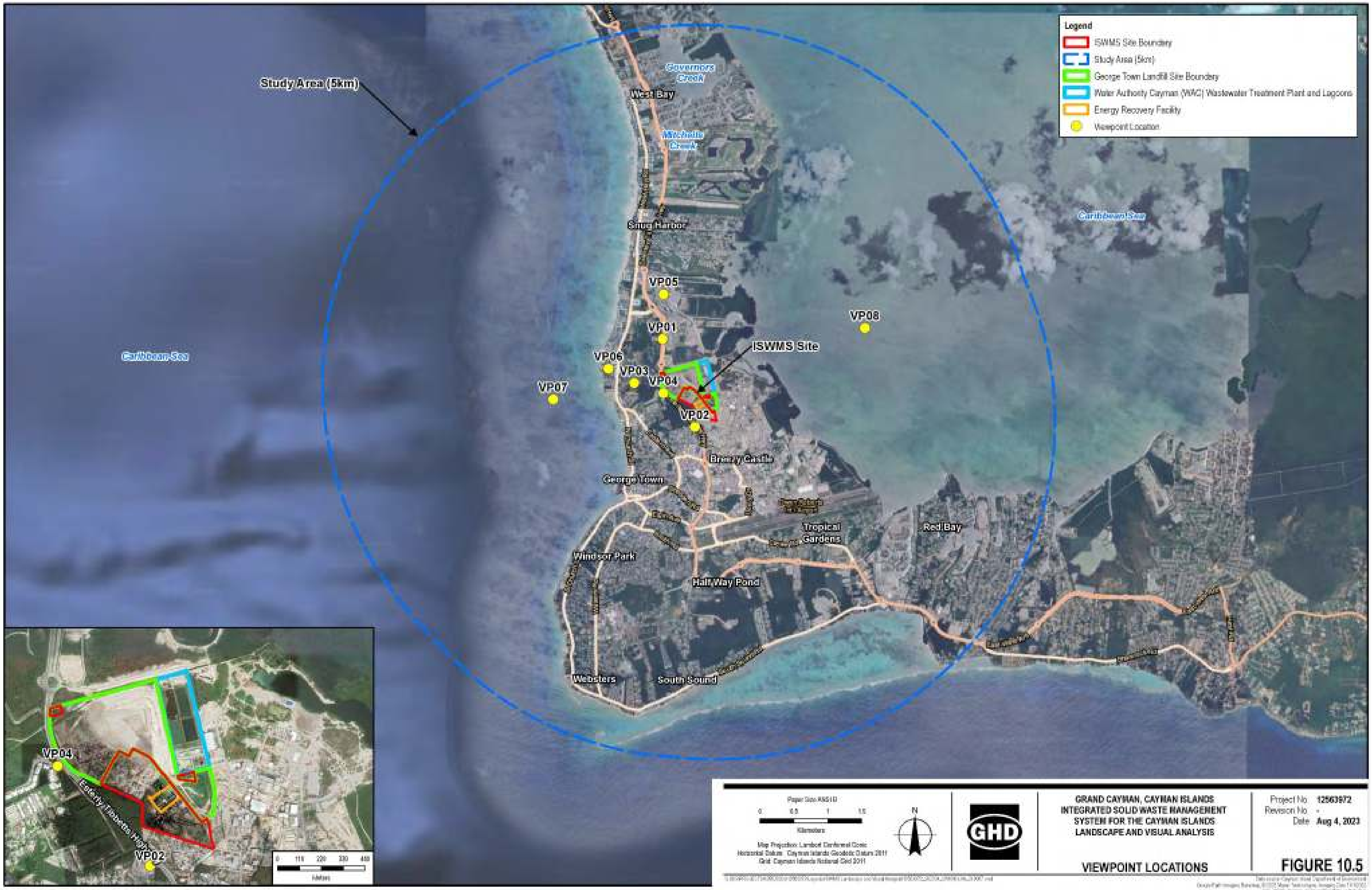

Figure 10.5 Viewpoint location map

10.7.1.1 Viewpoint 1: National Gallery of the Cayman Islands

VP01 is located at National Galley of the Caymans Island - entry drive intersection with Esterly Tibbetts Highway, looking in a south-eastern direction towards the Project Site. The assessment for VP01 is discussed in Table 10.13. The existing view is illustrated in Photo 10.27 and an artistic impression illustrating the Project design is shown in Photo 10.28.

Photo 10.27 Viewpoint 1: National Galley of the Caymans Island - entry drive intersection - existing view

Photo 10.28 Viewpoint 1: National Galley of the Caymans Island - entry drive intersection – Annotated after construction[5]

[5] Note: white outlines represent proposed Project infrastructure that is obscured from view from this vantage point by existing infrastructure, vegetation and topography

Table 10.13 VP01 assessment

Criteria	Comments
Location and view direction	Location (MGA Zone 55); 19.315997, -81.377728 Elevation: VP01 is situated 1,640 feet (500 metres) from the Project and is facing in a southeast direction. This viewpoint is representative of views experienced by vehicles along Esterly Tibbetts Highway, as well as visitors to the National Gallery of the Cayman Islands, the users of the Cayman International school along with the users and visitors of the Harquail Theatre, FJ Harquail Cultural Centre.
Description of existing view	The foreground features a clearly defined, raised road division constructed from cement and stone retaining walls and flanked by the Esterly Tibbetts Highway on either side. A series of streetlights occasion the division. In the mid-ground of the image, there is an abundance of vegetation at varying heights. On the far-left side of the composition, several buildings can be seen, providing a sense of urbanity to the landscape. A partially obstructed glimpse of the Project Site can be seen through the vegetation in the mid-range of the image. While on the right-hand side of the image, there is a varied and layered composition of mixed vegetation mirrored on the project's peripheral border. At the road edge, beyond the highway, the dense vegetation of shrubs and trees partially screens a construction site and crane in the centre of the background.
Anticipated change to view	In the centre background where the vegetation and tree line meet, a series of large industrial buildings and ventilation stack will be visible. The buildings are visually located behind the existing vegetation line and would be partially obscured from view with the stack being the most visible from this location. Plumes of white steam and gas would be exhausted from the stack during operation, which would make it more visible.
Sensitivity to change	The sensitivity to change is **Low**, as road users in motor vehicles, trains or on transport routes that are passing through or adjacent to the study area and therefore have short term views; Viewers indoor at their place of work, schools or similar.
Magnitude of change	The magnitude of change would be **Medium**, as there would be discernible changes in the existing view due to partial loss of, or change to elements, features, or characteristics of the view, however, has potential to be partly mitigated. The change would be out of scale with the existing view and would leave an adverse effect on the view.
Significance of effect	The significance of effect will be **Minor,** as sensitivity to change is low and magnitude of change is medium.

10.7.1.2 Viewpoint 2: United Pentecostal Church

VP02 is located at the northern point of Woodlake Drive in the United Pentecostal Church. The baseline and assessment for VP02 is discussed in Table 10.14. The existing view is illustrated in Photo 10.29 and artistic impressions illustrating the Project design are shown in Photo 10.30.

Photo 10.29 Viewpoint 2 existing view looking east

Photo 10.30 Artistic Impression showing the Project from viewpoint location 2

Table 10.14 VP02 assessment

Criteria	Comments
Location and view direction	Location (MGA Zone 55); 19.303703, -81.374600. Note elevation data not provided. VP02 is situated approximately 328 feet (100 m) from the Project and is facing in a northwest direction. This viewpoint is representative of views experienced by residents on Woodlake Drive and the users of the United Pentecostal church.
Description of existing view	The middle-foreground view is defined by the light-coloured concrete car park of the church. The church building can be seen in the far left of the image and is rendered in yellow and white colours. There are two white pillars supporting the roof of the covered entrance, with a minibus parked underneath. The car park is demarked by a low rectangular hedge, creating a low visual barrier to the property boundary and partially screening the Esterly Tibbetts Highway beyond. The hedge runs in a linear direction through the mid-range of the view, making a vanishing point to the left of the image; the hedge is occasioned with small rectangular rises that have been trimmed into the hedge's shape, the largest of which can be seen in the centre of the image, of which a streetlight is situated to the left. Behind, runs Esterly Tibbetts Highway and associated chain-link fence, which has vegetation growing through in points. It follows the same linear direction as the hedge but stands taller, adding another layer of visual barrier to the landscape beyond the boundary. Behind the chain-link fence, the tops of mature vegetation can be seen, with the Project Site visible over this and creating the composition's horizon line. Tall vertical infrastructure creates visual clutter in the mid-ground across the view from left to right, with two utility poles, transmission lines and the lamppost extending above the horizon line. The background consists of tree canopies, filtered views through to the land fill mound of the GTLF and expansive views to the sky.
Anticipated change to view	In the centre background, a series of large industrial ERF buildings and a ventilation stack will be visible. The facilities are visually located behind the existing vegetation line. The lower level of the ERF building will be partially obscured from view by vegetation, however the upper half will be visible above the horizon line, but below the height of the utility pole, transmission lines and church roof, when viewed from this viewpoint.
Sensitivity to change	The sensitivity to change would be **High** as the occupiers of residential properties, users of the car park and church goers would have direct and prolonged views of the Project.
Magnitude of change	The magnitude of change would be **High** as a substantial change to the existing view would be undertaken, which would cause the view to be permanently changed and its quality diminished.
Significance of effect	The significance of effect will be **Major** as sensitivity to change is high and magnitude of change is high.

10.7.1.3 Viewpoint 3: Residential properties on Marbel Drive Grand Cayman

VP03 is located on Marbel Drive. The assessment for VP03 is discussed in Table 10.15. The existing view is illustrated in Photo 10.31 and artistic impression illustrating the Project design are shown in Photo 10.32.

Photo 10.31 Viewpoint 3: Residential properties on Marbel Drive - existing view

Photo 10.32 Artistic impression showing the Project from viewpoint location three

Table 10.15 VP03 assessment

Criteria	Comments
Location and view direction	Location (MGA Zone 55); 19.310064N 81.381961W VP03 is situated 0.4 miles (650 metres) from the Project and is facing in an eastern direction. This viewpoint is representative of views experienced by residents of Marbel drive and the users of the road to access the joining roads of Jacada Close and Surrey Lane.
Description of existing view	In the image's foreground, the main feature is a road running through the neighbourhood, flanked on the left side by a single-story building painted white with a terracotta linear detail. The building is surrounded by a garden wall that borders the road, creating a sense of enclosure and privacy. Behind the wall, a variety of vegetation can be seen peeking over the top; a single species of sedge and a small linear-shaped grassed area on the exterior provides a buffer between the wall and the road. A solitary palm tree can be seen in the midground on the left. On the right-hand side of the image, the foreground is dominated by lush and verdant vegetation composition. A well-maintained hedge lines the road on this side, with equally spaced palm trees set into the hedge. A single-story dwelling can be seen nestled among the greenery, creating a sense of seclusion and privacy. The composition's vanishing point comprises a mix of mature tree species.
Anticipated change to view	The Project will not be visible from this location, due to the vegetation blocking the view. Refer to Photo 10.32.
Sensitivity to change	The sensitivity to change would be **High** as occupiers of residential properties, at home or going to or from, with long viewing periods, within close proximity to the proposed development; Communities that place value upon the landscape and enjoyment of views of their setting.
Magnitude of change	The magnitude of change would be **Negligible** as minor loss or alteration to one or more key view elements, features or characteristics, or the introduction of components that may be visible but may not be uncharacteristic within the existing view.
Significance of effect	The significance of effect will be **Minor** as sensitivity to change is high and magnitude of change is negligible.

10.7.1.4 Viewpoint 4: Residential properties on Lakeside Villas

VP04 is located in Lakeside Villas carpark looking east towards the Project Site across the Esterly Tibbetts Highway. The assessment for VP04 is discussed in Table 10.16. The existing view is illustrated in Photo 10.33 and an artistic impression illustrating the Project design is shown in Photo 10.34.

Photo 10.33 ***Viewpoint 4: Located in Lakeside Villas car park looking east towards Project Site across Esterly Tibbetts Highway - existing view***

Photo 10.34 ***Viewpoint 4: Lakeside Villas car park looking east towards Project Site across Esterly Tibbetts Highway - Artistic Impression***

Table 10.16 VP04 assessment

Criteria	Comments
Location and view direction	Location (MGA Zone 55); 19.308675N 81.377910W VP04 is situated 820 feet (250 metres) from the Project and is facing in an eastern direction. This viewpoint is representative of views experienced by the residents and visitors of Lakeside Villas that use the carparking spaces.
Description of existing view	A car park is featured in the foreground to mid-ground of the image, displaying various car models. The border of the car park is lined with palm trees, and trim liner hedges are maintained between the spaces. Moving towards the centre midground, the visual frame is created by the palm trees lining the area, providing a clear view of the mound of the GTLF. The central midground is free of vegetation hedges but is instead adorned with palm trees, three mature, three recently planted and of small stature, that contributes to the frame. To the left-hand side of this palm tree-lined centre view, a mixed-height hedge composed of various species is visible. The crash barrier running from left to right in the centre midground indicates the presence of a freeway, with a chainlink fence visible behind it, marking the boundary of the project site. Directly behind the fence is a hedge consisting of an unknown species. A series of utility wires run from left to right, with a single lamp post positioned at the centre of the frame.
Anticipated change to view	In the centre midground to the mid right where the vegetation and tree line meet, a series of large industrial buildings and ventilation stack will be visible. The buildings are visually located behind the existing vegetation line and would be partially obscured from view with the stack being the most visible from this location. Plumes of white steam and gas would be exhausted from the stack during operation, which would make it more visible.
Sensitivity to change	The sensitivity to change would be **High** as occupiers of residential properties, at home or going to or from, with long viewing periods, within proximity to the proposed development; Communities that place value upon the landscape and enjoyment of views of their setting.
Magnitude of change	The magnitude of change would be **Low** as minor loss or alteration to one or more key view elements, features or characteristics, or the introduction of components that may be visible but may not be uncharacteristic within the existing view.
Significance of effect	The significance of effect will be **Moderate** as sensitivity to change is high and magnitude of change is low.

10.7.1.5 Viewpoint 5: Camana Bay Observation Tower

VP05 is located on the Camana Bay Observation Tower (approximately 74 feet (22.5 metres) high). The assessment for VP05 is discussed in Table 10.17. The existing view is illustrated in Photo 10.35 and an artistic impression illustrating the Project design is shown in Photo 10.36.

Photo 10.35 Viewpoint 5: Camana Bay Observation Tower existing view

Photo 10.36 Artistic impression showing the Project from viewpoint location[6]

[6] Note: white outlines represent proposed Project infrastructure that is obscured from view from this vantage point by existing infrastructure, vegetation and topography

Table 10.17 VP05 assessment

Criteria	Comments
Location and view direction	Location (MGA Zone 55); 19.321814N 81.377712W Elevation: 74 feet (22.5 metres). VP05 is situated approximately one kilometre from the Project and is facing in a southern direction. This viewpoint is representative of views experienced by users of the observation tower.
Description of existing view	On the left-hand side of the image's foreground, there are two tall palm trees with a linear planting of smaller palm trees behind them, extending further into the mid-ground. A similar planting style can be seen on the far-right side of the image, bordering one of the buildings. The image's foreground, middle ground, and parts of the background feature buildings of various heights and designs, all showcasing a contemporary architectural finish. In the centre of the mid-ground, a tall office building stands out. Towards the right side of the centre of the image, an open space reveals a view of the vegetation line, creating a contrast to the otherwise urban and artificial environment.
Anticipated change to view	The Project will not be visible from this location, due to the office building obscuring the buildings and stack from view.
Sensitivity to change	The sensitivity to change would be **High** as occupiers of residential properties, at home or going to or from, with long viewing periods, within proximity to the proposed development; Communities that place value upon the landscape and enjoyment of views of their setting.
Magnitude of change	The magnitude of change would be **Negligible** as almost imperceptible or no change in the view as there is little or no loss of/or change to the elements, features, or characteristics of the view.
Significance of effect	The significance of effect will be **Minor** as sensitivity to change is high and magnitude of change is negligible.

10.7.1.6 Viewpoint 6: Tall residential properties on Seven Mile Beach

VP06 is taken from a tall residential building on Seven mile beach located on Snooze Lane. The assessment for VP06 is discussed in Table 10.18. The existing view is illustrated in 10.37 and artistic impression illustrating the Project design are shown in Photo 10.38 and Photo 10.39.

Photo 10.37 Viewpoint 6: Tall residential properties on Seven Mile Beach on Snooze Lane looking east – existing view.

Photo 10.38 Viewpoint 6: Tall residential properties on Seven Mile Beach on Snooze Lane looking east – Project at year 0.

Photo 10.39 Viewpoint 6: Tall residential properties on Seven Mile Beach, looking east – Project at year 10.

Table 10.18 VP06 assessment

Criteria	Comments
Location and view direction	Location (MGA Zone 55); 19.311931N 81.385333W Elevation: 74 feet (22.5 metres) approx. VP06 is situated approximately one kilometre from the Project and is facing in an eastern direction. This viewpoint is representative of views experienced by the residences of the building.
Description of existing view	The photo taken from an elevated position provides a panoramic view of the Project Site. In the foreground, a public service building with a roof and a surrounding car park is visible. Towards the centre of the image, a main road runs horizontally from right to left. The middle ground shows an urban setting with substantial vegetation, mainly consisting of palm trees planted linearly along the boundary lines of the properties and the road. The central background offers a clear view of the GTLF, with the sea visible beyond it. On the right side of the GTLF, the urban matrix can be seen extending towards the vanishing points of the composition while non-human made elements rise above the horizon line.
Anticipated change to view	In the centre background a series of large industrial buildings and a ventilation stack will be visible. Plumes of white steam and gas would be exhausted from the stack during operation, which would make it more visible.
Sensitivity to change	The sensitivity to change would be **High** as the occupiers of residential properties, at home or going to or from, with long viewing periods, within proximity to the proposed development; Communities that place value upon the landscape and enjoyment of views of their setting.
Magnitude of change	The magnitude of change would be **High** as a substantial/obvious change to the existing view due to total loss of, or change to, elements, features, or characteristics of the view. Would cause a view to be permanently changed and its quality diminished.
Significance of effect	The significance of effect will be **Major** as sensitivity to change is high and magnitude of change is high.

10.7.1.7 Viewpoint 7: Cruise Liner anchored off Seven Mile Beach

VP07 is taken from the deck of a cruise ship located approximately 2,297 feet (700 metres) off the coast of Seven Mile Beach. The baseline and effect assessment for VP07 is discussed in Table 10.19. The existing view is illustrated in Photo 10.40 and an artistic impression illustrating the Project design are shown in Photo 10.41.

Photo 10.40 Viewpoint 7 Cruise Liner anchored off Seven Mile Beach - existing view looking east

Photo 10.41 Viewpoint 7: Cruise Liner anchored off Seven Mile Beach – showing the Project year 10

Table 10.19 VP07 assessment

Criteria	Comments
Location and view direction	Location (MGA Zone 55); 19.311931N 81.385333W Elevation: 74 feet (22.5 m) approx. VP07 is situated approximately one kilometre from the Project and is facing in an eastern direction. This viewpoint is representative of views experienced by the tourists and staff of the cruise liners.
Description of existing view	The photo taken from an elevated position provides a panoramic view of the Project Site. In the foreground, the sea and bay that make up seven-mile beach is viewable. Towards the centre of the image, seven-mile beach and its hotels, residencies and small port can be seen. The middle ground shows an urban setting with substantial vegetation. The central background offers a clear view of the GTLF, with the sea visible beyond it.
Anticipated change to view	In the centre background a series of large industrial buildings and a ventilation stack will be visible. Plumes of white steam and gas would be exhausted from the stack during operation, which would make it more visible.
Sensitivity to change	The sensitivity to change would be **High** as the occupiers of residential properties, at home or going to or from, with long viewing periods, within proximity to the proposed development; Communities that place value upon the landscape and enjoyment of views of their setting.
Magnitude of change	The magnitude of change would be **High** as a substantial/obvious change to the existing view due to total loss of, or change to, elements, features, or characteristics of the view. Would cause a view to be permanently changed and its quality diminished.
Significance of effect	The significance of effect will be **Major** as sensitivity to change is high and magnitude of change is high.

10.7.1.8 Viewpoint 8: North Sound

VP08 is taken from a boat located approximately one mile (1.5 kilometres) off the coast of the North Sound Lagoon. The baseline and effect assessment for VP08 is discussed in Table 10.20. The existing view is illustrated in Photo 10.42 and the artistic impression illustrating the Project design is shown in Photo 10.43.

Photo 10.42 Existing view looking west

Photo 10.43 Artistic render showing the Project from the viewpoint

Table 10.20 VP08 assessment

Criteria	Comments
Location and view direction	Location (MGA Zone 55); 463235.771 E, 2137471.258 N Elevation: Not provided. VP08 is situated approximately one and a half kilometres east of the Project and is looking west. This viewpoint is representative of views experienced by the users of the North Sound Lagoon.
Description of existing view	The image's composition consists of the expansive water of the North Sound Lagoon across the foreground, the land of the Grand Cayman Island in the mid-ground, creating the thin horizon line, with the expansive heavily clouded blue sky above. The water's surface is textured by the wind, evident in the choppy and undulating waves. The midground of this composition depicts the North Sound Lagoon's mangroves, with dense dark green vegetation creating a strong delineation between the turquoise sea and dark green land. The mangroves upper vegetation has varied heights creating a filtered horizon line with the sky. The views are predominately to natural elements, with the exception of the land fill mound to the right of view. To the left of the view stand two communication towers, that rise above any existing element in the landscape, above the horizon line.
Anticipated change to view	A series of large industrial buildings and a ventilation stack will be visible in the central background. Plumes of white steam and gas may be exhausted from the stack during operation, making it more visible. However, from this location, the buildings and stack sit below or are equal to the height of communications towers within the viewpoint. The Project is visually located behind the mangroves.
Sensitivity to change	The sensitivity to change would be **High** for users and communities of the North Sound who hold an appreciation for the landscape's significance and the scenic views of their surroundings.
Magnitude of change	The magnitude of change is deemed **High**, as it would lead to a permanent alteration of the landscape, causing a reduction in its overall quality.
Significance of effect	The significance of effect will be **Major** as sensitivity to change is high and magnitude of change is high.

10.7.2 Other Views

Photo 10.44 Additional view of looking East down Courts Road from Eastern Avenue.

Photo 10.45 Additional view of typical residential area within Zone 3

10.7.3 Construction effects

At present, it is anticipated that the construction period will be over a 24-33 month period from 2024 to 2027. During this period, construction activities may be within view, including the temporary presence of cranes, concrete pumps and other machinery, as well as construction compounds and other ancillary structures.

The presence of the above elements is not anticipated to be significantly out of character within the existing visual environment due to the location of the Project within an industrial area. Furthermore, existing and anticipated future construction sites are expected to be present within the surrounding visual environment. The visual effects associated with construction are temporary and therefore do not influence the overall ratings of the viewpoints in this report.

10.8 Mitigation measures

The below mitigation measures are to be considered to reduce the effects of the Project. These include:

- Consider colour gradations to reflect the surrounding sky, landscape and seascape.
- Consider materials of low reflectivity.
- Consider façade treatment or alternative use to create visual variation (such as artistic mural, outdoor cinema, rock climbing etc.).

10.9 Conclusion

This Landscape and Seascape Visual Assessment has been undertaken to identify the potential effects of the Project based on its concept design.

The Project area is located to the north of central George Town towards the western coast of Grand Cayman, immediately south-west of the existing George Town Landfill. The Project Site sits within the identified LCZ2, bordering with LCZ3 and SCZ4. The scale and location of the Project within this zone which already contains similar land uses reduces the potential for significant direct landscape effects upon Grand Caymans key landscape and townscape characteristics.

A total of five landscape and seascape character zones were identified within the study area: Tourism foreshore and George Town centre (LCZ1), Industrial, waste and airport (LCZ2), Residential settlement (LCZ3), Mangroves and recreation (SCZ4), Caribbean Sea and North Sound Lagoon (SCZ5). In terms of indirect landscape effects upon surrounding character areas, these will primarily be a consequence of a visual effect (i.e., where some components of the Project during the construction and/or operation periods will become visible in outward views available from these character areas). However, the likely level of screening provided by built form within the northern and central parts of George Town to the south; and the development associated with Seven Mile Beach and Camana Bay to the west allied with the context within which the development will be viewed (i.e., within a zone in which industrial development and construction activities are common), will reduce the potential for the Project to have a significant influence upon the character and key characteristics of these neighbouring landscape and seascape character areas.

LCZ2 Industrial, waste and airport was found to have a **Moderate-** effect associated with location of the Project within LCZ2, along with the tall stack height (158 ft or 48.1 m) which will have high visibility. The landscape and seascape character zones LCZ3 and SCZ5 were found to have **Minor** landscape character effects, due to their high sensitivity and negligible magnitude of change. LCZ1 and SCZ4 were found to have **Negligible** landscape character effects as a result from the Project, due to their medium sensitivity and negligible magnitude of change.

Sensitive visual receivers in the study area include residents, pedestrians, road users, cruise liner users, and workers of the industrial zone. Eight viewpoint locations were chosen to assess the visual effects of the Project on sensitive receivers within the study area. Visual effects were assessed using panoramas of the existing view and seven artistic impressions were created illustrating the proposed view of the Project, from eight viewpoint locations. The assessment found that the Project would have a **Major** visual effect on VP02, VP06 VP07 and VP08 due to the high sensitivity of residents and church users on Woodlake Drive, residents on Seven Mile Beach tourists and staff of the cruise liners off Seven Mile Beach and users of the North Sound Lagoon. A **Moderate** visual effect is experienced from VP04, while VP01, VP03 and VP05 experience a **Minor** overall visual effect.

Mitigation measures proposed for the construction and operational stages should be incorporated into detailed design and construction management plans to reduce visual effects. Mitigation measures such as screening vegetation may be useful locally to screen views from the residential areas, however the size of the project as seen from VP06 and VP07 would not be mitigated by this approach.

The following Table 10.21 and Table 10.22 provide a summary of landscape and visual effects for the Project.

Table 10.21 Summary of landscape effects

LCZ	Description	Sensitivity to change	Magnitude of change	Overall Rating
LCZ1	Tourism foreshore and George Town centre	Medium	Negligible	**Negligible (Not significant)**
LCZ2	Industrial, waste and airport	Low	High	**Moderate (Probably significant)**
LCZ3	Residential settlement	High	Negligible	**Minor (Not significant)**
SCZ4	Mangroves and recreation	High	Negligible	**Negligible (Not significant)**
SCZ5	Caribbean Sea and North Sound Lagoon	High	Negligible	**Minor (Not significant)**

Table 10.22 Summary of visual effects

Viewpoint	Location	Sensitivity to change	Magnitude of change	Overall Rating
VP01	National Galley of the Cayman Islands	Low	Medium	**Minor (Not significant)**
VP02	United Pentecostal Church	High	High	**Major- (Significant)**
VP03	Residential properties on Marbel Drive	High	Negligible	**Minor (Not significant)**
VP04	Residential properties on Lakeside Villas	High	Low	**Moderate (Probably significant)**
VP05	Camana Bay Observation Tower	High	Low-Negligible	**Minor (Not significant)**
VP06	Tall residential properties on Seven Mile Beach	High	High	**Major (Significant)**
VP07	Cruise Liner anchored off Seven Mile Beach	High	High	**Major (Significant)**
VP08	North Sound Lagoon	High	High	**Major (Significant)**

11. Air Quality and Greenhouse Gases Emissions

11.1 Purpose

GHD Limited (GHD) was retained by ReGen and the Cayman Islands Government (CIG) as approved by the Environmental Assessment Board (EAB) to undertake an Air Quality and Greenhouse Gases Assessment (Assessment) as part of the Environmental Impact Assessment (EIA) for the proposed Integrated Solid Waste Management System (ISWMS, Proposed Development).

Emissions of air pollutants are known to have an adverse impact on human health and ecological features. The activities proposed during the construction and operational phases of the ISWMS have the potential to result in an increase of air emissions, thereby having the potential to affect the air quality in the vicinity of the proposed development, leading to the potential for significant effects on health and ecological features, and so must be assessed as part of the EIA.

In line with the Terms of Reference (ToR) and Air Quality Method Statement, the Air Quality and Greenhouse Gases Assessment discusses the existing air quality in the vicinity of the Proposed Development, provides an assessment of the potential impacts from the construction and operation of the ISWMS on local air quality, and makes a determination as to the significance of the likely potential effects. The potential air quality impacts were compared to relevant standards and guidelines and to the existing air quality conditions. This Assessment relies, in part, upon baseline data collected through the ambient air monitoring program (Program) **(Appendix 11.A [Air Quality Assessment – Appendix A])** initiated in October 2021 in support of the Proposed Development, as agreed via the Air Quality Methods Statement (approved October 2021).

11.2 Study area

For the purpose of this assessment, an Air Quality Study Area (Study Area) was defined to extend up to 6 miles (10 kilometres) in all four cardinal directions (see Figure 11.1).

Figure 11.1 Air quality Study Area

11.3 Applicable standards and guidelines

As noted in the ToR, standards and guidance were used to define the scope of the air quality assessment. The Cayman Islands Government do not have any relevant published Standards and/or guidance specific to air quality and odour. A general reference to emissions sources that can have an impact on human health or cause a nuisance is made in the Cayman Public Health Law (2002 revision), described below. Due to the lack of more specific guidance in the national legislation, the Assessment relied on reference to relevant British and International Standards.

11.3.1 Summary of standards and technical guidance

Cayman Public Health Law (2002 revision)[1]

The Public Health Law (2002 revision) sets out powers in respect of nuisance from pollution. This Law provides provisions that apply to any "furnace, chimney, fireplace, bonfire or other place from which is emitted smoke or other unconsumed combustible matter…[and]…any vehicle or vessel, in such a condition as to be prejudicial to health or a nuisance". A nuisance is defined "as any act, omission, or thing occasioning or likely to occasion injury, annoyance, offence, harm, danger or damage to the sense of sight, smell or hearing, or which is or is likely to be dangerous or injurious to person or property". Under this Law, the Chief Environmental Health Officer can serve Notices requiring abatement of any source of pollution deemed to be a nuisance, with powers extending to the potential closing of activities that do not comply with such Notices.

EU Directive 2008/EU/EC[2]

The 2008 directive replaced nearly all the previous EU air quality legislation and was made law in England through the Air Quality Standards Regulations 2010. It sets legally binding limits for concentrations of major air pollutants in outdoor air that impact public health.

EU Industrial Emissions Directive (IED – 2010/75/EU)[3]

Emissions in the Cayman Islands are guided by the EU Industrial Emissions Directive (IED – 2010/75/EU). The IED - 2010/75/EU is the main EU instrument regulating pollutant emissions from industrial installations, including waste incinerators and Energy Recovery Facility (ERF). It provides acceptable emission values and aims to achieve a high level of protection of human health and the environment taken as a whole by reducing harmful industrial emissions across the EU, in particular through better application of Best Available Techniques (BAT).

Institute of Air Quality Management Guidance on land-use planning and development control: Planning for air quality 2017 v1.2[4]

Presents a methodology for determining air quality impacts upon sensitive receptors from changes in road traffic emissions due to new developments. It provides criteria to define the significance of impacts.

Institute of Air Quality Management Guidance for the Assessment of dust from demolition and construction 2014[5]

Presents a methodology for determining impacts related to the generation of dust during construction activities. It provides criteria to define the sensitivity of receptors and the magnitude of impacts and combines them to define the risk of dust impacts.

1 Watler, *Cayman Public Health Law*, 2002
2 European Parliament, *Directive 2008/50/EC*, 2008
3 European Parliament, *Directive 2010/75/EC*, 2010
4 Moorcroft et.al, *IAQM Guidance on land use planning and development control*, 2017
5 Holman et.al, *IAQM Guidance for the Assessment of dust from demolition and construction*, 2014

Air Quality Guidelines – Second Edition; World Health Organization, Copenhagen, Denmark, 2000[6]

This document presents reasoning for, and establishes guidelines for, ambient air concentrations of hydrogen sulphide to avoid adverse health and odour impacts.

Institute of Air Quality Management Guidance on the assessment of odour for planning[7]

This document provides a recommended scope for prediction and assessment of odour impacts by defining the sensitivity of receptors, the magnitude of impact and the risk of odour impacts.

Cayman Islands Climate Change Policy (2011)[8]

The Climate Change Policy contains measures required to curb greenhouse gas (GHG) emissions from activities that contribute to the problem of continued climate change. This Climate Change Policy recognizes that the combined actions of responding to the inevitable impacts of a changing climate (adaptation) and reducing further contributions to climate change (mitigation) are cost-effective and urgently needed in order to ensure low-carbon climate-resilient development in the Cayman Islands.

The Public Consultation Draft of the updated Climate Change Policy was released in May 2023 for comment and reflects the findings of the Cayman Islands Climate Change Risk Assessment[9].

International Finance Corporation (IFC) Guidance Note 3 (2006)[10]

The Guidance Note states that during the development or operation of projects that are expected to produce significant quantities of GHGs (i.e., more than 100,000 tons of carbon dioxide (CO_2) equivalent (CO_2eq) per year), the operator should quantify direct emissions from the facilities owned or controlled within the physical project boundary and indirect emissions associated with the off-site production of power used by the project and evaluate technically and financially feasible and cost-effective options to reduce or offset project-related GHG emissions during the design and operation of the project.

Public Health (Infectious Waste) Regulations (2002 Revision)[11]

Sets out the equipment and air pollution control requirements relating to the management of infectious waste including the operation of a medical waste incinerator in the Cayman Islands.

Florida Administrative Code (FAC) Chapter 62-709[12]

Sets out the design, operating, testing, recording and reporting requirements for organics processing and recycling, including yard waste processing operations. This includes the requirements for odour control in accordance with subsection 62-296.320(2), F.A.C.

11.3.2 Regulatory framework

The following includes a review of the regulatory framework that governs the ambient air quality as well as the industrial emission limits.

11.3.2.1 Ambient air quality

The standards that were used for the determination of compliance with ambient air criteria were taken from the UK National Air Quality Objectives. These applicable air quality standards and associated time averaging periods are provided in Table 11.1.

6 WHO Regional Office for Europe, Air Quality guidelines for Europe, 2nd Edition, 2000
7 Bull et.al, Institute of Air Quality Management Guidance on the assessment of odour for planning, 2018
8 Cayman Island Government. *Climate Change Policy*. 2011
9 Cayman Islands Government. *Cayman Islands Climate Change Risk Assessment*. 2022
10 IFC. *Pollution Prevention and Abatement*. 2006
11 Cayman Island Government, *Public Health (Infectious Waste) Regulations*, 2002
12 Florida Department of State. *Criteria for Organics Processing and Recycling Facilities*. 2010

Table 11.1 Summary of applicable air quality standards and averaging periods

Category	Contaminant	CAS#	Averaging Period	Compliance Limit	Standard
Contaminants of Potential Concern (CoPCs) [9]	Carbon Monoxide (CO)	630-08-0	8 Hour running average across a 24 hour period	10 mg/m^3	AAD Limit Value and AQS Objective
	Nitrogen Dioxide (NO_2)	11104-93-1	1 Hour	200 $\mu g/m^3$ (2)	AAD Limit Value
	Nitrogen Dioxide (NO_2)	11104-93-1	Annual	40 $\mu g/m^3$	AAD Limit Value
	Particulates (PM10)	NA - 1	24 Hour	50 $\mu g/m^3$ (3)	AAD Limit Value
	Particulates (PM10)	NA - 1	Annual	40 $\mu g/m^3$	AAD Limit Value
	Particulates (PM2.5)	NA - 2	Annual	20 $\mu g/m^3$ (10)	AAD Limit Value
	Sulphur Dioxide (SO_2)	7446-09-5	1 Hour	350 $\mu g/m^3$ (4)	AAD Limit Value
	Sulphur Dioxide (SO_2)	7446-09-5	24 hour	125 $\mu g/m^3$ (5)	AAD Limit Value
	Sulphur Dioxide (SO_2)	7446-09-5	15-Minute Mean	266 $\mu g/m^3$ (6)	UK AQS Objective
	Hydrogen Chloride (HCl)	7647-01-0	Hourly Limit in $\mu g/m^3$	750 $\mu g/m^3$	EAL
	Hydrogen Flouride (HF)	7664-39-3	Annual Limit	16 $\mu g/m^3$ (monthly average)	EAL
	Hydrogen Flouride (HF)	7664-39-3	Hourly Limit in $\mu g/m^3$	160 $\mu g/m^3$	EAL
	Cadmium (Cd)	7440-43-9	Annual	5 ng/m^3	AAD Target Value
	Arsenic (As)	7440-38-2	Annual	6 ng/m^3	AAD Target Value
	Lead (Pb)	7439-92-1	Annual	0.25 $\mu g/m^3$	UK AQS Objective
	Nickel (Ni)	7440-02-0	Annual	20 ng/m^3	AAD Target Value
	Dioxins and Furans [7]	NA - 3	24 Hour	0.1 $pgTEQ/m^3$	AAQC
Additional contaminants included for background monitoring assessment [8]	Polycyclic Aromatic Hydrocarbons (PAHs) [8]	50-32-8	Annual	0.25 ng/m^3 of benzo(a)pyrene (BaP) total content within the PM10 fraction	UK AQS Objective
	Volatile Organic Carbon (VOCs) (Benzene) [8]	71-43-2	Annual-Running Mean	0.25 ng/m^3 of benzo(a)pyrene (BaP) total content within the PM10 fraction	EAL
	Volatile Organic Carbon (VOCs) (Benzene) [8]	71-43-2	24 Hour	30 $\mu g/m^3$	EAL
	Hydrogen Sulphide [7,8]	7783-06-4	10 Minute	13 $\mu g/m^3$	AAQC

Notes:

(1) Reporting Standards sourced from National Air Quality objectives and European Directive limit and target values for the protection of human health (applicable to the UK). https://uk-air.defra.gov.uk/assets/documents/Air_Quality_Objectives_Update.pdf

(2) Not to be exceeded more than 18 times a year.

(3) Not to be exceeded more than 35 times a year.

(4) Not to be exceeded more than 24 times a year.

(5) Not to be exceeded more than 4 times a year.

(6) Not to be exceeded more than 35 times a year.

(7) Reporting Standards for Hydrogen Sulphide, Dioxins and Furans were sourced from "The Ministry of the Environment, Conservation and Parks" of Ontario, Canada. https://www.ontario.ca/page/ontarios-ambient-air-quality-criteria#section-4

(8) These contaminants were measured for the background air quality assessment, however are not included in the Project modelling due to the Project not being expected to emit these contaminants.

(9) CoPCs were defined in the Terms of Reference and Air Quality Method Statement. Total dust is assessed using Particulates (PM10 and PM2.5). VOCs and TOCs represent a grouping of substances and does not have applicable air quality standards to list in this table.

(10) The UK AAD Limit value for PM2.5 was updated in 2020 from 25 $\mu g/m^3$ to 20 $\mu g/m^3$. Therefore, the updated value was used as it is more conservative than the limit defined in the terms of reference.

EAL - Environmental Assessment Levels
AAD - Ambient Air Quality Directive
AQS - Air Quality Strategy Value
AAQC - Ambient Air Quality Criteria

The primary EU tool for controlling pollutant emissions from industrial units, such as waste incinerators and ERFs, is the EU Industrial Emissions Directive (IED – 2010/75/EU). By lowering harmful industrial emissions throughout the EU, particularly through improved application of Best Available Methods, it strives to ensure a high degree of protection for human health and the environment as a whole. The ISWMS ERF will have one primary exhaust stack for emissions from the ERF activities, referred to hereafter as the "ERF stack". The applicable emission standards for the ERF stack is summarized in Table 11.2.

Table 11.2 Industrial emission limits for ERFs

Pollutant	Emission Limit Values[1] (mg/Nm^3)
SO_x	50
CO[3]	50
CO[4]	100
CO[5]	150
TOC	10
HCl	10
HF	1
NOX	200
TOC	10
Dust[2]	10
Cd	Total 0.05
Tl	
Hg	0.05
Sb	Total 0.5
As	
Pb	
Cr	
Co	
Cu	
Mn	
Ni	
V	
PCDD & PCDF	1.00E^{-07}

Notes:
(1) Directive 2010/75/EU (Annex VI Part 3) of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control).
(2) Dust is assessed as PM10 and PM2.5
(3) Daily average value
(4) Half-hour average value
(5) 10-minute average value

Although the UK National Air Quality Objectives has an air quality standard for H_2S, the Ontario (Canada) 10-minute limit for odour is used because the purpose of assessing H_2S for this study is in relation to an odour assessment.

There are no ambient air quality limits for dioxins and furans in the UK National Air Quality Objectives. For reference, the Ontario limits have been used which is based on WHO guidance. Industrial Emission Limits.

11.4 Methodology

During the ISWMS operational time, airborne dispersion of contaminants will serve as the main conduit for air contaminants to reach human and sensitive receptors.

The assessment of the effect on air quality from the ISWMS was performed by conducting dispersion modelling to predict the downwind concentrations of air contaminants and comparing these predictions to regulatory standards and guidelines. There are several steps to building a plume dispersion model. The preparation of a representative emissions inventory is key to a successful modelling prediction.

The assessment of air quality effects related to the ISWMS consisted of the following elements:

– Assessment of existing baseline ambient air quality conditions for Chemicals of Potential Concern (CoPCs) from the existing air emissions sources at the Site and its vicinity through emission inventory and air monitoring measurements.
– Compilation of emissions estimates for CoPCs from ISWMS point and mobile sources.
– Dispersion modelling of the existing emissions from the Site and significant sources identified in the vicinity to establish a baseline model and compare to monitored data.
– Comparison of dispersion model predictions to ambient air quality criteria as well as evaluation of the incremental change in air quality associated with the ISWMS.

The impact assessment methodology primarily consisted of ensuring that there would be no exceedances to the air quality limits defined in the air quality criteria, defined further in Section 11.3.2.1. This was the main consideration for whether the air quality changes would have a significant impact.

The following timeframes were considered for dispersion modelling, in order to assess potential impacts on the air quality.

Baseline

Existing emission sources at the Site and its vicinity would be contributing towards the baseline or background air concentrations.

Construction Phase

The time during which the construction activities occur on the site to setup the facilities associated with the Project. Predominantly emission from the construction phase is expected to be dust.

Operational

This phase includes the fully operational state of the Project. Estimated maximum emissions of the CoPCs are modelled and the maximum offsite concentrations are added to the baseline monitored concentrations for a cumulative impact assessment.

11.4.1 Contaminants of potential concern

The expected emissions, based on the ISWMS-specific design and operation (see Chapter 4), formed the basis for selecting the substances for evaluation. A comprehensive list of CoPCs was developed in consultation with the EAB and published in the ToR and Air Quality Method Statement, included in **Appendix 11.A (Air Quality Assessment - Appendix A**). The CoPCs are listed below:

– Dioxins and Furans (PCDD/PCDF)
– Total Dust, assessed as:
    - Particulate (particulate matter < 10 microns [PM_{10}])
    - Particulate (particulate matter < 2.5 microns [$PM_{2.5}$])
– Volatile organic compounds (VOC) as Total Organic Carbon (TOC)

– Hydrogen Chloride (HCl)
– Hydrogen Fluoride (HF)
– Sulphur Dioxide (SO_2)
– Oxides of Nitrogen (NOx) expressed as NO_2
– Carbon Monoxide (CO)
– Heavy Metals:
  - Cadmium (Cd)
  - Thallium (Tl)
  - Mercury (Hg)
  - Antimony (Sb)
  - Arsenic (As)
  - Lead (Pb)
  - Chromium (Cr)
  - Cobalt (Co)
  - Copper (Cu)
  - Manganese (Mn)
  - Nickel (Ni)
  - Vanadium (V)

Dust was assessed as $PM_{2.5}$ and PM_{10}. In addition, as part of the odour assessment, hydrogen sulphide (H_2S) from the landfilling activities and the surrounding potential odour sources was identified as a compound of concern. Polycyclic Aromatic Hydrocarbons (PAHs) was also included as a compound of concern due to fuel combustion background sources. The most significant VOC from the fuel combustion sources is benzene and it was used as the indicator for VOCs.

11.4.2 Impact assessment and mitigation

As noted in the ToR, the significance of air quality impacts are defined following the Institute of Air Quality Management (IAQM) Guidance on land-use planning and development control: Planning for air quality 2017 v1.2.

The significance of odour impacts are defined following IAQM Guidance on the assessment of odour for planning. Per this guidance, the assessment of odours follows a two-stage assessment process including an odour risk assessment and, if warranted, odour dispersion modelling, performed only if the risk assessment identifies a risk for odour impacts to take place. Odour dispersion modelling was not required for the ISWMS as the odour risk assessment carried out as part of the ambient air monitoring program did not identify a risk for odour impacts.

There is no guidance that sets out how to determine the significance of bioaerosol impacts. As such, a qualitative approach was taken for bioaerosol assessment based upon the likelihood of the generation of bioaerosols, the quantity likely to be generated, the potential for them to be released to the air outside of the facility, and the potential for such releases to lead to significant impacts at the nearest sensitive receptors.

The IFC states in its Guidance Note 3 (2006)[13] that the significance of a project's contribution to GHG emissions varies between industry sectors and provides an indicative threshold of 100,000 tons (101,604 tonnes) CO2 equivalent per year for the aggregate emissions of direct sources and indirect sources associated with purchased electricity for own consumption. GHG emissions should be quantified annually in accordance with internationally recognised methodologies and reporting procedures. All reasonable attempts should be made to maximise energy efficiency and design facilities to minimise energy use.

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[13] International Finance Corporation. *Guidance Note 3*. 2006.

The likely significant effects on air quality identified in the ToR and taken forward for assessment are summarized in Table 11.3.

Table 11.3 Likely significant air quality effects

Activity	Effect	Receptor
Site construction	Emission of dust causing loss of amenity at sensitive receptors that occur near to work sites and haul road	Residential properties, schools, commercial sites, ecological sites
Site construction	Emissions from construction vehicles and plant through fuel combustion that could increase concentrations of pollutants that could affect human health (NO_2 and particulate matter)	Residential properties, schools, commercial sites, ecological sites
Site operations	Emission of air pollutants causing effects on human health and ecological receptors	Residential properties, schools, commercial sites, ecological sites
Site operations	Odour emissions causing effects on quality of life	Residential properties, schools, commercial sites
Site operations	Increased emissions from project vehicles on public highways that could increase concentrations of pollutants that could affect human health (mainly NO_2) at receptors near to road	Residential properties, schools, commercial sites, ecological sites
Site operations	Bioaerosol causing effects on human health	Residential properties, schools, commercial sites
Site operations	GHG emissions causing effects on climate	Climate
Site operations	Dust arising from the ash storage area causing effects on human health and quality of life	Residential properties, schools, commercial sites
Site operations	Dust arising from the production of the aggregate causing effects on human health and quality of life	Residential properties, schools, commercial sites
Site operations	Emissions arising from RWL development activities	Residential properties, schools, commercial sites, ecological sites

It should be noted that the proposed development includes the closure and capping of the existing George Town Landfill (GTLF). This closure plan will not be addressed through this EIA but will be subject to a risk-based assessment. The closure is expected to result in the following benefits:

- Elimination of refuse odour from the landfill;
- Elimination of landfill fires that have contributed to significant air emissions; and
- Reduction of GHG and volatile organics emissions through the collection of landfill gas.

11.4.2.1 Air quality impact assessment

As noted in Section 11.3, the standards that were used in the Air Quality Assessment for the determination of contaminants of concern compliance with ambient air criteria were taken from the UK National Air Quality Objectives. While these compliance limits do strictly indicate whether emissions of a particular contaminant are significant or not, IAQM offers the following methodology for further assessing impacts, as presented in Table 11.4, where an impact of substantial is considered to be significant and moderate may be considered significant, as determined by professional judgement.

Table 11.4 Air quality significance rating

Long term average concentration at receptor in assessment year	Percent change in concentration relative to Air Quality Assessment Level (AQAL)			
	1	2-5	6-10	>10
75 percent or less of AQAL	Negligible	Negligible	Slight	**Moderate**
76-94 percent of AQAL	Negligible	Slight	**Moderate**	**Moderate**
95-102 percent of AQAL	Slight	**Moderate**	**Moderate**	**Substantial**
103-109 percent of AQAL	**Moderate**	**Moderate**	**Substantial**	**Substantial**
110 percent or more of AQAL	**Moderate**	**Substantial**	**Substantial**	**Substantial**

11.4.2.2 Odour

The determination of significance for odour, per IAQM guidance, considers the sensitivity of odour receptors (between high and low sensitivity, based on professional judgement per Table 11.5) and the risk of odour exposure (impact) (Table 11.6) to arrive at the likely magnitude of odour effects (Table 11.7), where an impact of substantial is considered to be significant and moderate may be considered significant, as determined by professional judgement.

Table 11.5 Odour receptor sensitivity

Sensitivity level	Description
High	Surrounding land where: - users can reasonably expect enjoyment of a high level of amenity; and - the people would reasonably be expected to be present here continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land. Examples may include residential dwellings, hospitals, schools/education and tourist/cultural.
Medium	Surrounding land where: - users would expect to enjoy a reasonable level of amenity, but wouldn't reasonably expect to enjoy the same level of amenity as in their home; or - people wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land. Examples may include places of work, commercial/retail premises and playing/recreation fields.
Low	Surrounding land where: - the enjoyment of amenity would not reasonably be expected; or - there is transient exposure, where the people would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land. Examples may include industrial, farms, footpaths and roads.

Table 11.6 Risk of odour exposure (impact)

		Source odour potential (considers magnitude of the odour release accounting for odour-control measures, how inherently odorous the compounds are, and the unpleasantness of the odour)		
		Small	Medium	Large
Pathway effectiveness (considering distance, prevailing wind direction, effectiveness of mitigation/ control and dispersion/dilution, topography and terrain)	Highly	Low risk	Medium risk	High risk
	Moderately	Negligible risk	Low risk	Medium risk
	Ineffective	Negligible risk	Negligible risk	Low risk

Table 11.7   Likely magnitude of odour effects

Risk of odour exposure	Receptor sensitivity		
	Low	Medium	High
High	Slight adverse effect	**Moderate adverse effect**	**Substantial adverse effect**
Medium	Negligible effect	Slight adverse effect	**Moderate adverse effect**
Low	Negligible effect	Negligible effect	Slight adverse effect
Negligible	Negligible effect	Negligible effect	Negligible effect

11.5 Baseline conditions

The following Sections describe the existing physical environment and baseline conditions within the Study Area in relation to air quality.

11.5.1 Topography

The general topography of the study area is flat landscape with mangrove swathes. The general land use in the area is a mix of industrial and residential developments. The highest point on Grand Cayman, is about 70 feet (21 metres) above sea level. There are no rivers located on the island. The coasts are usually shielded by offshore reefs and, in some locations, a mangrove fringe that occasionally reaches inland marshes.

11.5.2 Climate

The Cayman Islands have a tropical climate that is hot and humid. The northeast trade winds provide a dry, comparatively cold season from late November to mid-April, and a wet, muggy season from late April to early November. The Cayman Islands see relatively lower temperatures in the winter compared to the summer. The Islands occasionally experience cool breezes from the United States from December to March which can cause the nighttime temperature to drop to about 59°F (15°C). Maximum temperatures during the rainy season are about 90°F (32 °C).

According to the Cayman Island National Weather Service, the annual average temperature is about 82°F (28°C), with maximum temperatures reaching up to 91°F (33°C) and lowest temperatures of 64°F (18°C). The Grand Cayman on an annual basis receives about 55 in (1400 mm) of rainfall, with an annual average relative humidity of 77 percent. The predominant winds are mostly blowing from the east to the west, with an average wind speed of 15 ft/s (4.6 m/s).

11.5.3 Sensitive receptors

The ISWMS Site is located in a predominantly industrial area with sensitive receptors such as residential areas and schools located primarily to the southwest, west, and northwest. The following sensitive receptors, as shown on Figure 11.2, were included as part of the Assessment.

– Locations within the Lakeside Development (residential dwellings immediately west of the ISWMS development, on the opposite side of the Esterly Tibbetts Highway).
– Locations within the OLEA residential development approximately 2,624 ft (800 m) north of the ISWMS development.
– Properties on Parkside Close (residential dwellings approximately 2,624 ft (800 m) to the northwest of the ISWMS development).
– The Cayman International School (educational institute approximately 2,624 ft (800 m) to the north of the ISWMS development).
– The Seven Mile Beach corridor which starts approximately 4,921 ft (1,500 m) to the northwest of the ISWMS development, which includes residential tourism properties.

- Health City-Camana Bay's Cancer Research facility approximately 1,968 ft (600 m) to the north of the ISWMS development, estimated to be operational by the year 2024.
- Jasmine Hospice facility located on West Bay Road, approximately 3,281 ft (1,000 m) west of the ISWMS development.
- Royale Medical and Wellness Center is a medical laboratory located approximately 3,281 ft (1,000 m) west of the ISWMS development.
- Cayman Medical located approximately 2,952 ft (900 m) south of the ISWMS development.
- George Town Primary School located approximately 2,952 ft (900 m) southwest of the ISWMS Development.

Figure 11.2 Air quality key sensitive receptors

11.5.4 Background air quality

An ambient air monitoring program was run as part of the EIA for the Cayman Islands ISWMS. The Cayman Islands Government and its consultants assessed an Air Quality Method Statement (Method Statement) submitted by GHD. On October 8, 2021, the Method Statement was reviewed, approved, and given comments. A decision was made to construct an ambient air monitoring program (AAMP) to characterize the background (baseline) ambient air concentrations of air contaminants near the prospective location of the ISWMS, which will be close to the current area of the GTLF. GHD, Valley Environmental Services (VES), Dart Enterprises Cayman, and the Department of Environmental Health (DEH) all contributed to the creation and management of the AAMP.

The list of air pollutants that were tracked and measured for the program included the CoPC emissions that are anticipated to come from new sources connected to the ISWMS plant as well as other emissions that are already being produced by fuel combustion emissions sources in the Study Area, such as nitrogen oxides. The potential emission sources that make contributions to the current baseline are shown on Figure 11.3.

On October 24, 2021, the AAMP was launched and lasted for about four months, with around one month of the wet season and three months of the dry season. Staff from Dart and DEH managed the AAMP after GHD and VES completed the assembly of the monitoring stations and initial calibration of the monitoring apparatus. GHD and VES gave training on all facets of the equipment being utilized in the AAMP prior to the start of the Program. GHD and VES provided remote support and had access to the CEM data during the monitoring period. The Ambient Air Monitoring Report prepared by GHD in March 2023 describes the AAMP in detail, included in **Appendix 11.A (Air Quality Assessment – Appendix B)**.

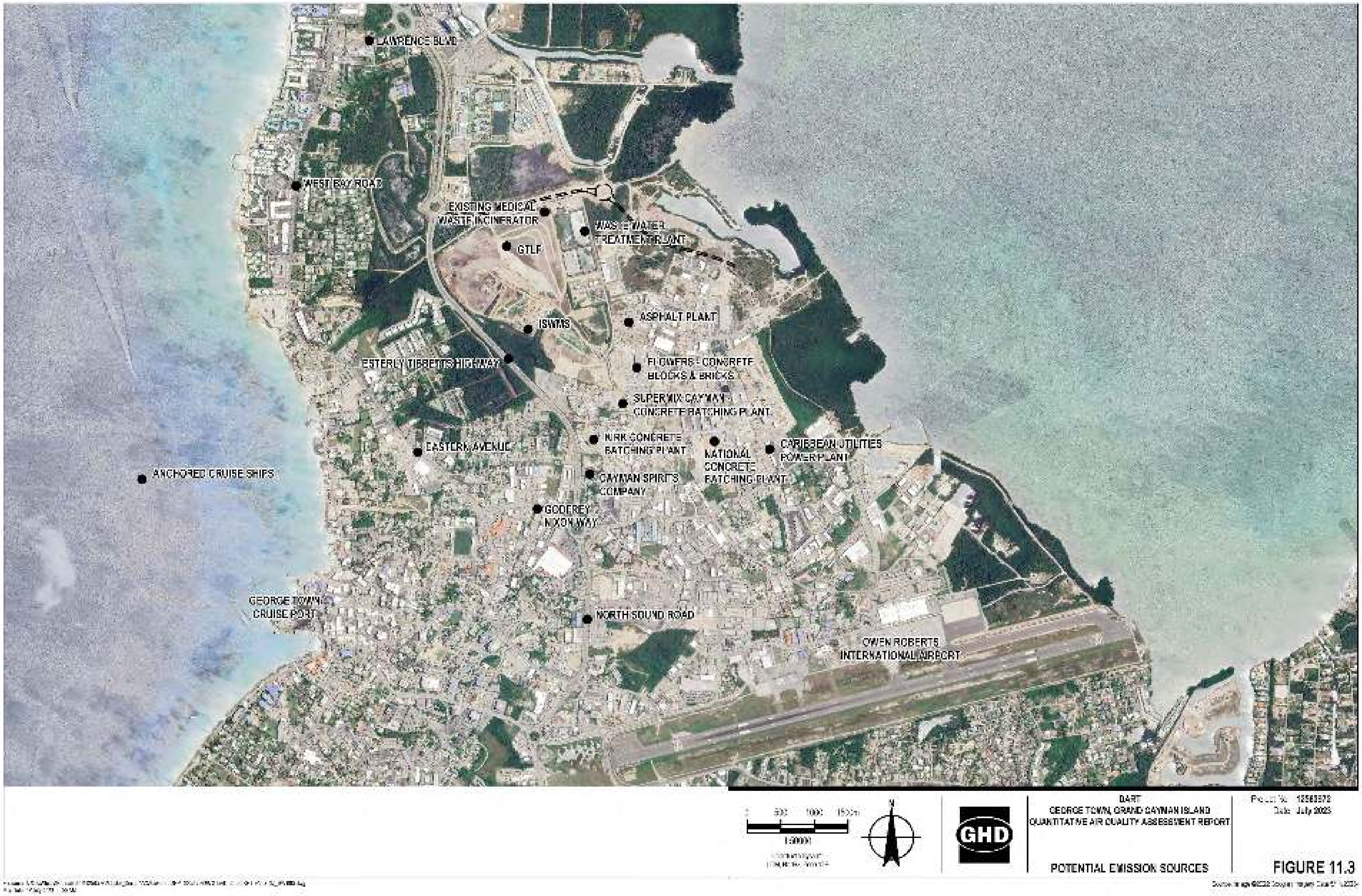

Figure 11.3 Potential emission sources

11.5.4.1 General description and purpose of each monitoring station

The choices for the sampling sites and technique were based on a hybrid strategy that combined Ontario (Canada) monitoring methods, USEPA ambient air monitoring methods, and United Kingdom/European Union (UK/EU) ambient air monitoring methods. Labs in North America were selected for analysis of collected samples because of their proximity to ensure compliance with sample holding times. The methods used in the UK/EU, USEPA, and Ontario for sampling, analysis, and continuous/passive ambient air monitoring are generally relatively comparable. There were three types of monitoring: passive, intermittent, and continuous. The seven locations for the air monitoring stations are shown on Figure 11.4, along with the parameters that were monitored at each station.

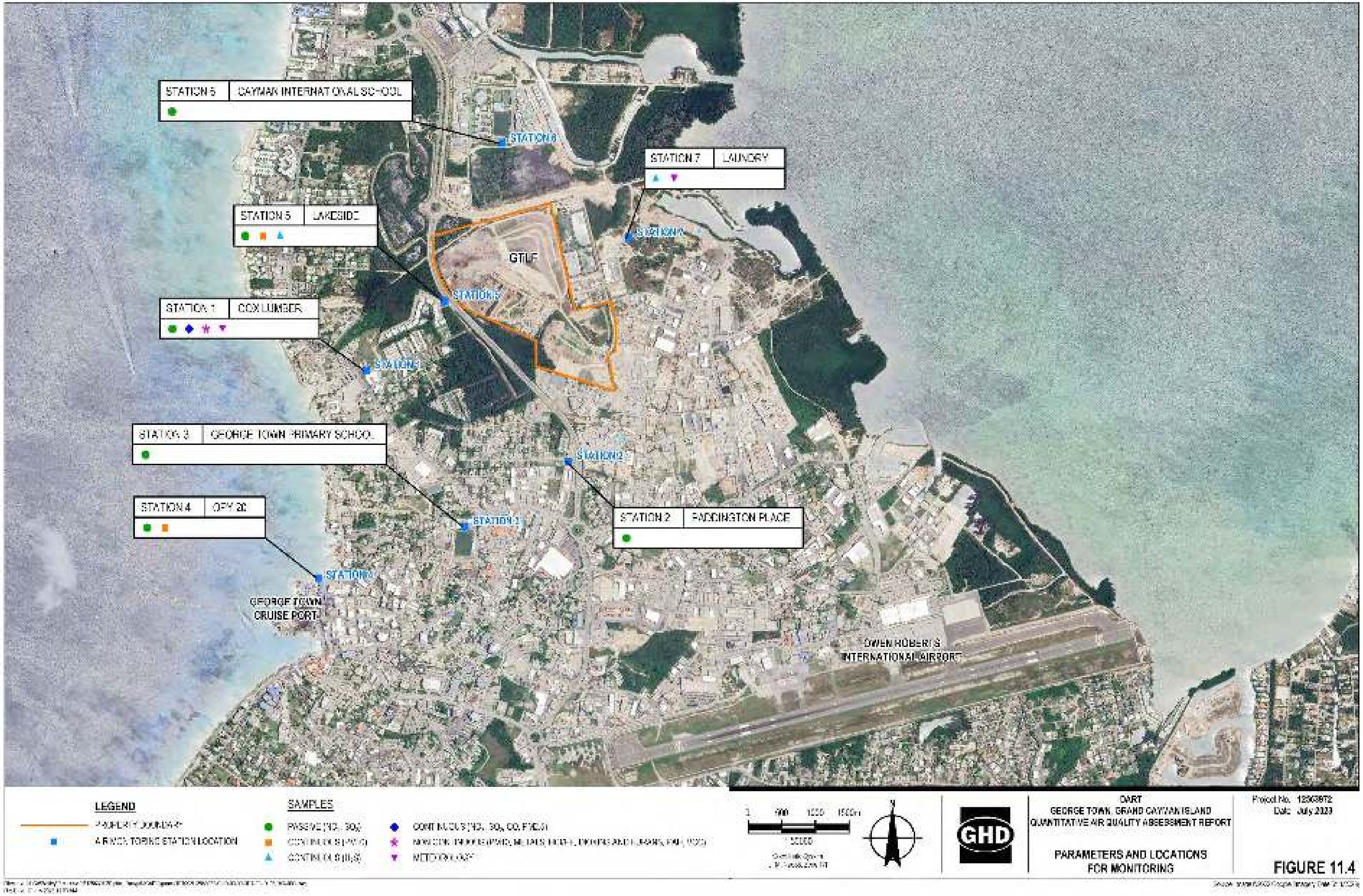

Figure 11.4 Parameters and locations for monitoring

Station 1 – COX Lumber

Station 1 was the primary monitoring station, consisting of an air-conditioned container that housed the following Federal Reference Method (FRM)/Federal Equivalent Method (FEM) and associated equipment:

- Teledyne API (TAPI) T200 NO_x Chemiluminescence analyzer.
- TAPI T300 CO Gas Filter Correlation analyzer.
- TAPI T100 SO2 UV Fluorescence analyzer.
- MetOne Beta Attenuation Monitor (BAM) 1020 Continuous $PM_{2.5}$ Monitor.
- Zero Air Generator.
- EPA Protocol 1 Calibration Gases (NO, SO_2 and CO).
- HF and HCl impinger samplers.
- A 20 ft (6 m) meteorological tower (above the roof of the container) with an RM Young wind speed (WS) and wind direction (WD) monitor including relative humidity (RH), and ambient temperature (AT).
- A dedicated sample recovery area including a refrigerator for interim storage of samples requiring cool storage.

A rooftop area with a railing also housed non-continuous samplers such as the following:

- FRM high volume PM_{10} sampler for the collection of PM_{10} and metals in the PM_{10} fraction for 24-hours every six days.
- FRM medium volume (PUF) sampler for the collection of semi-volatiles including PCDD/PCDF and PAH compounds for 24-hours every six days.
- Summa canister for the collection of VOCs using Method TO 15 for 24-hours every six days.
- Passive monitors for NO_2 and SO_2 for correlation purposes.

This station was located according to the criteria for the location of a background monitoring station away from major roads and trees and was not influenced significantly by any specific emissions source. The station was located downwind of the future site of the ISWMS and the ERF and other significant emissions sources in the area.

Figure 11.5, below, shows a photograph of the COX Lumber Monitoring Station.

Figure 11.5 COX Lumber Monitoring Station

Station 2 – Paddington Place

Station 2 was used for passive monitoring of NO_2 and SO_2 from industrial areas, the Caribbean Utilities Company (CUC), and road traffic emissions. Paddington Place was located close to the Esterly Tibbetts highway and a major roundabout.

Station 3 – George Town Primary School

Station 3 was used for passive monitoring of NO_2 and SO_2 for sensitive receptors at the George Town Primary school.

Station 4 – OPY 20

Station 4 was used for passive monitoring of NO_2 and SO_2 and continuous monitoring of PM_{10} and WS/WD from the downtown core.

Station 5 – Lakeside

Station 5 was used for passive monitoring of NO_2 and SO_2, continuous monitoring of PM_{10} and H_2S, and WS/WD near sensitive receptors at this residential complex located directly downwind of the GTLF. The Lakeside monitors are also located very close to the edge of Esterly Tibbetts highway and will therefore show impacts from road traffic.

Station 6 – Cayman International School (CIS)

Station 6 was used for passive monitoring of NO_2 and SO_2 for the sensitive receptors at CIS.

Station 7 – Laundry

Station 7 was used for continuous monitoring of H_2S from the Wastewater Treatment Plant (WWTP) and other H_2S sources upwind of the GTLF, as well as continuous monitoring of WS/WD.

11.5.4.2 Background values

The background concentrations for the air contaminants measured at each Station during the four month air monitoring campaign are summarized in Table 11.8. For the various air contaminants and their averaging periods (except for the annual averaging period), the 90th percentile value was used to represent the background concentration at each station. For the air contaminants with annual limits, the average background concentration from the full range of data collected was used. To estimate the background concentration for the Study Area for compounds that were monitored at multiple monitoring stations, the average of the 90th percentile values were used, as summarized in Table 11.8.

NO_2

The NO_2 concentrations were measured at Station 1 with CEMS. Passive samples for NO_2 were monitored at six Stations (1 through 6), including a co-located passive sampler at Station 1. The one-hour and annual background concentrations are provided in Table 11.8. Combustion gas emissions were relatively stable with low concentrations measured throughout the monitoring period.

CO

The TAPI CEM located at Station 1 was used for the baseline concentrations for CO. The eight-hour background concentration for CO is provided in Table 11.8.

SO_2

Continuous samples for SO_2 were monitored at Station 1 and passive samples were collected at six Stations (1 through 6), including a co-located passive sampler at Station 1. The one-hour, 24-hour and 15-minute background concentrations are provided in Table 11.8.

$PM_{2.5}$

The BAM 1020 CEM with the $PM_{2.5}$ cut cyclone located at Station 1 was used for the baseline concentrations for $PM_{2.5}$. The $PM_{2.5}$ annual background concentration is provided in Table 11.8.

H_2S

H_2S was monitored continuously upwind and downwind of the GTLF at Station 7 and Station 5 respectively. These Stations were located to monitor specific sources of H_2S, namely the WWTP and the GTLF, so they may not be representative of true background concentrations of areas outside of the influence of these two specific sources. H_2S data collected at Station 5 was potentially influenced by a large holding tank containing sewage located close to the instrument. The comparison of this limit to H_2S concentrations measured at Lakeside Station 5 produced the only air quality limit exceedance during the program. This exceedance was likely influenced by the location of the monitor as noted above. It should also be noted that H_2S is not considered as a by-product of the emissions from the ERF, so ambient concentrations should be lower after construction of the ISWMS.

PM_{10}

PM_{10} was measured non-continuously from Station 1 every 6 days for a 24-hour period for the monitoring duration, for a total of 20 samples. PM_{10} was also measured continuously from Stations 4 and 5. The continuous PM_{10} concentrations from these two stations show the impacts of vehicle traffic in the downtown areas and the Esterly Tibbetts highway. The 24-hour and annual PM_{10} background concentrations from the continuous and non-continuous samplers are provided in Table 11.8.

Metals

Metals were measured non-continuously from the PM_{10} fraction at Station 1 every six days for a 24-hour period for the monitoring duration for a total of 20 samples. The annual background concentrations for cadmium, arsenic, lead and nickel are provided in Table 11.8.

PCDD/PCDF

Dioxins and furans were measured non-continuously at Station 1 every six days for a 24-hour period for the monitoring duration for a total of 20 samples. The 24-hour dioxin and furan background concentrations are provided in Table 11.4.

PAHs

PAHs were measured non-continuously at Station 1 every six days for a 24-hour period for the monitoring duration, for a total of 20 samples. The PAH standard is based on benzo(a)pyrene (BaP) as noted in Table 11.1. The annual BaP background concentration is provided in Table 11.8.

VOCs

VOCs were measured non-continuously at Station 1 every six days for a 24-hour period for the monitoring duration, for a total of 20 samples. Benzene is the VOC of most concern for this Assessment because it is present in fuel combustion exhausts, the primary sources of VOCs in the area, and it has a low air quality standard. The ambient air standard for benzene is shown in Table 11.1. The hourly and annual benzene background concentrations are provided in Table 11.8.

HF/HCl

HCl/HF were measured non-continuously at Station 1 every six days for a 24-hour period for the monitoring duration, for a total of 20 samples. The hourly background HCl concentration and the hourly and annual background HF concentrations are provided in Table 11.8.

Passive Monitoring for NO_2 and SO_2

Passive samples for NO_2 and SO_2 were deployed at Stations 1, 2, 3, 4, 5 and 6 for nine (9) two-week periods. The hourly and annual NO_2 concentrations from each Station are provided in Table 11.8. The 15-minute, one-hour, and 24-hour SO_2 concentrations from each Station are provided in Table 11.8.

Table 11.8 Monitored background air concentrations and averaging periods

Parameters	Station #	Station Name	CAS #	Averaging Period	Units	Background Concentration	Standard	percent of the Standard
Carbon Monoxide 8 Hour Background Concentrations								
Carbon Monoxide (CO)	1	COX Lumber	630-08-0	8 Hour running average across a 24 hour period	(mg/m³)	2.258	10	23 percent
Nitrogen Dioxide 1 Hour Background Concentrations								
Nitrogen Dioxide (NO_2) - CEMS	1	COX Lumber	11104-93-1	1 Hour	µg/m³	14.340	200	7 percent
Nitrogen Dioxide (NO_2) - Passive	1	COX Lumber	11104-93-1	1 Hour	µg/m³	20.559	200	10 percent
Nitrogen Dioxide (NO_2) - Passive	2	Paddington Place	11104-93-1	1 Hour	µg/m³	82.805	200	41 percent
Nitrogen Dioxide (NO_2) - Passive	3	George Town Primary School	11104-93-1	1 Hour	µg/m³	103.160	200	52 percent
Nitrogen Dioxide (NO_2) - Passive	4	OPY 20	11104-93-1	1 Hour	µg/m³	68.625	200	34 percent
Nitrogen Dioxide (NO_2) - Passive	5	Lakeside	11104-93-1	1 Hour	µg/m³	50.395	200	25 percent
Nitrogen Dioxide (NO_2) - Passive	6	Cayman International School	11104-93-1	1 Hour	µg/m³	11.222	200	6 percent
Average	-	-	11104-93-1	1 Hour	µg/m³	**50.158**	**200**	**25 percent**
Nitrogen Dioxide Annual Background Concentrations								
Nitrogen Dioxide (NO_2) - CEMS	1	COX Lumber	11104-93-1	Annual	µg/m³	5.796	40	14 percent
Nitrogen Dioxide (NO_2) - Passive	1	COX Lumber	11104-93-1	Annual	µg/m³	5.499	40	14 percent
Nitrogen Dioxide (NO_2) - Passive	2	Paddington Place	11104-93-1	Annual	µg/m³	21.641	40	54 percent
Nitrogen Dioxide (NO_2) - Passive	3	George Town Public School	11104-93-1	Annual	µg/m³	25.990	40	65 percent
Nitrogen Dioxide (NO_2) - Passive	4	OPY 20	11104-93-1	Annual	µg/m³	16.016	40	40 percent
Nitrogen Dioxide (NO_2) - Passive	5	Lakeside	11104-93-1	Annual	µg/m³	11.228	40	28 percent
Nitrogen Dioxide (NO_2) - Passive	6	Cayman International School	11104-93-1	Annual	µg/m³	2.509	40	6 percent
Average	-	-	11104-93-1	1 Hour	µg/m³	**12.668**	**200**	**6 percent**

Parameters	Station #	Station Name	CAS #	Averaging Period	Units	Background Concentration	Standard	percent of the Standard
Particulates (PM10) 24 Hour Background Concentrations								
Particulates (PM10) - Non-Continuous	1	COX Lumber	NA - M09	24 Hour	µg/m³	31.215	50	62 percent
Particulates (PM10) - Continuous	4	OPY 20	NA - M09	24 Hour	µg/m³	6.965	50	14 percent
Particulates (PM10) - Continuous	5	Lakeside	NA - M09	24 Hour	µg/m³	8.915	50	18 percent
Average	-	-	NA - M09	24 Hour	µg/m³	**15.698**	**50**	**31 percent**
Particulates (PM10) Annual Background Concentrations								
Particulates (PM10) - Non-Continuous	1	COX Lumber	NA - M09	Annual	µg/m³	25.768	40	64 percent
Particulates (PM10) - Continuous	4	OPY 20	NA - M09	Annual	µg/m³	14.948	40	37 percent
Particulates (PM10) - Continuous	5	Lakeside	NA - M09	Annual	µg/m³	16.525	40	41 percent
Average	-	-	NA - M09	24 Hour	µg/m³	**19.080**	**50**	**38 percent**
Particulates (PM2.5) Annual Background Concentrations								
Particulates (PM2.5)	1	COX Lumber	NA – M10	Annual	µg/m³	**5.117**	**20**	**26 percent**
Sulphur Dioxide 1 Hour Background Concentrations								
Sulphur Dioxide (SO_2) - CEMS	1	COX Lumber	7446-09-5	1 Hour	µg/m³	3.087	350	1 percent
Sulphur Dioxide (SO_2) - Passive	1	COX Lumber	7446-09-5	1 Hour	µg/m³	17.932	350	5 percent
Sulphur Dioxide (SO_2) - Passive	2	Paddington Place	7446-09-5	1 Hour	µg/m³	8.450	350	2 percent
Sulphur Dioxide (SO_2) - Passive	3	George Town Primary School	7446-09-5	1 Hour	µg/m³	5.742	350	2 percent
Sulphur Dioxide (SO_2) - Passive	4	OPY 20	7446-09-5	1 Hour	µg/m³	5.144	350	1 percent
Sulphur Dioxide (SO_2) - Passive	5	Lakeside	7446-09-5	1 Hour	µg/m³	38.610	350	11 percent
Sulphur Dioxide (SO_2) - Passive	6	Cayman International School	7446-09-5	1 Hour	µg/m³	15.960	350	5 percent
Average	-	-	7446-09-5	1 Hour	µg/m³	**13.561**	**350**	**4 percent**

Parameters	Station #	Station Name	CAS #	Averaging Period	Units	Background Concentration	Standard	percent of the Standard
Sulphur Dioxide 24 Hour Background Concentrations								
Sulphur Dioxide (SO_2) - CEMS	1	COX Lumber	7446-09-5	24 Hour	µg/m³	1.268	125	1 percent
Sulphur Dioxide (SO_2) - Passive	1	COX Lumber	7446-09-5	24 Hour	µg/m³	17.515	125	14 percent
Sulphur Dioxide (SO_2) - Passive	2	Paddington Place	7446-09-5	24 Hour	µg/m³	7.423	125	6 percent
Sulphur Dioxide (SO_2) - Passive	3	George Town Primary School	7446-09-5	24 Hour	µg/m³	5.339	125	4 percent
Sulphur Dioxide (SO_2) - Passive	4	OPY 20	7446-09-5	24 Hour	µg/m³	3.795	125	3 percent
Sulphur Dioxide (SO_2) - Passive	5	Lakeside	7446-09-5	24 Hour	µg/m³	37.038	125	30 percent
Sulphur Dioxide (SO_2) - Passive	6	Cayman International School	7446-09-5	24 Hour	µg/m³	11.039	125	9 percent
Average	-	-	7446-09-5	1 Hour	µg/m³	**11.917**	**350**	**3 percent**
Sulphur Dioxide 15 Min Background Concentrations								
Sulphur Dioxide (SO_2) - CEMS	1	COX Lumber	7446-09-5	15-Minute	µg/m³	4.551	266	2 percent
Sulphur Dioxide (SO_2) - Passive	1	COX Lumber	7446-09-5	15-Minute	µg/m³	119.325	266	45 percent
Sulphur Dioxide (SO_2) - Passive	2	Paddington Place	7446-09-5	15-Minute	µg/m³	47.258	266	18 percent
Sulphur Dioxide (SO_2) - Passive	3	George Town Primary School	7446-09-5	15-Minute	µg/m³	30.717	266	12 percent
Sulphur Dioxide (SO_2) - Passive	4	OPY 20	7446-09-5	15-Minute	µg/m³	22.447	266	8 percent
Sulphur Dioxide (SO_2) - Passive	5	Lakeside	7446-09-5	15-Minute	µg/m³	251.646	266	95 percent
Sulphur Dioxide (SO_2) - Passive	6	Cayman International School	7446-09-5	15-Minute	µg/m³	64.979	266	24 percent
Average	-	-	7446-09-5	15-Minute	µg/m³	**77.275**	**266**	**29 percent**
Hydrogen Chloride 1 Hour Background Concentrations								
Hydrogen Chloride (HCl)	1	COX Lumber	7647-01-0	1 Hour	µg/m³	**32.279**	**750**	**4 percent**
Hydrogen Fluoride Annual Background Concentrations								
Hydrogen Fluoride (HF)	1	COX Lumber	7647-39-3	Annual	µg/m³	**6.971**	**16**	**44 percent**
Hydrogen Fluoride 1 Hour Background Concentrations								
Hydrogen Fluoride (HF)	1	COX Lumber	7647-39-3	1 Hour	µg/m³	**22.888**	**160**	**14 percent**

Parameters	Station #	Station Name	CAS #	Averaging Period	Units	Background Concentration	Standard	percent of the Standard
Metals Annual Background Concentrations								
Cadmium (Cd)	1	COX Lumber	NA-03	Annual	µg/m³	**0.0003**	**5**	**0.003 percent**
Arsenic (As)	1	COX Lumber	NA-02	Annual	µg/m³	**0.0018**	**6**	**0.031 percent**
Lead (Pb)	1	COX Lumber	NA-08	Annual	µg/m³	**0.0020**	**0.25**	**0.816 percent**
Nickel (Ni)	1	COX Lumber	NA-11	Annual	µg/m³	**0.0022**	**20**	**0.011 percent**
Polycyclic Aromatic Hydrocarbons (PAHs) Annual Background Concentrations								
PAHs (Benzo(a)Pyrene)	1	COX Lumber	50-32-8	Annual	ng/m³	**0.0765**	**0.25**	**31 percent**
Volatile Organic Compounds Annual Background Concentrations								
VOCs (Benzene)	1	COX Lumber	71-43-2	Annual	µg/m³	**0.503**	**5**	**10 percent**
Volatile Organic Compounds 1 Hour Background Concentrations								
VOCs (Benzene)	1	COX Lumber	71-43-2	1 Hour	µg/m³	**1.587**	**30**	**5 percent**
Hydrogen Sulphide 10 Min Background Concentrations								
Hydrogen Sulphide	5	Lakeside	7783-06-4	10 Min	µg/m³	**34.847**	**13**	**268 percent**
Hydrogen Sulphide	7	Laundry	7783-06-4	10 Min	µg/m³	**2.788**	**13**	**21 percent**
Dioxin and Furans 24 Hour Background Concentrations								
Mid Point PCDD/F TEQ (WHO 2005)	1	COX Lumber	-	24	pqTEQ/m³	**0.013**	**0.1**	**13 percent**

Notes:

(1) For the various parameters and their averaging periods (except for the annual averaging period), the 90th percentile value was used to represent the background concentration.
(2) For the various parameters for which the annual averaging period is applicable, the average of the entire sampling duration was used.
(3) PCDD/F - Polychlorinated Dibenzo-p-dioxins (PCDDs, Dioxins) and Polychlorinated Dibenzofurans (PCDFs, Furans),
(4) TEQ - Toxic equivalency of a dioxin or furan homologue to that of 2,3,7,8 PCDD.
(5) The background concentrations that are in BOLD font for each parameter, are the maximum from all the monitored stations.

Odour

An odour assessment survey was conducted by GHD, DEH and Dart staff during daylight and after sundown as part of the background monitoring, and the following sources were assessed qualitatively:

- CUC
- WWTP
- GTLF
- Mangroves and shoreline areas
- Medical Waste Incinerator (MWI)
- Asphalt Plant

In addition, the following sensitive receptor locations were assessed qualitatively for odour:

- Cayman International School
- Lakeside Condominiums

Details of the odour assessment survey are included in the Ambient Air Monitoring Report **(Appendix 11.A [Air Quality Assessment – Appendix B]**). The odour assessment concluded that once the ISWMS becomes operational there will be a reduction in odour due to diversion of waste from landfilling activities which can generate fugitive odours from the working face and from landfill gas. Therefore, the implementation of the ISWMS should result in fewer odour emissions from the Site.

Given the finding that there is no risk of odour impacts from the ISWMS, odour dispersion modelling was not required per the Institute of Air Quality Guidance.

11.6 Emissions inventory

The emissions estimates for the ISWMS and the existing background emissions sources were based on available data of similar units, published emission factors or manufacturer emissions guarantees. The United States Environmental Protection Agency's (US EPA) Compilation of Air Pollutant Emissions Factors (AP-42) is the primary resource of published emission factors relied on for the emission calculations. Emissions estimates are estimated to be conservative and represent worst-case short-term emissions from each source considered.

11.6.1 Background emissions sources

The purpose of modelling the background emissions was to provide a comparison to the ambient air monitoring program results. The ambient air monitoring program was used to establish the background air quality in the Study Area and the background emissions modelling was used to verify the reasonableness of the background air monitoring data for the primary background air contaminant (NO_x). The modelling of the background NO_x emissions involved many assumptions about the various emissions sources, and GHD took a generally conservative approach.

The background air emissions of concern from the existing emissions sources are primarily related to fuel combustion. The major fuel combustion contaminant is NO_x. The emissions of NO_x, from existing fuel combustion sources (traffic, industry, power generation and airport) was modelled to compare with the measured concentration of NO_x at the ambient air monitoring program stations. The emissions of NO_x were estimated based on best available references for emissions data and published emission factors for the known major contributors (sources) of NO_x in and around the Site. These sources have been identified on Figure 11.3.

A description of each background source and how the emission estimates are calculated is included in **Appendix 11.A (Air Quality Assessment – Appendix C)**.

11.6.2 Construction

According to the "Guidance on the Assessment of Dust from Demolition and Construction (Version 1.1)[14]", a preliminary screening was carried out for the particulate emissions that might occur due to construction activities. The nearest sensitive receptor (a residence) is more than 1148 ft (350 m) away from the construction site, and the route taken by construction vehicles is mainly through an industrial area. There are no significant effects likely to occur due to the construction activities at the ISWMS Site with the implementation of appropriate site-specific dust mitigation plans that will be outlined in the Facility's Environmental Management Plan (EMP). Hence the emissions from the construction phase were not considered as a part of this Assessment.

11.6.3 Operation

This Section provides a description of the proposed ISWMS and the emissions estimates associated with the significant emissions sources.

11.6.3.1 Key features

The design life of the ISWMS is 25 years. For ISWMS layout and building dimensions see Chapter 4 and **Appendix 11.A (Air Quality Assessment – Appendix D)**. By transforming waste into electrical energy and ash, the ERF will enhance the recovery and diversion levels in the Cayman Islands. The bottom ash is expected to be recovered through recycling as construction-grade aggregate.

Contract waste will be transported to the ERF by Approved Vehicles, which may include bulk trailers, roll-on/roll-off trucks, and/or waste collection vehicles. The driver of the Approved Vehicles is in charge of emptying the Contract Waste into the reception bunker at the tipping hall.

The ISWMS Site will receive wrapped bales of contract waste from the Sister Islands of Cayman Brac and Little Cayman. The bales will be held in a storage area next to the Materials Recovery Facility before being moved to the tipping hall for debaling and processing in the ERF.

Two grab cranes will be used to drop the contract waste into the furnace hoppers, where it will then be moved onto the moving grate of the furnace. On the moving grate, waste is burned, producing bottom and fly ash as by-products as well as radiant heat and hot flue gases. The steam boiler makes a series of passes where energy in the form of heat is recovered. To lower NOx generation, urea solution is introduced into the first vertical boiler pass. To help with combustion, combustion air is delivered through the grate bars. Before entering the flue gas treatment plant, combustion flue gases flow via the various boiler channels, transferring heat to water- and steam-filled superheater tubes.

Induced draught fans encourage flue gas flow through the boiler, the gas treatment plant, and the bag filter system before being released into the atmosphere through the stack. Combustion air is supplied by primary and secondary air systems. The flue gas treatment facility absorbs dioxins and furans by injecting activated carbon into the acidic gases to neutralize them. To remove particulates, the gas is subsequently passed through bag filters. Flue gas treatment system waste will be stabilized before being placed in the landfill facility.

The steam turbine and linked generator are propelled by superheated steam, which produces power that is used both on the project site and exported to the transmission grid.

As it is transported to the bottom ash storage bunker, bottom ash produced during the combustion process is quenched. From the bottom ash, metals will be removed and recycled.

A logical flow of materials and processing will be provided from input to output by the Facility's design. A secondary weighbridge will be used to weigh recovered ferrous and non-ferrous metals as they are transported to the end-of-life vehicle (ELV) facility for baling and storage before being shipped to metal re-processors. Material that is too large and

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unusable will either be delivered to the Landfill Facility for disposal or to the Construction & Demolition (C&D) Facility for additional processing.

11.6.3.2 ERF stack

The stack associated with the ERF facility will emit combustion products along with some particulate, metals, HCl, HF, and VOCs. The emissions from this stack will be governed by the EU Industrial Emissions Directive (IED - 2010/75/EU). The manufacturer has guaranteed that the emissions from the ERF stack will not exceed the IED – 2010/75/EU Part 3 air emission limit values for waste incineration plants and the new limits introduced by the BAT Reference Document for Waste Incineration[15]. A table of the maximum emission limit values provided by the manufacturer is included in **Appendix 11.A (Air Quality Assessment – Appendix E)**. The emissions from the ERF stack are calculated by assuming the maximum IED – 2010/75/EU in-stack concentration limits are emitted at the maximum design flow rate. This conservatively estimates the maximum possible contaminant emissions from the ERF stack based on the manufacturer's guarantee. The contaminant emission rates and stack parameters for the ERF stack are summarized in Table 11.9.

Table 11.9 Estimated pollutant emission rates - main stack at ERF

Pollutant	Emission Limit Values (mg/Nm^3)	Gas Concentration8 STP-Dry (mg/Nm^3)	Emission Rate (g/s)
SO_x	50	50	6.54E-01
CO	100[6]	100	1.31E+00
TOC	10	10	(5)
HCl	10	10	1.31E-01
HF	1	1	1.31E-02
NO_x	200	200	2.62E0+00
Dust	10	10	1.31E-01
Cd	Total 0.05	0.02	2.62E-04
Tl		0.02	2.62E-04
Hg	0.05	0.02	2.62E-04
Sb	Total 0.5	0.3	3.93E-03
As[7]		0.1 (7)	1.31E-03
Pb		0.3	3.93E-03
Cr		0.3	3.93E-03
Co		0.3	3.93E-03
Cu		0.3	3.93E-03
Mn		0.3	3.93E-03
Ni		0.3	3.93E-03
V		0.3	3.93E-03
PCDD & PCDF	1.00E-07	6.00E-08	7.85E-10

15 European Parliament, *BAT Conclusions…for Waste Incineration*, 2019, Table 5.3

<table>
<tr><th colspan="3">Pollutant</th><th colspan="3">Emission Limit Values (mg/Nm^3)</th><th colspan="3">Gas Concentration8 STP-Dry (mg/Nm^3)</th><th colspan="3">Emission Rate (g/s)</th></tr>
<tr><th colspan="12">Stack Parameters</th></tr>
<tr><th colspan="2">Stack UTM X Coordinate (m)</th><th colspan="2">Stack UTM Y Coordinate (m)</th><th colspan="2">Exhaust Flow rate (m^3/s)</th><th colspan="2">Gas Exit Temperature (°C)</th><th colspan="2">Stack Tip Inside Diameter (m)</th><th colspan="2">Stack Tip Release Height (m above msl)</th></tr>
<tr><td colspan="2">460836.68</td><td colspan="2">2134829.23</td><td colspan="2">24.982</td><td colspan="2">141</td><td colspan="2">1.3</td><td colspan="2">44.58</td></tr>
</table>

Notes:

(1) Stack parameters and stack emissions were communicated by METKA, through their email on August 8, 2022. The stack concentration of Cd and Tl together is 0.05 (mg/Nm3), but was conservatively assumed to be 0.05 (mg/Nm3) each. Similarly the stack concentration of Sb, As, Pb, Cr, Co, Cu, Mn, Ni, and V together is 0.5 (mg/Nm3), but was conservatively assumed to be 0.5 (mg/Nm3) each.

(2) Exhaust volumetric flow rate is 47,108 m3/hr STP-Dry.

(3) As communicated by Iona Capital Ltd. in their email on December 23, 2022; the actual stack height is designed to be 41.23 m, but after grading and construction, the Stack Tip Release height is designed to be at 44.58 m above mean sea level. The Stack Tip Release height was adjusted in the dispersion model, such that it represented 44.58 m above mean sea level.

(4) Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control).

(5) In-stack limit only. Not included in dispersion modelling. See Report text for discussion.

(6) Half-hour average value selected to conservatively assess CO emissions against 8 hour average air standard.

(7) Although the emission limit value for Arsenic is a cumulative limit for the group of heavy metals, the manufacturer has provided that measurements from other plants have shown arsenic concentrations well below 0.1 mg/m³

(8) Some concentrations limited by the BAT conclusions (WI-BREF 2019) - See Appendix 11.A (Air Quality Assessment – Appendix C).

For CO, the IED – 2010/75/EU in-stack limits have a daily average, half-hour average, and 10-minute average limits. For the purpose of assessing against the air quality standard described in Table 11.1, which has an eight-hour average, the half-hour average in-stack limit is conservatively used as the maximum emission concentration.

For some of the heavy metals emitted, there are no individual emission guarantees, but a combined emission guarantee. For example, the manufacturer guarantees that Cd and Tl together will be emitted at 0.05 mg/Nm^3 as a conservative approach these heavy metals were each modelled at an emission rate assuming an exhaust concentration 0.05 mg/Nm^3. For arsenic, the manufacturer provided a separate in-stack limit of below 0.1 mg/Nm^3 based on measurements from other similar plants.

Regular emissions monitoring will be conducted in accordance with IED – 2010/75/EU Section 2.1. This requires continuous emissions monitoring of NO_x, CO, particulate, TOC, HCl, HF, and SO_2 as well as semi-annual monitoring of metals and D&F. This monitoring will ensure that the emissions remain below the manufacturer's guarantee.

11.6.3.3 Landfill flares

Landfill Gas emissions from the capped section of GTLF are currently collected and directed to five landfill flares. The combustion of landfill gas in these flares reduce the GHG impacts on the environment. The flares will be de-commissioned when the proposed enclosed Landfill Gas Flare System becomes operational when the ISWMS is commissioned. To be conservative, the emissions from these flares are included in the maximum future emissions assessment to allow for the potential overlap in EFW stack emissions in addition to the landfill flares. Details of the flares, along with its emission estimates are provided in Table 11.10.

Table 11.10 Estimated emissions rates – passive vent flares on the Landfill

Make and Model of Passive Vent Flare	Landfill Gas Flow Rate per Vent (Nm^3/hr)	NOx Emission Factor ($kg/10^6m^3$ methane)[1]	CO Emission Factor ($kg/10^6m^3$ methane)[1]	NOx Emission Rate[2] (g/s)	CO Emission Rate[2] (g/s)
Solar Spark Flare CF-5	153	650	1.20E+04	0.015	0.281

Stack Parameters

Source ID	Stack UTM X Coordinate (m)	Stack UTM Y Coordinate (m)	Gas Exit Flow rate [3] (m^3/s)	Gas Exit Temperature [4] (°C)	Stack Tip Inside Diameter (m)	Effective Release Height (m)
FLARE1	460726.97	2135220.77	0.043	350	0.038	3.626
FLARE2	460661.81	2135308.15	0.043	350	0.038	3.626
FLARE3	460746.13	2135345.71	0.043	350	0.038	3.626
FLARE4	460791.35	2135271.36	0.043	350	0.038	3.626
FLARE5	460807.44	2135183.22	0.043	350	0.038	3.626

Notes:
(1) Emission factors used as provided by USEPA AP-42 in Chapter 2.4, Table 2.4.2 (1998) for landfill gas flares as these are the factors with the highest data quality available.
(2) The emission rates have been determined based on an estimated 55 percent methane in biogas
(3) A reasonably conservative assumption of maximum design flow rate was used.
(4) A typical open flare specification can range from 350-950̊ C. The lowest temperature of 350̊C is used as the conservative value.

11.6.3.4 Landfill gas flare

A dedicated enclosed Landfill Gas Flare system is proposed to flare excess landfill gas during the operational phase of the Project. The Landfill Gas Flare can handle a maximum flow rate of 500 Nm^3/hr. Details of this flare, along with its emission estimates are provided in Table 11.11.

Table 11.11 Estimated emission flares – landfill gas flares

Compound	CAS No.	Emission Factor ($kg/10^6m^3$ methane) [(1)]	Concentration in Biogas mg/Nm^3	Estimated Maximum Emission Rate for Flare (S3) (g/s)[(2)]
Carbon Monoxide	630-08-0	1.20E+04	-	9.17E-01
Nitrogen Oxides	10102-44-0	6.50E+02	-	4.97E-02
Sulphur Dioxide	7446-09-5		50	6.94E-03

Stack Parameters

Source ID	Stack UTM X Coordinate (m)	Stack UTM Y Coordinate (m)	Gas Exit Flow rate (m^3/s)	Gas Exit Temperature (°C)	Stack Tip Inside Diameter (m)	Release Height (m)
STCK17	460932.21	2134956.19	0.139	875	1	10

Notes:
(1) Emission factors used as provided by USEPA AP-42 in Chapter 2.4, Table 2.4.2 (1998) for landfill gas flares as these are the factors with the highest data quality available.
(2) The emission rates have been determined based on an estimated 55percent methane in biogas.
(3) The concentration of SO2 is based on the 50 mg/Nm3 SOx emission limit from Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control).

11.6.3.5 Medical waste incinerator

An existing medial waste incinerator was included in the background NOx emissions assessment, discussed in **Appendix 11.A (Air Quality Assessment – Appendix C)**. The incinerator processes about 6,400 pounds of waste in one batch and the burn and cooldown cycle lasts about 24 hours. The site operates two batches per week to process the current inflow of medical waste. The ISWMS will include a replacement of the existing Medical Waste Incinerator, in kind. Emissions information for current MWI is not available nor is info on operational practices. The operations of the MWI under the operation of the ISWMS will follow standard protocols. The emissions from this source will be relocated with a new exhaust stack towards the northern to the eastern section of the Site. See Table 11.12 for details of the emission estimate and source parameters.

Table 11.12 Estimated emission rates – Medical Waste Incinerator of ISWMS

Medical Waste Incinerated per Batch (Mg)	NOx Emission Factor (kg/Mg)	CO Emission Factor (kg/Mg)	NOxCO (kg)	Daily CO Emission Rate (g/s)	NOx Emission per Batch (kg)	Daily NOx Emission Rate (g/s)
2.90	1.58	0.15	0.435	0.012	4.587	0.127
Stack Parameters						
	Stack UTM X Coordinate (m)	**Stack UTM Y Coordinate (m)**	**Exhaust Flow rate (m^3/s)**	**Gas Exit Temperature (ºC)**	**Stack Tip Inside Diameter (m)**	**Stack Tip Release Height (m)**
Existing Location	460795.11	2135424.3	0.6	1000	0.75	10
Future Location	460752.73	2135046.5	0.6	1000	0.75	10

Notes:

(1) As per information received by DART from DEH on 2 Nov 2022, the Medical Waste Incinerator, handles 6,400 lbs of medical waste per batch. There are two batch handled a week, and each batch lasts 10 hours. The Secondary chamber operates at 1900°F (1038 °C).
(2) Reasonable assumptions were made for stack height, stack diameter, stack gas exit temperature since there was no available information.
(3) The stack flow rate is assumed to be 0.6 m^3/s, which is the ideal design consideration as per a guidance document by Central Pollution Control Board of India for medical waste incinerators.
(4) Emission factors for Modular Starved Air Combustors from Table 2.1-9 of the AP-42 was used.

11.6.3.6 Haul road within ISWMS

Currently, the road to unload material at the existing facility is predominantly unpaved. A paved haul road will be constructed from the ISWMS entrance to the ERF to facilitate movement of traffic. Paving the onsite roads will significantly reduce potential emissions from the road as a source. The formula 13.2.1.3 (2) from AP-42 was used to estimate the road particulate emissions. This formula takes into account the number of days in a year that had rain, since the resuspension of particulates on a rainy day would be negligible. A rain day is defined to be any day with at least 0.01 inches of rain, and this information was sources from "The Cayman Islands' Compendium of Statistics 2021". The ISWMS Facility plans on implementing a fugitive dust management program that will be outlined in the EMP to control particulate emissions from the haul roads. Details of the emissions factor and parameters used for estimating emission rates are mentioned under Table 11.13.

Table 11.13 Estimated particulate emission rates – future paved haul route within ISWMS

Variable or Constant	$PM_{2.5}$	PM_{10}
k (g/VKT)	1.1	4.6
sL (Slit Loading)[1]	0.33	0.33
Formula (AP-42 13.2.1.3 (2)): EF(g/VKT) = [k * (sL)^0.91 * (W)^1.02] *(1-P/4N) * (100percent - CE) Where P = 138 (number of days in a year with at least 0.254 mm (0.01 in) of precipitation.) N = 365 days in a year CE = 50percent Control Efficiency		

Variable or Constant		$PM_{2.5}$	PM_{10}
emission factors			
truck route	**w – mean vehicle weight of haul truck (ton)**	**pm_{10} (g/vkt)**	**$pm_{2.5}$ (g/vkt)**
ISWMS			
Entrance > Tipping Face	13	1.05E + 01	2.50E + 00
Estimated Particulate Emission Rates - Haul Route within ISWMS ER(g/s) = EF(g/VKT) * # of trips * Distance (km) / (3600 s/hr) Distance from Entrance to Tipping Face (km) = 0.61			
Hourly Emission Rates			
Truck Route	**# of One-way Trips per hour**	**PM_{10} (g/s)**	**$PM_{2.5}$ (g/s)**
ISWMS			
Entrance > Tipping Face	26	4.59E-02	1.10E-02

Notes:

(1) The paved road surface silt loadings from Site C of Reference 31 and Commercial/Industrial roads of Reference 8 from Emission Factor Documentation for Ap-42 Section 13.2.1 (January, 2011) were averaged to get a representative silt loading for this Facility. https://www.epa.gov/sites/default/files/2020-10/documents/emission_factor_documentation_for_ap-42_section_13.2.1_paved_roads_.pdf

(2) Tailpipe particulate emissions have not been included as they are insignificant when compared to road dust emissions.

(3) The Mean Vehicle Weight was estimated using a weighted average of the truck traffic data for the month of October in the year 2022.

(4) The number of rain days data was obtained from "The Cayman Islands' Compendium of Statistics 2021". The average number of rain days from the years 2017 through 2021 was used.

(5) According to the State of Utah Department of Environmental Quality Guidelines memo (January 12, 2015), a control efficiency of 95percent can be achieved through vacuum sweeping and watering of paved roads.

11.7 Dispersion modelling

This Section provides a description of how the dispersion modelling was conducted for the ISWMS to calculate the maximum concentration at a point of impact (POI), and for comparison to the monitored background concentrations. The assessment was carried out using AERMOD, one of the United States Environmental Protection Agency's (USEPA) preferred and recommended atmospheric dispersion models. The AERMOD modelling system includes the Plume Rise Model Enhancements (PRIME) algorithms for assessing the effects of buildings on air dispersion.

The AERMOD modelling system is made up of the AERMOD dispersion model, the AERMET meteorological pre-processor and the AERMAP terrain pre-processor. The following dispersion model and pre-processors were used in the assessment:

– AERMOD dispersion model (v. 22112)
– AERMAP surface pre-processor (v. 18081)
– BPIP building downwash pre-processor (v. 04274)

See **Appendix 11.A (Air Quality Assessment – Appendix F)** for a summary of the AERMOD source input parameters.

Same structure contamination was not considered. General building vents, roof exhausts, building heating, ventilation, and air conditioning were considered as negligible sources and not considered as a part of this modelling assessment.

11.7.1 Co-ordinate system

The Universal Transverse Mercator (UTM) coordinate system was used to specify model object sources, buildings and receptors. All coordinates were defined in the North American Datum of 1983 (NAD83), zone 17 north.

11.7.2 Meteorology

11.7.2.1 Meteorological records

The Owen Roberts International Airport is the nearest meteorological station with available hourly meteorological data. Data for this station was retrieved from the US National Oceanic and Atmospheric Administration (NOAA) Integrated Surface Database (ISD; also referred to as the TD-3505 ISHD full archival format) for review. The Owen Roberts station is identified as ID 783840-11813 in the ISD. Data from 2011 to 2020 was retrieved and reviewed.

Review of the Owen Roberts station data indicated that the ISD data was incomplete since approximately 35 percent of total records were missing. Nighttime-hours represented the majority of the missing-hours, typically the eight-hour span between 10:00 PM and 06:00 AM. Nighttime-hours typically have cooler conditions resulting in more calm and low wind conditions.

Some data elements were also determined to be missing from otherwise complete hourly records. These missing elements varied randomly and at different rates. Missing elements included: wind speed, wind direction, temperature, humidity, pressure, cloud cover, and precipitation.

As a result of the review, the ISD data was not used. Figure 11.6 provides a wind rose plot of the Owen Roberts station data.

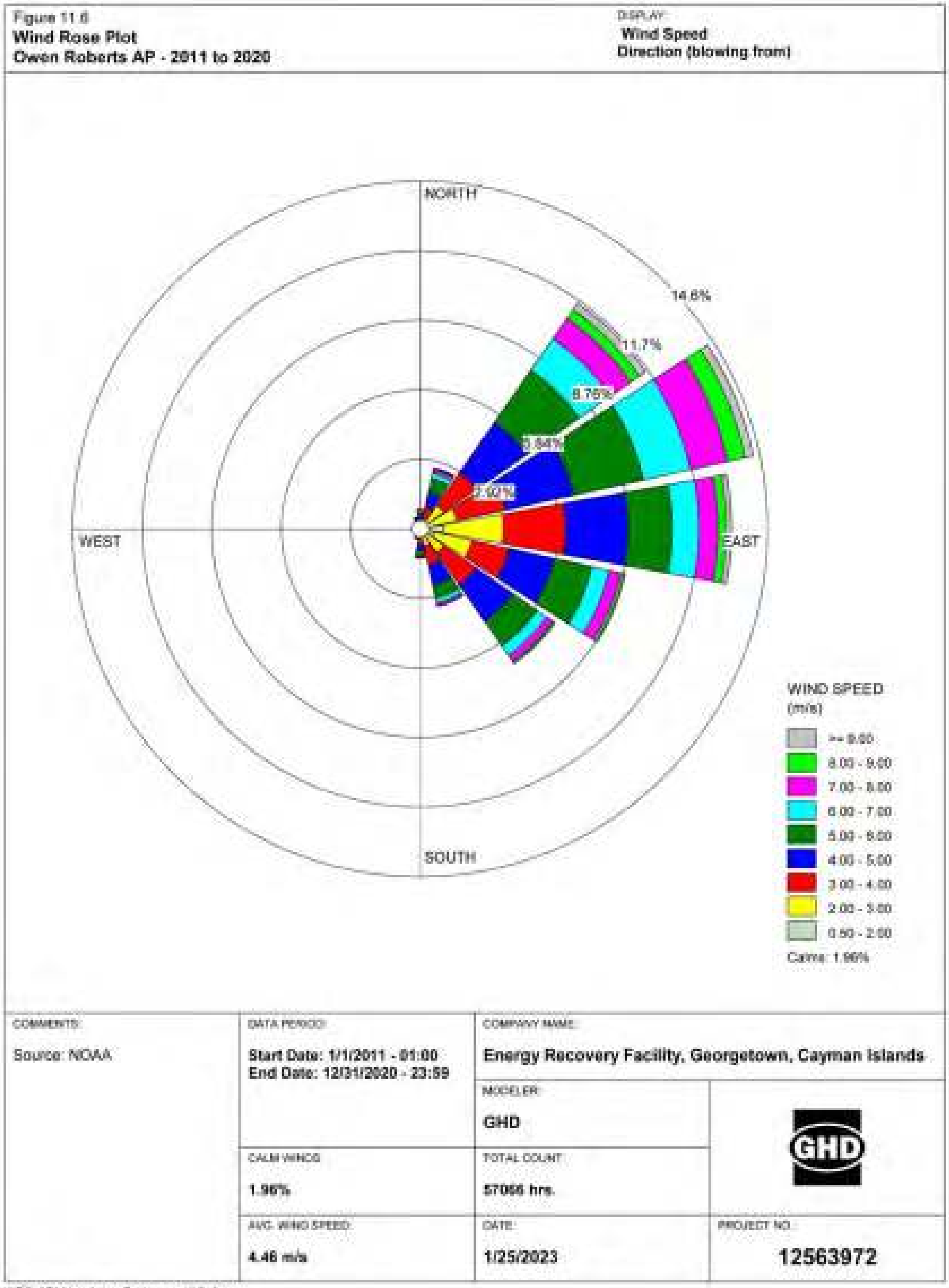

Figure 11.6 Wind rose plot Owen Roberts Station data

11.7.2.2 Prognostic meteorological data

Due to the incompleteness of the Owen Roberts data, prognostic meteorological data was used instead. AERMET-ready data was acquired from Lakes Environmental Software. The simulation data was produced using the Weather Research and Forecasting (WRF) model and further processed using the USEPA Mesoscale Model Interface Program (MMIF) for use with the AERMET meteorological preprocessor (surface .DAT and upper air .FSL files). The prognostic WRF data was generated with the following parameters:

– Center Point: Latitude, 19.311 N; Longitude, 81.374 W
– WRF Grid Cell: 2.5 miles x 2.5 miles (4 km x 4 km)
– Start/End Data: January 1, 2017 hour 00 to December 31, 2021 hour 23
– Datum: WGS 84
– UTM Zone: 17

A wind rose of the Prognostic data is provided on Figure 11.7 A comparison of Figure 11.6 and Figure 11.7 shows similar distributions of wind directions and wind speeds. The Prognostic data set is a therefore a reasonable data set to use for this Assessment.

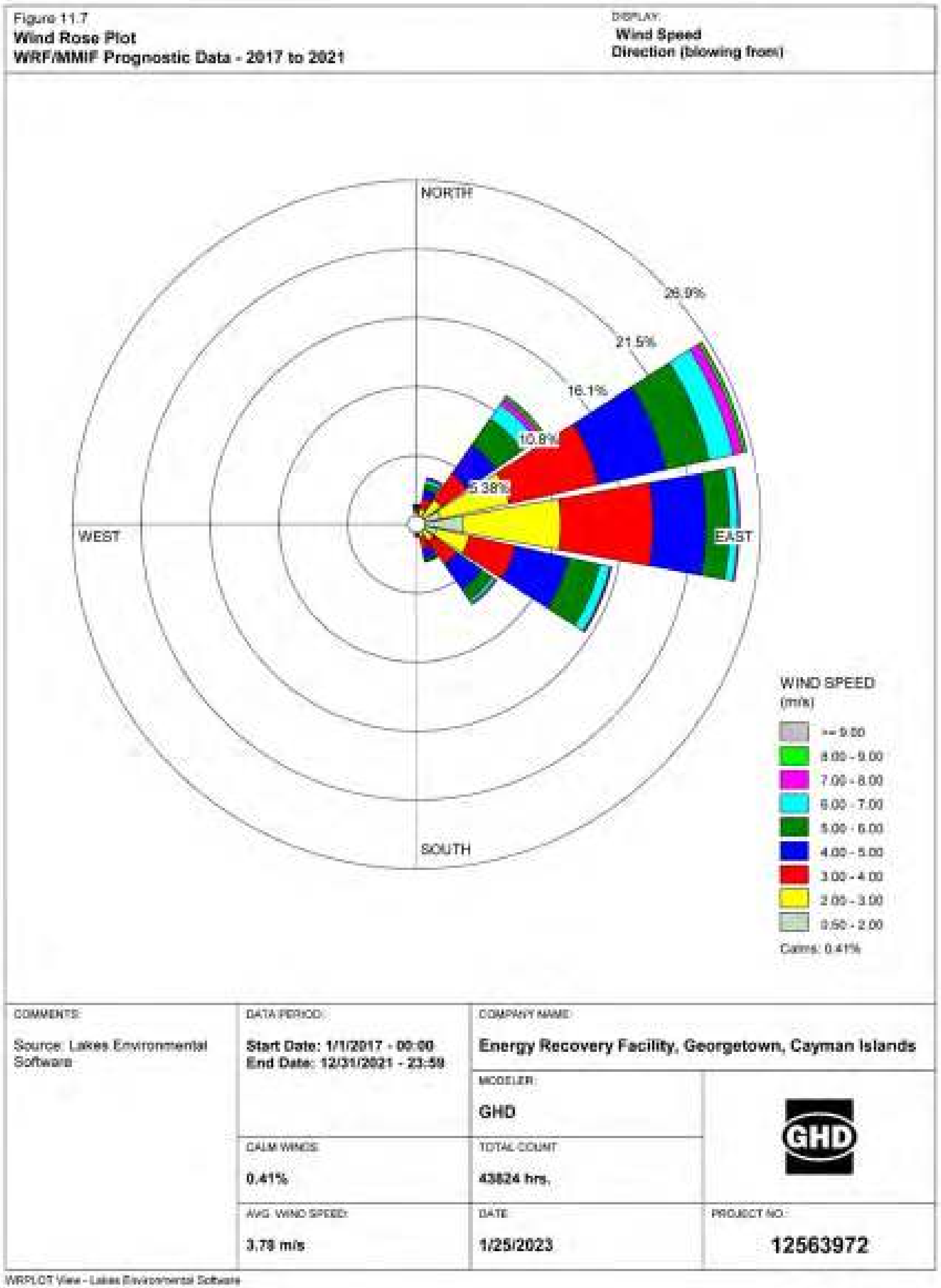

Figure 11.7 Wind rose plot prognostic data

11.7.2.3 Land use preprocessing

Land use was extracted from the Global Land Cover Characterization (GLCC) dataset for use in calculating the surface characteristics (albedo, Bowen ratio, surface roughness) surrounding the facility using AERSURFACE v.20060. Surface characteristics were calculated on a monthly basis and for the maximum number of wind sectors. The AERMET output surface characteristics are tabulated in **Appendix 11.A (Air Quality Assessment – Appendix G)**.

11.7.2.4 AERMET processing

The prognostic data was processed using AERMET v.22112 into AERMOD-ready surface (.SFC) and profile (.PFL) files.

11.7.3 Terrain

AERMOD captures the essential physics of dispersion in complex terrain though the use of a separate height scale factor for each receptor[16]. The highest scale factor represents the terrain that would dominate flow in the vicinity of the receptor. The height scale factor that is used by AERMOD is generated by an AERMAP terrain pre-processor. AERMAP utilizes terrain data, or Digital Elevation Model (DEM) data in conjunction with a layout of receptors and sources to generate height scale factors that can be directly used in AERMOD. Terrain data used in this assessment was obtained from the United States Geological Survey's Shuttle Radar Topography Mission[17] (SRTM) 1 Arc-Second (98 ft (30 m)) Global data.

11.7.4 Receptors

For this Assessment two sets of receptor grids were used. One set for the simulation of background concentrations using existing emissions sources, and the second set for determining the maximum concentrations from the full-time operation of the ISWMS.

For the modelling of background concentrations, a 3 mile x 3 mile (5 kilometre x 5 kilometre) uniform grid was used, with a uniform spacing of 1640 ft (500 m) between each receptor. Uniform polar grid (5 rings with increments of 65 ft (20 m), with 36 direction radials in increments of 10 degrees) receptors were also placed at the location of the background air monitoring stations. At the Site's property line, ground-level receptors with a 65 ft (20 m) spacing was used to evaluate the maximum property boundary concentrations. No receptors were placed within the Site's property line.

See **Appendix 11.A (Air Quality Assessment – Appendix F)** for the background concentrations modelling grid.

For the determination of maximum concentrations due to emissions from the Site, a tiered receptor grid was defined starting with a rectangular boundary that encloses all the modelled sources (bounding box). A tiered grid was then defined starting from the edge of the bounding box with a fine resolution, to coarser resolutions further away. All tiered distances were defined relative to the bounding box. The receptor grid used is described as follows:

- 65 ft (20 m) spacing within 656 ft (200 m) of the edge of the bounding box
- 164 ft (50 m) spacing from 656 to 1,640 ft (200 to 500 m)
- 328 ft (100 m) spacing from 1,640 to 3,280 ft (500 to 1,000 m)
- 656 ft (200 m) spacing from 3,280 to 6,561 ft (1,000 to 2,000 m)
- 1640 ft (500 m) spacing from 6,561 to 16,404 ft (2,000 to 5,000 m)
- 3280 ft (1000 m) spacing from 16,404 to 32,808 ft (5,000 m to 10,000 m)

Although the above tiered receptor grid would capture impacts at the sensitive receptors identified under Section 11.5.3, additional uniform polar grid receptors (five rings with increments of 65 ft [20 m], with 36 direction

[16] USEPA, 1998 – AERMAP UG
[17] USGS EROS, SRTM, 2020

radials in increments of 10 degrees) were placed at all these sensitive receptors, except for the seven-mile beach corridor. The said tiered receptor grid should sufficiently capture impacts along the seven-mile beach corridor.

See **Appendix 11.A (Air Quality Assessment – Appendix F)** for the maximum POI concentrations modelling grid. Figure 11.8 and Figure 11.9 show the receptors used for modelling maximum POI concentrations.

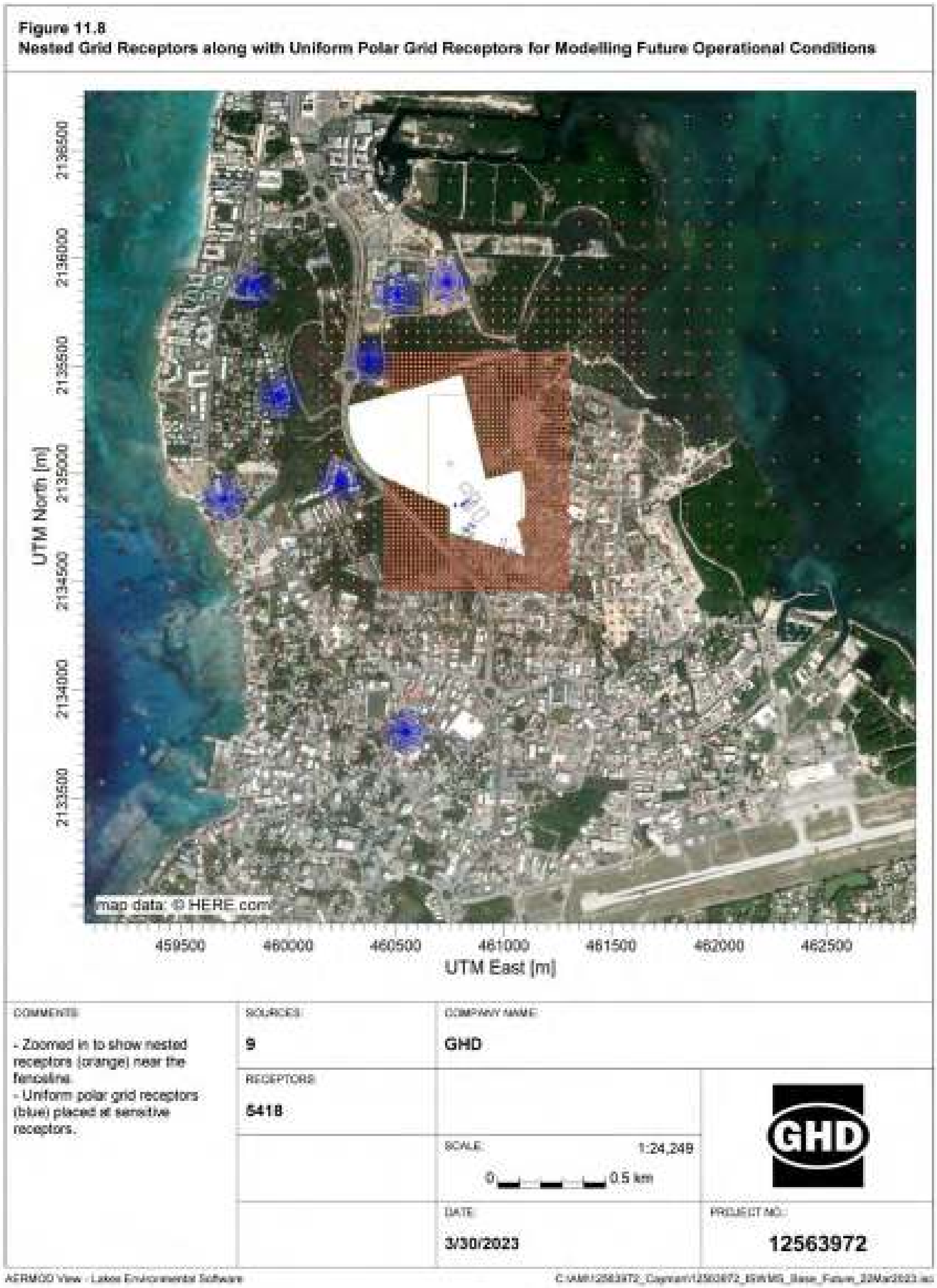

Figure 11.8 Nested grid receptors and uniform polar grid receptors for modelling future operational conditions

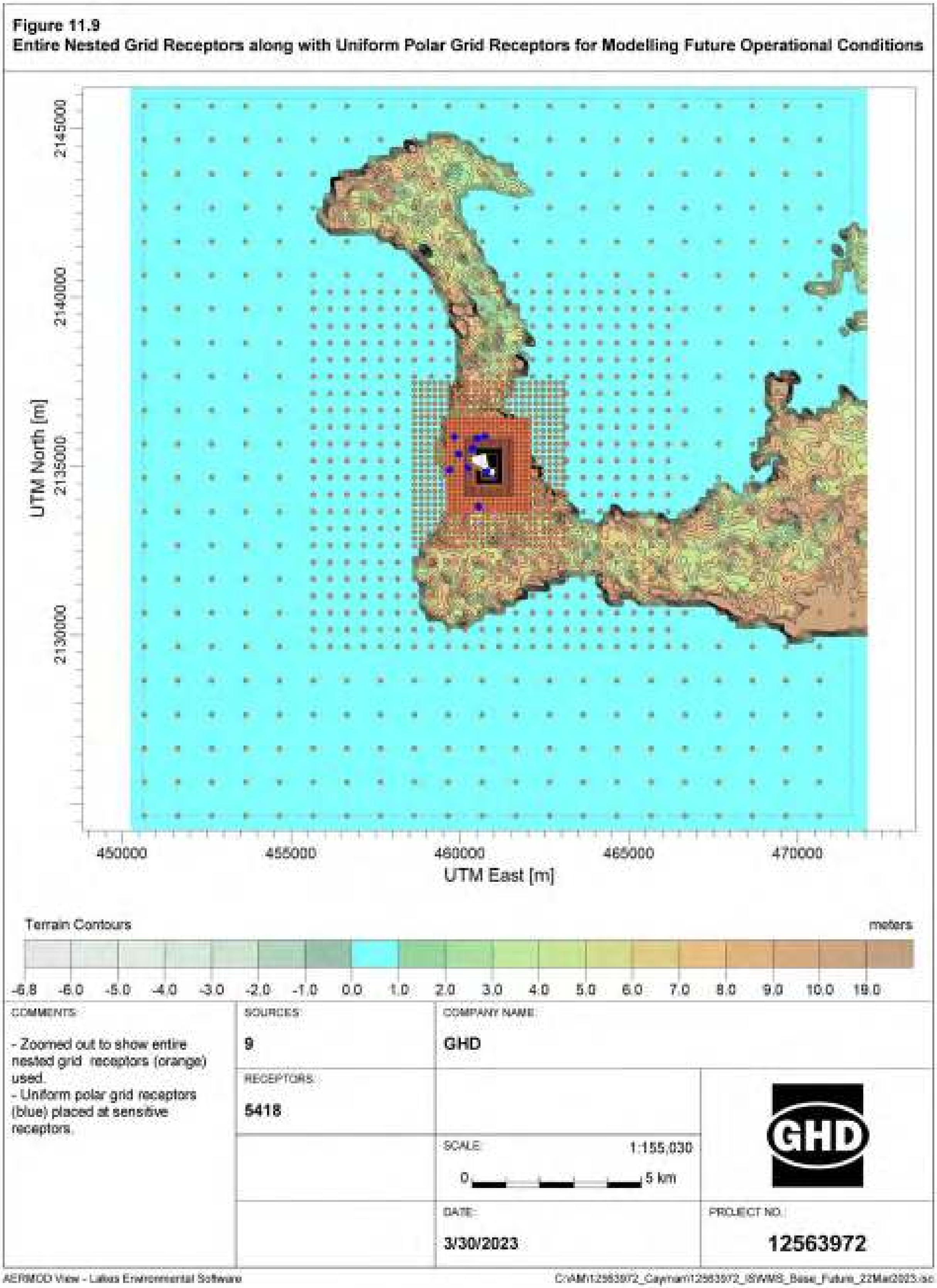

Figure 11.9 Entire nested grid receptors and uniform polar grid receptors for modelling future operational conditions

11.7.5 Building downwash

The ISWMS buildings were entered into the model using the USEPA Building Profile Input Program (BPIP-PRIME). The inputs into this pre-processor include the coordinates and heights of the buildings and stacks. The BPIP program was executed to evaluate any building cavity downwash effects. Cavity downwash can result in air contaminants being forced to ground level prematurely under certain meteorological conditions. The on-Site buildings and structures were modelled with their respective average roof heights.

The PRIME plume rise algorithms include vertical wind shear calculations (important for buoyant releases from short stacks (i.e., stacks at release heights within the recirculation zones of the buildings). The PRIME algorithm also allows for the wind speed deficit factors to improve the accuracy of predicted concentrations within building wake zones that form in the lee of buildings.

The layout of the ISWMS used for the purpose of this Assessment is provided in **Appendix 11.A (Air Quality Assessment – Appendix D)**.

11.7.6 Deposition

AERMOD can account for wet and dry deposition of substances that would reduce ground-level concentrations at points of impact. However, the deposition algorithm has not been implemented in this assessment and therefore, the predicted concentrations are considered to be more conservative.

11.7.7 Averaging time and conversions

The shortest time scale that AERMOD predicts is a one-hour average value. Many of the standards are based on one hour, 24-hour, and annual averaging times, which are averaging times that can also be calculated by AERMOD. In cases where a standard has an averaging period less than one hour (e.g., ten minutes), a conversion to the appropriate averaging period was completed using the Ontario's Ministry of the Environment, Conservation and Parks recommended conversion factors, as documented in the Air Dispersion Modelling Guideline for Ontario[18].

11.8 Modelling results and discussion

The estimated emissions for background sources of NO_x and the estimated ISWMS emissions, as described in Section 11.5 and Section 11.6, were used in the AERMOD modelling, as described in Section 11.9. This Section provides a discussion of the results of the background NO_x modelling and the future ISWMS emissions modelling. The existing background NO_x emissions model results are compared with the background monitoring results for NO_x. The future ISWMS model results, including the addition of the background air contaminant concentrations, are compared with the air quality standards listed in Table 11.1.

11.8.1 Background emissions

The modelled 90th percentile NO_x (as NO_2) results were compared to the measured background monitoring values. A summary of this is shown in Table 11.14. The modelled 90th percentile results are consistent with the measured values at each monitoring station.

[18] Guideline A-11 Version 3.0

Table 11.14 Measured and modelled NO_2 background concentrations (1 hour averaging)

Station #	Station Name	Units	Measured Background Concentration (90th Percentile)	Modelled Background Concentrations (90th Percentile)	Roads	Airport	Port	CUC	Hot Mix Asphalt & Concrete Batch Mixers	Small Boilers
1	COX Lumber	µg/m³	20.559	65.076	4.702	0.952	9.621	40.584	3.074	1.528
2	Paddington Place	µg/m³	82.805	71.503	14.567	2.274	4.721	46.165	3.206	1.811
3	George Town Primary School	µg/m³	103.160	63.935	8.169	2.750	6.278	42.912	2.030	0.908
4	OPY 20	µg/m³	68.625	69.229	1.843	2.362	9.555	52.171	1.618	0.390
5	Lakeside	µg/m³	50.395	72.757	16.621	0.512	6.942	41.177	1.808	3.525
6	Cayman International School	µg/m³	11.222	14.764	0.000	0.013	4.366	3.519	0.062	0.240

Notes:

(1) A 0.6 mile (1 km) polar grid receptor was set at the location of each monitoring station. The 90th percentile modelled results at each of these polar receptors were averaged and represented here.

11.8.2 ISWMS operation

The modelled maximum off-site contaminant concentrations from the ISWMS were added to the measured background concentration (Table 11.8) for each air contaminant to obtain the cumulative impact. The off-Site concentrations from the ISWMS are conservatively based on the highest modelled values for the maximum potential emission rates. The data was not refined to remove any meteorological anomalies or to apply any statistics. The cumulative concentrations (modelled ISWMS concentration plus background) were compared to the appropriate limits (Table 11.1) for compliance. A summary of the results is shown in Table 11.15.

Table 11.15 Maximum concentrations from the Project, including background concentration

Parameters	CAS #	Averaging Period	Units	Project Concentrations	Background Concentrations	Cumulative Concentrations	Project Contribution to Cumulative	Limit	percent of Limit
Carbon Monoxide (CO)	630-08-0	8 Hour	mg/m³	0.34	2.26	2.60	13 percent	10	26 percent
Nitrogen Dioxide (NO_2)	11104-93-1	1 Hour	µg/m³	116	50	166	70 percent	200	83 percent
Nitrogen Dioxide (NO_2)	11104-93-1	Annual	µg/m³	8.9	12.7	21.5	41 percent	40	54 percent
Particulates (PM10)	NA - 1	24 Hour	µg/m³	25	16	40	61 percent	50	81 percent
Particulates (PM10)	NA - 1	Annual	µg/m³	12	19	31	38 percent	40	77 percent
Particulates (PM2.5)	NA - 2	Annual	µg/m³	2.8	5.1	7.9	35 percent	20	40 percent
Sulphur Dioxide (SO_2)	7446-09-5	1 Hour	µg/m³	12	14	26	47 percent	350	7 percent
Sulphur Dioxide (SO_2)	7446-09-5	24 Hour	µg/m³	8.0	11.9	19.9	40 percent	125	16 percent
Sulphur Dioxide (SO_2)	7446-09-5	15-Minute Mean	µg/m³	18	77	95	19 percent	266	36 percent
Hydrogen Chloride (HCl)	7647-01-0	1 Hour	µg/m³	2.4	32.3	34.6	7 percent	750	5 percent
Hydrogen Fluoride (HF)	7664-39-3	Annual	µg/m³	0.033	6.971	7.004	0.5 percent	16	44 percent
Hydrogen Fluoride (HF)	7664-39-3	1 Hour	µg/m³	0.24	22.89	23.12	1 percent	160	14 percent
Cadmium (Cd)	7440-43-9	Annual	µg/m³	0.0007	0.0002	0.0008	80 percent	0.005	17 percent
Arsenic (As)	7440-38-2	Annual	µg/m³	0.003	0.002	0.005	65 percent	0.006	86 percent

Parameters	CAS #	Averaging Period	Units	Project Concentrations	Background Concentrations	Cumulative Concentrations	Project Contribution to Cumulative	Limit	percent of Limit
Lead (Pb)	7439-92-1	Annual	µg/m³	0.010	0.002	0.012	83 percent	0.25	5 percent
Nickel (Ni)	7440-02-0	Annual	µg/m³	0.010	0.002	0.012	82 percent	0.02	61 percent
Dioxins and Furans	NA - 3	24 Hour	pgTEQ/m³	0.009	0.013	0.023	41 percent	0.1	23 percent

Notes: (1) Concentrations are the maximum modelled values that occur. No data is removed from meteorological anomalies and no statistics are applied.

All contaminants are shown to have a cumulative concentration that is below the applicable air quality standard. This shows that the implementation of the ISWMS will not result in any air quality exceedances.

Dioxins and Furans (PCDD/PCDF)

PCDD/PCDF are expected contaminants from the ERF stack. The PCDD/PCDF concentrations were assessed with background concentrations and maximum potential emissions from the ERF stack. The ISWMS emissions contribute up to 54 percent of the cumulative concentration.

There are no ambient air quality limits for dioxins and furans in the UK National Air Quality Objectives, therefore the air quality standard from Ontario, Canada is used instead. With the ISWMS in full operation, the PCDD/PCDF cumulative concentration is 23 percent of the defined air quality standard limit.

Particulate Matter

PM_{10} and $PM_{2.5}$ are expected contaminants from the EFR stack and from the haul roads. The haul roads are located close to the Site property line and therefore the maximum cumulative concentrations of PM are observed to occur directly on the property line and contribution is dominated by the haul road emission source. The ISWMS emissions contribute up to 61 percent of the daily and 38 percent of the annual cumulative concentrations of PM_{10}.

The cumulative concentration from the background air quality and the future project are shown to be below the UK National Air Quality Objectives for both the 24-hour and annual standards. The cumulative concentrations for PM_{10} are 81 percent of the 24-hour limit and 77 percent of the annual limit. The cumulative concentration for $PM_{2.5}$ is 40 percent of the annual limit.

Hydrogen Chloride

HCl is an expected contaminant from the ERF stack. The HCl concentrations were assessed with background concentrations and maximum potential emissions from the ERF stack. ISWMS emissions contribute up to seven percent of the cumulative concentration. The one-hour maximum cumulative concentration is five percent of the air quality standard limit.

Hydrogen Fluoride

HF is an expected contaminant from the ERF stack. The HF concentrations were assessed with background concentrations and maximum potential emissions from the ERF stack. ISWMS emissions contribute up to one percent of the hourly and less than one percent of the annual cumulative concentrations. The one-hour maximum cumulative concentration is 14 percent and the annual maximum cumulative concentration is 44 percent of the air quality standard limit.

Sulphur Dioxide

SO_2 is an expected contaminant from the ERF stack and the future landfill gas enclosed flare. The SO_2 concentrations were assessed with background concentrations and maximum potential emissions from the ISWMS. ISWMS emissions contribute up to 19 percent of the 15-minute, 47 percent of the hourly, and 40 percent of the daily cumulative concentrations. Of the three SO_2 air quality standard limits, the highest percent of limit that SO_2 reaches is 36 percent of the 15-minute limit.

Oxides of Nitrogen

NO_2 is an expected contaminant from the ERF stack, the future landfill gas enclosed flare, and the existing landfill flares. Assessment of the maximum NO_2 emissions included both the flare types to allow for overlap between the decommissioning of the existing flares and the installation of the new flare. The NO_2 concentrations were assessed with background concentrations and maximum potential emissions from the ISWMS. ISWMS emissions contribute up to 70 percent of the hourly and 41 percent of the annual cumulative concentrations. The one-hour maximum cumulative concentration is 83 percent and the annual cumulative concentration is 54 percent of the air quality standard limit.

Carbon Monoxide

CO is an expected contaminant from the ERF stack, the future landfill gas enclosed flare, and the existing landfill flares. Assessment of the maximum CO emissions included both the flare types to allow for overlap between the decommissioning of the existing flares and the installation of the new flare. The CO concentrations were assessed with background concentrations and maximum potential emissions from the ISWMS. ISWMS emissions contribute up to 13 percent of the cumulative concentration. The existing landfill flares are the highest contributors to this maximum concentration. This concentration is 26 percent of the air quality standard limit.

Heavy Metals

The CoPCs, defined above, includes 12 metals that may emit from the ERF activities. For the purpose of detailed monitoring and assessment, four metals were selected as the worst-case metals that have the lowest emission standards to compare against. Cadmium, arsenic, lead, and nickel are therefore assessed as the most stringent air quality standard metals.

Background monitoring for these metals showed that ambient concentrations are very low. Emissions from the ERF stack contribute between 65 percent to 83 percent of the cumulative concentration for each of these metals. Of the four metal air quality standard limits, the highest percent of limit is 86 percent for arsenic.

11.9 Impact assessment and mitigation

This Section reports the likely effects of the Proposed Development, as identified in the ToR, in terms of air quality impacts, based on the findings from the data collection and modelling, in the context of the Site and surrounding area, and whether these would be deemed to be significant.

Dust

As noted in Section 11.6.2, according to the "Guidance on the Assessment of Dust from Demolition and Construction (Version 1.1)[19]", a preliminary screening was carried out for the particulate emissions that might occur due to construction activities. The nearest sensitive receptor (a residence) is more than 1,148 ft (350 m) away from the construction site, and the route taken by construction vehicles is mainly through an industrial area. There are no significant effects likely to occur due to the construction activities at the ISWMS Site with the implementation of appropriate site-specific dust mitigation plans that will be outlined in the Facility's EMP. Hence the emissions from the construction phase were not considered as a part of this Assessment.

As described in Section 11.6.3.1 and further detailed in Chapter 4, bottom ash produced during the combustion process is quenched and transported to the Bottom Ash Storage Area on the RWL to mature for six to eight weeks, following which it is transported to the Bottom Ash Processing Facility. The Bottom Ash Processing Facility will be enclosed to provide complete containment for security purposes during non-operational periods and to reduce dust and noise emissions during operations.

During maturation at the Bottom Ash Storage Area, storm water collected through the leachate collection system will be recirculated (sprayed) over the bottom ash to assist with the weathering process and reduce dust emissions. As such, the ash storage area is not anticipated to be a significant source of dust and will have a negligible effect on human health and quality of life.

As the Bottom Ash Processing Facility will be fully enclosed, dust arising from processing will be contained within the Bottom Ash Processing Facility and will have a negligible effect on human heal and quality of life.

Fuel combustion

There are no significant effects likely to occur due to the construction activities at the ISWMS Site with the implementation of appropriate Site-specific dust mitigation plans that will be outlined in the Facility's EMP. Best practices to limit fuel combustion by construction vehicles and plant during construction will be included in the EMP. The potential for increased emissions and therefore increased concentrations of pollutants that could affect human

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health at nearby sensitive receptors during construction is considered very low given the temporary nature of the construction activities.

As reported in Chapter 13 – Traffic and Transport, trip generation by the ISWMS Site is expected to be in line with the trips currently generated by the GTLF and there are no plans to modify the waste collection practices. Trip distribution to and from the ISWMS Site is expected to be similar to existing trip distribution at the GTLF. As such, the ISWMS will not result in an increase in emissions from project vehicles on public highways that could increase concentrations of pollutants that could affect human health (mainly NO_2) at receptors near to road.

Air emissions

Modelling of air quality for the ISWMS Site shows all contaminants with a cumulative concentration that is below the applicable air quality standard, demonstrating that the implementation of the ISWMS will not result in any air quality exceedances. Per the IAQM air quality assessment methodology, Table 11.16 below provides the resulting impact level considering the worst-case contaminant concentrations off-site (property boundary and beyond), the change in concentration relative to the AQAL, and the long term average concentration. Considering these results reflect the worst-case instances for each contaminant, including locations at the property boundary (the nearest sensitive receptor (a residence) is more than 1,148 ft (350 m) away), based on professional judgement, the air emission impacts overall are considered not to be significant.

As such, the ISWMS is considered to have a negligible impact on human health.

Table 11.16 Air quality impacts

Parameters	Averaging Period	Units	Project Concentrations[1]	Cumulative Concentrations	Limit	Change in Concentration relative to Limit	Percent of limit of long term average Concentration [2,3]	Impact Level
Carbon Monoxide (CO)	8 Hour	mg/m³	0.34	2.60	10	3 percent	26 percent	Negligible
Nitrogen Dioxide (NO_2)	Annual	µg/m³	8.9	21.5	40	22 percent	54 percent	Moderate
Particulates (PM10)	Annual	µg/m³	12	31	40	29 percent	77 percent	Moderate
Particulates (PM2.5)	Annual	µg/m³	2.8	7.9	20	14 percent	40 percent	Moderate
Sulphur Dioxide (SO_2)	24 Hour	µg/m³	8.0	19.9	125	6 percent	16 percent	Slight
Hydrogen Chloride (HCl)	1 Hour	µg/m³	2.4	34.6	750	0.3 percent	5 percent	Negligible
Hydrogen Fluoride (HF)	Annual	µg/m³	0.033	7.004	16	0.2 percent	44 percent	Negligible
Cadmium (Cd)	Annual	µg/m³	0.0007	0.0008	0.005	13 percent	17 percent	Moderate
Arsenic (As)	Annual	µg/m³	0.003	0.005	0.006	56 percent	86 percent	Moderate
Lead (Pb)	Annual	µg/m³	0.010	0.012	0.25	4 percent	5 percent	Negligible
Nickel (Ni)	Annual	µg/m³	0.010	0.012	0.02	50 percent	61 percent	Moderate
Dioxins and Furans	24 Hour	pgTEQ/m³	0.009	0.023	0.1	9 percent	23 percent	Slight

Notes:

(1) Concentrations are the maximum modelled values that occur. No data is removed from meteorological anomalies and no statistics are applied.
(2) To be conservative, highest concentration occurring at any location offsite is used (not just sensitive receptors).
(3) 'Long term average' is selected to be the longest averaging air assessment limit identified for the contaminant.

Odour

The construction of the ISWMS will lead to a reduction in odour from the following:

GTLF: The active face of the landfill will remain until the ERF facility has been commissioned at which time it is reasonable that odours will be significantly reduced as organics will be moved to outdoor composting windrows and combustible waste will be brought to the ERF. Landfill gas will be captured and flared until gas quality for other uses is examined. This will reduce the landfill gas odour from the mound and capped areas.

Medical Waste Incinerator: The MWI will be moved and operate with best available control technology systems for pollution control that will reduce odour.

There is a potential for odour emissions from the Green Waste Facility (GWF) composting area. According to the "Guidance on the Assessment of odour for planning (Version 1.1)" by the Institute of Air Quality Management, odour emissions from aerated green waste composting is classified as 'moderately offensive'. However, the facility will only be used to process leaf and yard waste, which is a small subset of the types of waste typically included in a composting facility. The material received is significantly less odourous than other types of green waste such as food and animal by-products. Odour emitted from yard waste compost is described as 'earthy' and is therefore categorized as 'less offensive'. The nearest sensitive receptors to the GWF are properties approximately 984 feet (300 metres) southwest of the development. Per the UK Environment Agency's policy on composting, there is a recommended separation distance of 820 feet (250 metres) buffer separating the nearest sensitive receptors. This policy is in relation to bioaerosols which would be a strong contributor to potential odour effects. Additionally, the ISWMS facility will conform to a Code of Good Practice to adopt operations and mitigation measures to control activities that may generate and affect the release of odours. In addition to the setback distance and odour management procedures, the frequency of the historical wind data is observed to have less than 2 percent 'calms' which would be the wind condition most likely to propagate odour complaints due to low dispersion. There may also be some potential for low dispersion in low wind conditions when the wind is blowing from the northeast direction. Wind from the northeast that has a speed less than 10 feet (3 metres) per second occurs less than 3 percent of the time. These conditions combined with the variable nature of the odour emitted from a composting area would cause any odour impacts to be highly infrequent. The location of the GWF results in an increased separation distance for most of the identified sensitive receptors discussed in Section 11.5.3 compared to the existing GTFL. Therefore, overall, the GWF is not expected to have a significant risk of odour impact and the ISWMS project is expected to be a net reduction in odour impacts.

As such, based on the Air Quality Management Guidance on the assessment of odour for planning, the "source odour potential" for the ISWMS is considered ***Small*** and the "pathway effectiveness" is considered ***Moderate*** resulting in a risk of odour exposure (impact) at receptor locations of ***Negligible***. The identified receptors for the odour assessment, the Cayman International School and Lakeside Condominiums, are considered to have a sensitivity of ***High*** as the users/residents would reasonably be expected to be present here continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land. Despite the ***High*** sensitivity of these receptors, the likely magnitude of the odour effects are considered to be ***Negligible***.

Bioaerosols

Bioaerosols were considered as part of the determination of existing conditions for the ISWMS. In consideration of the potential effect of bioaerosols at sensitive receptors the following UK guidance documents were referenced:

– Technical Guidance Note (Monitoring) M9 Environmental Monitoring of Bioaerosols at Regulated Facilities, Environmental Agency, July 2018
– Occupational and Environmental Exposure to Bioaerosols from Composts and Potential Health Effects - A Critical Review of Published Data, 2003
– Guidance on the Evaluation of Bioaerosol Risk Assessments for Composting Facilities; Leeds University, 2008
– Site Specific Bioaerosol Risk Assessment, WRM, 2020

Bioaerosols are found naturally within the environment. They consist of airborne particles that contain living organisms, such as bacteria, fungi and viruses or parts of living organisms, such as plant pollen, spores and endotoxins from bacterial cells or mycotoxins from fungi. The components of a bioaerosol range in size from around

0.02 to 100 micrometres (μm) in diameter. The size, density and shape of a bioaerosol will affect its behaviour, survivability and ultimately its dispersion in the atmosphere.

Composting and anerobic digestion appear to be the largest sources of bioaerosols. The dependence on microorganisms to degrade the organic material, and the way in which the material is processed make biological treatment facilities a source of bioaerosols.

Bioaerosols degrade and disperse in the air a short distance away from the source. This distance appears to be within 656 to 820 ft (200 to 250m) depending on the meteorological conditions. Because of the nature of bioaerosols, their impact is largely on the workers who are exposed to them daily at close proximity and therefore can be a worker exposure issue.

The UK Environment Agency's policy position on composting and potential health effects from bioaerosols (2007) is that they will:

> "take into account the potential effects of bioaerosols on human health when authorizing new waste composting facilities or changes to existing facilities. To do this, applicants will have to provide us with a site-specific bioaerosol risk assessment if there is a workplace or dwelling within 820 feet (250 metres) of the composting site boundary. The assessment must be based on clear scientific evidence and show that bioaerosols can and will be maintained at appropriate levels at any workplace or boundary of a dwelling"

Dispersion models can accurately predict the movement of dusts and aerosols on which bioaerosols are attached, but cannot accurately predict efficacy, so the 820 ft (250 m) buffer is used.

Neither composting nor anerobic digestion are currently occurring at the GTLF. Composting of green waste will be a component of the proposed ISWMS which will be well within a 820 ft (250 m) buffer separating the nearest sensitive receptors. The ISWMS Site will conform to a Code of Good Practice to adopt operations and mitigation measures to control activities that may generate and affect the release of bioaerosols.

Therefore, the Methods Statement determined that an assessment of the existing conditions of bioaerosols was not warranted as part of the EIA. The ISWMS will be designed such that the potential health affects to workers and sensitive receptors will be well within UK Guidance, and a risk assessment will not be necessary.

GHG emissions

Currently, GTLF receives over 115,000 tons (116,845 tonnes) of solid waste per year. Organic material in waste degrades into methane (CH_4) over time which can emit from landfills. Because methane is a GHG that has 30 times more global warming potential than CO_2 over a 100-year period, most landfills, including GTLF, include a landfill gas capture system in which the landfill gas is flared to instead be emitted as carbon dioxide. However even a highly efficient landfill capture system will only capture 60-90 percent of CH_4 emissions[20].

By diverting solid waste from a conventional landfill to an energy recovery process, the 10-40 percent of uncontrolled CH_4 emissions are avoided from the source and the CO_2 emissions are classified as biogenic as the same CO_2 would have been a natural decomposition of the organic material. Therefore, the energy recovery process would emit significantly less GHG and will offset emissions with every ton of avoided waste to a landfill.

According to the Cayman Islands Department of Environment (DOE), power generation accounts for 65 percent of Cayman Island GHG emissions as of 2007. In addition to the landfill offsets, surplus power generated through the ERF will be sold to the Cayman power grid. This will further reduce GHG emissions through the displacement of higher GHG emission power generation.

[20] United States Environmental Protection Agency (US EPA). *Benefits of Landfill Gas Energy Projects*. 2023. https://www.epa.gov/lmop/benefits-landfillgas-energy-projects

Table 11.17 Significance of operation and construction on air quality effects

Likely significant potential effect	Receptor	Mitigation	Residual effect	
			Magnitude & rationale	**Significance**
Construction				
Emission of dust causing loss of amenity at sensitive receptors that occur near to work sites and haul road	Residential properties, schools, commercial sites, ecological sites	Site-specific dust mitigation plans (road dust mitigation) included in EMP	The nearest sensitive receptor (a residence) is more than 1,148 feet (350 metres) away from the construction site, and the route taken by construction vehicles is mainly through an industrial area. There are no significant effects likely to occur due to the construction activities at the ISWMS Site with the implementation of appropriate Site-specific dust mitigation plans.	Not significant
Emissions from construction vehicles and plant through fuel combustion that could increase concentrations of pollutants that could affect human health (NO_2 and particulate matter)	Residential properties, schools, commercial sites, ecological sites	Best practices to limit fuel combustion to be included in EMP	The potential for increased emissions and therefore increased concentrations of pollutants that could affect human health at nearby sensitive receptors during construction is considered very low given the temporary nature of the construction activities and distance to the nearest sensitive receptor more than 1,148 feet (350 metres) away.	Not significant
Operations				
Emission of air pollutants causing effects on human health and ecological receptors	Residential properties, schools, commercial sites, ecological sites	Site-specific dust mitigation plans (road dust mitigation), BAT included in EMP	Modelling of air quality for the ISWMS Site shows all contaminants with a cumulative concentration that is below the applicable air quality standard, demonstrating that the implementation of the ISWMS will not result in any air quality exceedances and will therefore have a negligible impact on human health and ecological receptors.	Not significant
Odour emissions causing effects on quality of life	Residential properties, schools, commercial sites	Combustible waste will be brought to the ERF, operating under negative pressure Landfill gas will be captured and flared MWI will operate with best available control technology systems for pollution control	Odour emission causing effects on quality of life is considered to be negligible, given the ISWMS will result in a reduction in odour at sensitive receptor locations.	Not significant

Likely significant potential effect	Receptor	Mitigation	Residual effect	
			Magnitude & rationale	Significance
Increased emissions from project vehicles on public highways that could increase concentrations of pollutants that could affect human health (mainly NO_2) at receptors near to road	Residential properties, schools, commercial sites, ecological sites	None proposed	As reported in Chapter 13 – Traffic and Transport, trip generation by the ISWMS Site is expected to be in line with the trips currently generated by the GTLF and there are no plans to modify the waste collection practices. Trip distribution to and from the ISWMS Site is expected to be similar to existing trip distribution at the GTLF. As such, the ISWMS will not result in an increase in emissions from project vehicles on public highways that could increase concentrations of pollutants that could affect human health (mainly NO_2) at receptors near to road.	Not significant
Bioaerosol causing effects on human health	Residential properties, schools, commercial sites	Conform to a Code of Good Practice to adopt operations and mitigation measures to control activities that may generate and affect the release of bioaerosols.	Bioaerosols degrade and disperse in the air a short distance away from the source (approximately 656-820 ft (200-250 m)). As there are no sensitive receptors located within 820 ft (250 m) of the green waste processing facility, bioaerosols from the ISWMS are not anticipated to cause effects on human health at surrounding residential properties, schools or commercial sites.	Not significant
GHG emissions causing effects on climate	Climate	GHG emissions to be quantified annually in accordance with internationally recognised methodologies and reporting procedures. All reasonable attempts to be made to maximise energy efficiency and design facilities to minimise energy use.	By diverting solid waste from a conventional landfill to an energy recovery process, 10-40 percent of uncontrolled CH_4 emissions are avoided from the source and CO_2 emissions are classified as biogenic. Therefore, the energy recovery process would emit significantly less GHG and will offset emissions with every ton of avoided waste to a landfill. In addition to landfill offsets, surplus power generated through the ERF will be sold to the Cayman power grid, further reducing GHG emissions through the displacement of higher GHG emission power generation.	Not significant

Likely significant potential effect	Receptor	Mitigation	Residual effect	
			Magnitude & rationale	Significance
Dust arising from the ash storage area causing effects on human health and quality of life	Residential properties, schools, commercial sites	During maturation at the Bottom Ash Storage Area, storm water collected through the leachate collection system will be recirculated (sprayed) over the bottom ash to assist with the weathering process and reduce dust emissions by keeping the bottom ash moist/quenched.	The ash storage area is not anticipated to be a significant source of dust and will have a negligible effect on human health and quality of life.	Not significant
Dust arising from the production of the aggregate causing effects on human health and quality of life	Residential properties, schools, commercial sites	Bottom Ash Processing Facility fully enclosed	Dust arising from the production of aggregate will be contained within the Bottom Ash Processing Facility and will have a negligible effect on human heal and quality of life.	Not significant
Emissions arising from the RWL development activities	Residential properties, schools, commercial sites, ecological sites	Site-specific dust mitigation plans (road dust mitigation), BAT included in EMP	Modelling of air quality for the ISWMS Site shows all contaminants with a cumulative concentration that is below the applicable air quality standard, demonstrating that the implementation of the ISWMS will not result in any air quality exceedances and will therefore have a negligible impact on nearby sensitive receptors.	Not significant

11.10 Conclusions

The proceeding Sections provide an assessment of the potential air quality impacts resulting from the ISWMS. A detailed assessment of the air quality-related aspects of the Proposed Development was undertaken, including a discussion on the existing environment and baseline conditions, ISWMS operation key components and contaminants of concern, key sensitive receptors, modelling results, and evaluation.

Background monitoring was conducted in the Study Area to determine Site-specific background air quality data for contaminants of concern. Using emission estimates and dispersion modelling, a theoretical background emissions assessment for NO_2 was conducted and compared to the results of the NO_2 monitoring program. The calculated assessment demonstrated similar background concentrations to the measured concentrations, thereby demonstrating the reliability of the monitoring program results.

Existing air quality in the Study Area was shown to be in compliance with the applicable air quality standards with one exception of an odour-based standard for H_2S. This outlier is further explained in the odour assessment documented in the Ambient Air Monitoring Report (**Appendix 11.A [Air Quality Assessment – Appendix B])**.

The potential impacts of the ISWMS on local air quality were assessed by modelling the estimated maximum emissions of each contaminant to determine the maximum potential concentration of each contaminant that could occur off-Site. The cumulative air quality impacts that included the determined background concentrations were compared to relevant standards and guidelines and to the existing air quality conditions. All cumulative impacts are shown to be below the air quality standards. The standard values of pollutants used as reference for this assessment are protective of human health.

With the implementation of the mitigation measures proposed, the results of the Air Quality and Greenhouse Gases Assessment indicate the following:

– Effects related to emissions of dust and loss of amenity at close by sensitive receptors during construction are considered **Not Significant**
– Effects related to emissions from construction vehicles and plant through fuel combustion that could affect human health during construction are considered **Not Significant**
– Emission of air pollutants causing effects on human health and ecological receptors during operation are considered **Not Significant**
– Odour emissions causing effects on quality of life during operation are considered **Not Significant**
– Increased emissions from Project vehicles on public highways that could increase concentrations of pollutants that could affect human health during operation are considered **Not Significant**
– Bioaerosol causing effects on human health during operation are considered **Not Significant**
– GHG emissions causing effects on climate during operation are considered **Not Significant**
– Dust arising from the ash storage area causing effects on human health and quality of life during operation are considered **Not Significant**
– Dust arising from the production of the aggregate causing effects on human health and quality of life during operation are considered **Not Significant**
– Emissions arising from the RWL development activities during operation are considered **Not Significant**

12. Noise and Vibration

12.1 Purpose

GHD Limited was retained by ReGen and the Cayman Islands Government (CIG) as approved by the Environmental Assessment Board (EAB) to undertake a Noise and Vibration Impact Assessment (NVIA) as part of the Environmental Impact Assessment (EIA) for the proposed Integrated Solid Waste Management System (ISWMS). The NVIA reports the likely effects of the Proposed Development in terms of noise and vibration in the context of the ISWMS Site and surrounding area, and whether these would be deemed to be significant. In particular it considers the likely effects of noise and vibration from the Proposed Development and its impact on nearby receptors through the construction and operational phases of the project.

In line with Terms of Reference (ToR) for project, the objectives for the NVIA are to evaluate that the direct and indirect significant effects of a proposed development which are to be identified, described and assessed. Unwanted noise and vibration are known to have an adverse impact on health and quality of life. The activities proposed during the construction and operational phases of the ISWMS have the potential to result in a measurable increase to levels of noise and vibration in the vicinity of the proposed development, and therefore a potential for significant effect on health and quality of life and so these activities have been assessed in detail to confirm potential impacts as part of the EIA process.

The NVIA has been informed by the outcomes of stakeholder consultation conducted by the proponent to date, which sought input from key project-affected stakeholders and members of the broader local community. It also includes consideration of the results of other technical chapters prepared for the EIA, including Traffic and Transport (Chapter 13).

12.2 Study area and assessment boundaries

12.2.1 Spatial boundaries

The following spatial boundaries apply to Noise and Vibration:

Site Study Area (SSA) (or "Project Footprint")

The SSA encompasses the land area directly disturbed by Project construction activities, including associated physical works and activities. The proposed ISWMS Site is located to the north of central George Town towards the western coast of Grand Cayman, immediately south-west of the existing GTLF as shown on Figure 12.1. Access to the Site will be via Seymour Drive from the south.

Local Study Area (LSA)

The Noise and Vibration LSA encompasses all lands within a 3281 ft (1,000 m) radius of the SSA boundaries as shown on Figure 12.1. The maximum noise impacts are expected to occur at the property line and within 1640 ft (500 m) of the SSA. The LSA has been defined as double this distance to conservatively assess all likely and lessor noise impacts in George Town, which contains the area directly occupied by the Project infrastructure, as well as communities and landholders that may be directly affected by Project construction and operation activities.

Figure 12.1 Site Study Area and Local Study Area for noise and vibration

Regional Study Area (RSA)

The Noise and Vibration RSA encompasses all lands which may provide a source of workers, goods or services for the Project as the main noise source in the existing area is the Esterly Tibbetts Highway, the RSA would include the lands connected to the Esterly Tibbetts Highway as depicted on Figure 12.2. The RSA has been defined conservatively to assess all likely sources of potential noise impacts to the sensitive areas surrounding the ISWMS Facility.

The maximum distance recommended for assessment is not stipulated in the United Kingdom's (UK) Institute of Environmental Management and Assessment Guidelines for Environmental Noise Impact Assessment (IEMA)[1]. Therefore, for the purpose of this baseline noise assessment the noise at the worst-case sensitive Noise Sensitive Receptors (NSRs) within the LSA will be evaluated. The maximum noise impacts are however expected to occur at the property line and within approximately 1,640 ft (500 m) of the SSA.

Figure 12.2 Regional Study Area for noise and vibration

12.2.2 Temporal boundaries

There are two different types of temporal boundaries to consider. The first type are the boundaries that are associated with the temporal limits of a Project. They include both large scale limits: different phases of a project (construction, operation, and closure and post-closure) and small-scale limits: duration of specific project activities. Generally, the temporal boundary encompasses all project phases; however, the temporal boundary can vary depending on the Valued Components (VC) being considered. The second are the temporal characteristics associated with each VC. Temporal characteristics include both the timing and duration of critical or sensitive life stages of biological VCs (e.g., nesting and spawning periods and over-wintering). Temporal characteristics also include timing and duration of human activities (e.g., heavy tourism and recreation seasons).

[1] IEMA. *Environmental noise assessments*. 2014. IEMA. Retrieved April 14, 2023, from https://www.iema.net/articles/environmental-noise-assessments.

For the ISWMS Project the temporal boundary limits for all VCs encompass all project phases as follows:

– **Construction (C)**: Initial Site preparation and construction (approximately three years).
– **Operations (O)**: Waste acceptance at the Site, ongoing landfill clearing and landfill cell construction, progressive landfill cell closure, and monitoring (approximately 25 years, depending on demand for facility services).
– **Decommissioning (D)**: removal of non-essential on-Site infrastructure and closure of the facility (approximately six months).

Relevant temporal characteristic boundaries for Noise and Vibration include:

– Seasonal fluctuations in traffic volumes and composition.
– Fluctuations in weather patterns, and their corresponding effect on Noise propagation.

12.2.3 Technical boundaries

Technical boundaries reflect the limitations in the ability to predict the effects of a project, which impose potential constraints on an assessment. An example of a technical boundary is the difficulty associated with sampling certain reclusive species, resulting in a data gap for a VC. Technical limitations are also associated with modeling and the possible margin of error in the generated data.

Technical boundaries relevant to the existing conditions assessment of Noise and Vibration include:

– Accuracy of the sound level data and traffic data used in the assessment.
– Modelling accuracy.
– Level of detailed design.

12.2.4 Sensitive receptor locations – ISWMS Development

The identification of appropriate sensitive receptors is necessary to conduct the NVIA. A NSR is any point on the premises of a person, where sound, originating from external sources other than those that premises, is received. In general, NSRs may include permanent or seasonal residences, nursing/retirement homes, hotels/motels, rental residences, hospitals, campgrounds, parks, schools, cemeteries, or places of worship.

The objective of the NVIA is to determine the predictable worst case 1-hour equivalent sound level (1-hour Leq) at the worst case NSR(s) and to prove and ensure that the construction and operation of the ISWMS does not significantly affect the acoustic environment of the worst case NSR(s). Also, this work will ensure that should future impact assessments require equipment which meets appropriate specifications or effective noise mitigation to meet existing sound levels, there is a reference to provide effective mitigation suggestions. The worst case NSR(s) is(are) defined as the sensitive receptor(s) with the greatest potential exposure to the ISWMS noise sources due to proximity and direct line of sight exposure.

As per the ToR, this section identifies NSRs that have the potential to be significantly affected by the main ISWMS development. The NSRs considered in the assessment include the following:

– NSR1 – Locations within the Lakeside Development (residential dwelling immediately west of the ISWMS development, on the opposite side of the Esterly Tibbetts Highway).
– NSR2 – Properties on Parkside Close (residential dwelling approximately 2,624 ft (800 m) to the northwest of the ISWMS development).
– NSR3 – Properties on Seymour Road (residential dwelling approximately 984 ft (300 m) to the southeast of the proposed ISWMS development).
– NSR4 – Representative of The Cayman International School (educational establishment approximately 2,624 ft (800 m) to the northeast of the ISWMS development); and Locations within the OLEA residential development approximately 2,624 ft (800 m) north of the ISWMS development.

– NSR5 – Properties on Woodlake Drive/Glenwood Drive (residential dwelling approximately 984 ft (300 m) to the southwest of the ISWMS development).
– NSR6 – Proposed New Health City Camana Bay Medical Campus (sensitive receptor approximately 2,296 ft (700 m) to the north of the ISWMS development).

All NSR locations within 3,281 ft (1,000 m) of the ISWMS were considered; however, the noise impact at only the worst case and most exposed NSRs are presented herein.

The location of the worst case NSRs are identified on Figure 12.3.

Figure 12.3 Point of reception location plan

12.3 Baseline conditions

12.3.1 Existing noise and vibration environment

The existing ambient acoustic environment and sound characteristics around the ISWMS is mainly influenced by road traffic attributed to the local and highway roads, cruise ships, airplanes supporting the local tourism industry to the north, south and west, and by existing industry to the southeast, which includes various automotive shops and ready-mix cement/concrete suppliers.

A description of the existing ISWMS Site and general surroundings is provided in Chapter 3 and **Appendix 12.A (Noise and Vibration Assessment)**.

One major highway and two major local roads are located within the Study Area including:

– Esterly Tibbetts Highway is a four lane highway that carries the majority of the traffic noise in the area around the proposed ISWMS Site.
– West Bay Road is a three lane municipal road.
– North Sound Road is a four lane municipal road that becomes a two lane road between Butterfield roundabout and Seymour Road.

Vehicular road traffic generates noise that consists of mechanical noise from the engine and brakes, friction noise created from the wheel contacting the road surface, and aerodynamic wind noise from the vehicle. Traffic volume, speed, road composition, gradient and surface type will affect the overall traffic noise that can be generated. Proximity and line of sight to the road corridor are most consequential for determining the noise impact exposure for an adjacent area.

Road traffic noise is generally considered atonal broadband noise, meaning that it generates a fairly even sound distribution over the frequency spectrum with little to no predominant peaks. For any broadband noise, the audibility and potential impact from a change in the overall noise level will be a function of how much it exceeds the existing ambient background sound level or baseline noise environment. The noise generated from vehicular traffic can be defined as a line type noise source, meaning that the noise generated will reduce by approximately 3 dBA for every doubling of distance from the source.

12.3.2 Baseline noise monitoring results

Baseline noise monitoring data was used in conjunction with predictive dispersion modelling using the Cadna A acoustical model to determine the potential effects of the ISWMS relative to the elevated baseline noise levels. The objective of the baseline monitoring was to accurately measure the baseline noise levels in the area from the existing potential noise emission sources in the Study Area.

12.3.2.1 Baseline noise monitoring systems

Baseline sound surveys were undertaken at the agreed NSRs using four Larson Davis LXT[2] Type 1 sound level meters[3]. All sound level meters were field calibrated before and after the measurement period by applying an acoustic calibrator that conformed to the latest versions of BS EN IEC 60942:2018 (Electroacoustics – Sound Calibrators) to the microphone to check the sensitivity of the measuring equipment. Any significant drift in calibration levels were noted. The equipment used for the noise monitoring had undergone laboratory calibration within a period not exceeding two years (one year for calibrators).

2 Serial Number 0006587, 0006393, 0003969, 0006585
3 As defined by BS EN 61672: Part 1: 2013 (Electroacoustics, Sound Level Meters, Specifications

Figure 12.4 Sound level meter

The local Cayman's airport weather station data was used to monitor weather patterns over the survey period and any periods measured under unsuitable weather conditions (precipitation and/or winds greater than 12.4 miles/hour (20 kilometres/hour)) were excluded from the final dataset.

The instrumentation used for the sound surveys was set up to simultaneously log, at a minimum, $L_{Aeq,T}$, $L_{A90,T}$, $L_{A10,T}$, L_{ASmin} and L_{ASmax} sound levels over continuous sampling periods for one hour, over a total period of five to eight days including a weekend period. All measurements were undertaken in accordance with recognised relevant methodologies[4]. The baseline sound survey results were then defined against BS4142:2014 in terms of background sound levels (defined as the L_{eq}, $L_{A90,\,T}$ parameter) in compliance with the requirements of the EAB scoping opinion, per Section 5.7.17 of the ToR. Section 5 of the scoping opinion states that "noise levels from the proposed activities should be calculated and assessed against baseline conditions and relevant standards, taking into account cumulative effects of adjacent activities and land uses".

The noise descriptors are described as the following:

– $L_{Aeq,\,T}$ – This is the A-weighted sound level of a steady sound carrying the same total energy in the time period T as the observed fluctuating sound. The time period T is given in hours. Leq without a specific time period means Leq.

[4] BS 4142:2014

- $L_{A90,T}$ – This is the A-weighted sound the level that is exceeded for 90 percent of the time and is often used to quantify the background noise levels in assessments of noise pollution and nuisance noise from industrial sources.
- $L_{A10,T}$ – This is the A-weighted sound the level that is exceeded for 10 percent of the time and takes account of any annoying peaks in noise.
- L_{ASmin} and L_{ASmax} – the minimum and maximum L_{Aeq} within a period of time.

The baseline noise monitoring program followed these standards. Unattended baseline monitoring was selected due to the variability of the sound levels in an urban environment and since the ISWMS will run year-round, a long-term evaluation is required to best evaluate the existing conditions. The month of October was selected due to favourable weather and because local schools would be in session depicting typical traffic patterns for the area.

12.3.2.2 Duration of baseline noise monitoring

Seasonality on the Cayman Islands consists of a wet and a dry season. The dry season usually begins in early November and lasts until April. The monitoring took place beginning in October 2021 which measured noise emissions occurring during the rainy season and after the summer school break so regular traffic is observed and documented with regards to ambient noise in the area.

Baseline monitoring was completed over eight days at NSRs 1, 3, and 4. The Baseline monitoring at NSR2 however was only completed over five days due to difficulty obtaining permissions and access to that location. This is still within the minimum five day required total period for determining background sound levels. All baseline monitoring included both weekday and weekend days for evaluation. Monitoring at NSR1 is considered representative of NSR5 due to the same line of sight, exposure and separation distance (approximately 164 ft [50 m]) to Esterly Tibbetts Highway. Monitoring at NSR4 is considered representative of NSR6 due to similar proximity to Esterly Tibbetts Highway.

12.3.2.3 Baseline noise monitoring results

Continuous one hour L_{Aeq}s were taken with the detector in slow response over the course of the measuring period when meteorological conditions were marked by low winds (less than 9 miles per hour (15 kilometers per hour [km/hr])) and minimal precipitation. The baseline noise monitoring was conducted from October 19, 2021 to October 27, 2021 with all statistical sound level measurements including $L_{Aeq,T}$, $L_{A90,T}$, $L_{A10,T}$, L_{ASmin} and L_{ASmax} over continuous hourly sampling periods for each monitoring location in addition to providing the average for the weekday periods of monitoring program (summarized in **Appendix 12.A [Noise and Vibration Assessment – Tables D.1-D.4 of Appendix D]**).

Daytime, evening, and nighttime statistical sound levels are summarized for each monitoring location in Table 12.1.

Table 12.1 Baseline noise monitoring week summary

NSR	Average Daytime (dBA) $L_{Aeq,\ 11\ hour}$	Average Evening (dBA) $L_{Aeq,\ 5\ hour}$	Average Night Time Level (dBA) $L_{Aeq,\ 8\ hour}$	Daytime Range (dBA) $L_{A90,\ 11\ hour}$	Evening Range (dBA) $L_{A90,\ 5\ hour}$	Night time Range (dBA) $L_{A90,\ 8\ hour}$
NSR1 – Lakeside Development (7.5 metres [m] above grade (AG))	63	58	58	51 - 59	49 - 54	45 - 47
NSR2 – Residence on Parkside Cl. (4 m AG)	56	48	44	43 - 46	40 - 43	36 - 40
NSR3 – Residence on Seymour Rd. (1.5 m AG)	65	57	57	53 - 57	52 - 54	49 - 53
NSR4 – Cayman International School (4.5 m AG)	61	54	51	43 - 52	42 - 45	38 - 41

NSR	Average Daytime (dBA) LAeq, 11 hour	Average Evening (dBA) $L_{Aeq,\ 5\ hour}$	Average Night Time Level (dBA) $L_{Aeq,\ 8\ hour}$	Daytime Range (dBA) $L_{A90,\ 11\ hour}$	Evening Range (dBA) $L_{A90,\ 5\ hour}$	Night time Range (dBA) $L_{A90,\ 8\ hour}$
NSR5 – Residence on Woodlake Drive (1.5 m AG)	63	58	58	51 - 59	49 - 54	45 - 47
NSR6 – Proposed New Health City Camana Bay Medical Campus (7.5 m AG)	61	54	51	43 - 52	42 - 45	38 - 41

Note that NSR1 baseline data is used to represent NSR5 and NSR4 baseline data is used to represent NSR6 due to similar proximity to Esterly Tibbetts Highway.

The average L_{90} hour for each monitoring period is typically used for comparison to the proposed operational impacts of the ISWMS, as this is the period in which the ambient environment is at its lowest and is therefore conservative criteria to evaluate potential noise impacts relative to the ambient.

12.4 Applicable standards and guidelines

Since the Cayman Islands is a British Overseas Territory, noise and vibration guidance regarding baseline monitoring will be referenced from the current EU Directives as noted in Table 5.33 of the ToR.

Emissions in the Cayman Islands are guided by the UK's IEMA[5] which presents guidelines on how the assessment of noise effects should be presented within the Environmental Impact Assessment (EIA) process. The IEMA guidelines cover aspects such as; scoping, baseline, prediction and example definitions of significance criteria.

The applicable guidance is summarized as follows:

- British Standard 5228-1:2009+A1:2014 Code of Practice for noise and vibration control on construction and open sites – Part 1: Noise (BS5228-1).
- British Standard 5228-2:2009+A1:2014 Code of Practice for noise and vibration control on construction and open sites – Part 2: Vibration (BS5228-2).
- UK's Highways Agency Design Manual for Roads and Bridges, 2011 (DMRB).
- British Standard 4142+A1:2019: Methods for rating and assessing industrial and commercial sound (BS4142).
- British Standard 8233:2014 Guidance on sound Insulation and noise reduction for buildings (BS8233).
- British Standard 6472-1:2008 Guide to evaluation of human exposure to vibration in buildings. Part 1: Vibration sources other than blasting (BS6472).
- UK's Department of Transport Calculation of Road Traffic Noise, 1988 (CRTN).
- Acoustics – Attenuation of sound during propagation outdoors: Part 2 General Method of Calculation, 1996 (ISO 9613-2).
- UK's Institute of Environmental Management and Assessment Guidelines for Environmental Noise Impact Assessment, 2014 (IEMA).
- Potential noise impacts at educational facilities – Acoustic design of schools: performance standards: Building bulletin 93, 2015 (BB93).
- Cayman Islands Government Department of Environmental Health – Guidelines for Development Control (July 2009) - Section 4.4 - Noise Pollution Control (https://www.gov.ky/deh/publications.html).

The potential noise effects associated with the ISWMS have been assessed in accordance with the guidance detailed in the following sections to determine whether statutory objectives are exceeded or whether undesirable/desirable consequences may arise for the receiving environment. Where potential adverse impacts are identified, appropriate mitigation measures are proposed to avoid, reduce or compensate for the adverse effects. The significance of an

[5] IEMA. *Environmental noise assessments*. 2014. Retrieved April 14, 2023, from https://www.iema.net/articles/environmental-noise-assessments

environmental impact will be determined not only by the magnitude of the impact but also by the sensitivity of the receptor. The significance of construction noise and vibration, and operational noise, is detailed below, respectively, as well as the determination of the sensitivity of the receptor.

12.4.1 Assessment Criteria for Operational Noise Effects

For each NSR the ISWMS operational noise assessment methodology, as described in BS 4142:2014, comprises:

– Ascertaining a representative $L_{A90,\ T}$ background sound level at the NSR from the results of baseline sound survey.

– Calculating or modelling the free-field $L_{Aeq,\ Tr}$ specific sound level (due to each item of plant) at said NSR and applying a character correction (for tonality, intermittency and impulsivity, if appropriate) to obtain the free-field $L_{Ar,\ Tr}$ rating level – for the identification of tonality, reference should be made to 1/3rd octave data if such data is available.

– Performing a decibel addition to obtain the cumulative effect (where appropriate) of all relevant $L_{Ar,\ Tr}$ rating levels on the NSR.

– Arithmetically subtracting the $L_{A90,\ T}$ background level from the cumulative $L_{Ar,\ Tr}$ rating level to obtain the excess of rating level over background level for the assessment.

– The assessment criteria for EIA magnitude of change has been derived from the assessment criteria described in section 11 of BS 4142: 2014 and is given in Table 12.2.

Table 12.2 EIA magnitude of change assessment criteria

EIA Magnitude of Change	Excess of Rating over Background Sound Level, dB	Typical BS 4142:2014 Assessment Outcome
Very High	> 12	A difference of around +10 dB or more is likely to be an indication of a significant adverse impact depending on context
High	8 – 12	A difference of around +10 dB or more is likely to be an indication of a significant adverse impact depending on context
Medium	3 – 7	A difference of around +5 dB is likely to be an indication of an adverse impact depending on context
Low	0 – 2	Less than an indication of adverse impact, depending on context
Very Low	< 0	Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on context

For the purposes of BS4142:2014, adverse impacts include, but are not limited to, annoyance and sleep disturbance. However, it should be noted that not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact.

Table 12.3 Sensitivity of receptor

Sensitivity	Receptor Type
High	**Receptor/resource has little ability to absorb change without fundamentally altering its present character or is of international or national importance. For example, hospitals, residential care homes, and internationally and nationally designated nature conservation sites which are also known to contain noise sensitive species (i.e., noise may change breeding habits or threaten species in some other way).**
Medium	**Receptors/resource has moderate capacity to absorb change without significantly altering its present character. For example, residential dwellings, offices, schools, and play areas. Locally designated nature conservation sites which are also known to contain noise sensitive species (i.e., noise may change breeding habits or threaten species in some other way).**

Sensitivity	Receptor Type
Low	Receptor/resource is tolerant of change without detriment to its character or is of low or local importance. (i.e., industrial estates).
Negligible	Receptor/ resource is not sensitive to noise.

The NSRs identified have been assessed to have medium sensitivity as noise and vibration assessments primarily apply to residential receptors in the ISWMS development area, with the exception of NSR6 and NSR4, which are assessed as high sensitivity due to being a hospital and a school, respectively.

The significance of an environmental impact for on-Site operational noise is determined by the interaction of magnitude and sensitivity. The Significance Evaluation Matrix used in this assessment is shown in Table 12.4:

Table 12.4 Significance evaluation matrix

		Magnitude of Change				
		Very High	High	Medium	Low	Very Low
Sensitivity	Very High	Major (Significant)	Major (Significant)	Major (Significant)	Major (Significant)	Moderate (Possibly significant)
	High	**Major (Significant)**	**Major (Significant)**	**Major (Significant)**	**Moderate (Possibly significant)**	**Minor (Not significant)**
	Medium	**Major (Significant)**	**Major (Significant)**	**Moderate (Possibly significant)**	**Minor (Not significant)**	**Negligible (Not significant)**
	Low	Major (Significant)	Moderate (Possibly significant)	Minor (Not significant)	Negligible (Not significant)	Negligible (Not significant)
	Very Low	Moderate (Possibly significant)	Minor (Not significant)	Negligible (Not significant)	Negligible (Not significant)	Negligible (Not significant)

Within the matrix that is used in most significance evaluation exercises, reference is made to:

– Major effects, which will always be determined as being significant.
– Moderate effects that are likely to be significant, although there may be circumstances where such effects are considered 'not significant' based on specific scenarios and professional judgement.
– Minor or negligible effects, which will always be determined as 'not significant'.

Additionally, moderate impacts might be noticeable and intrusive but may cause only a small change in behaviour, while significant impacts might be noticeable and disruptive and might cause a material change in behaviour or attitude.

12.4.2 Assessment of Operational Traffic Noise Effects

Predictions of the relative increase in traffic noise levels were undertaken where data indicates that there will be an increase of 25 percent or decrease of 20 percent in existing traffic levels or if there is an increase of more than 1 dBA due to heavy goods vehicle (HGV) traffic increases on the main route(s) to the development.

The Operational Traffic Roads includes the following roads: Seymour Road, North Sound Road, Thomas Russel Avenue, Elgin Avenue, Goring Avenue, Harbour Drive and Esterly Tibbets Highway. The Basic Noise Level (BNL) was predicted using noise emission rates in accordance with CRTN calculations using total flows, mean speed and percent HGVs.

18-hour (06:00 – 24:00) traffic counts from 2017 and 2019 for all roadways were obtained from the National Roads Authority (Cayman Islands) and manual traffic counts for Seymour Road was completed in December 2022 and

January 2023. Traffic data collected from automatic traffic counters in December 2022 as part of a Traffic Study by APEC Consulting Engineers Limited was also used. These counts were used to determine the minimum hourly count during the day, evening, and nighttime periods.

Table 12.5 Operational roads traffic parameters

Road Segment	DaytimeVehicle Count (06:00-00:00)	Night-time Vehicle Count (00:00-06:00)	Speed Limit (miles/hour)	Percent HGVs
Seymour	4505	277	25	9 percent
N Sound Rd. (West of Seymour Rd.)	10125	637	35	15 percent
N Sound Rd. (East of Seymour Rd.)	8628	543	35	15 percent
Thomas Russel Ave.	34102	899	35	11 percent
Elgin Ave.	19629	526	25	7 percent
Goring Ave.	19629	526	25	7 percent
Harbour Dr.	23107	686	25	15 percent
Esterly Tibbetts Highway	31185	816	40	15 percent

The above road traffic data was used to calculate the Haul Road noise levels. Note that North Sound Road east of Seymour Road is not part of the Haul Route, but is included to account for traffic coming from that direction.

The rounded road traffic noise modeling results are summarized as follows:

Table 12.6 Existing operational traffic $L_{A10,\ 18hr}$ noise impact levels

NSR	Existing 18 hr Operational Road Traffic $L_{A10,\ 18hr}$ (dBA)	Existing 6 hr Operational Road Traffic $L_{A10,\ 6hr}$ (dBA)
Seymour	65	58
N Sound Rd. (West of Seymour Rd.)	71	64
N Sound Rd. (East of Seymour Rd.)	71	63
Thomas Russel Ave.	76	65
Elgin Ave.	71	61
Goring Ave.	71	61
Harbour Dr.	74	64
Esterly Tibbetts Highway	77	66

Any increase will be assessed in terms of the criteria given in DMRB based on the magnitude of change for the long-term as the operation traffic will be a long-term effect and is defined in Table 12.7 below:

Table 12.7 Magnitude of change of operational traffic noise effects –long term

Magnitude	Long Term Noise Change (dBA $L_{A10,18hr}$)
Major	Greater than or equal to 10.0
Moderate	5.0 to 9.9
Minor	3.0 to 4.9
Negligible	Less than 3.0

Once the magnitude of change is determined, the Significance Evaluation Matrix (Table 12.4) will be consulted to determine the significance of the impact. It is expected that operational traffic noise change will be considered long term noise change.

12.4.3 Assessment Criteria for Construction Noise Effects

The activities associated with the construction phase of the ISWMS have the potential to generate noise and create an impact on the surrounding area. The potential noise impact during the construction phase has been assessed against the BS5228-1 ABC method. The magnitude of any impacts have been established, and the significance of the construction noise impact has been determined based on this method.

In addition to the construction activities, construction vehicle movements to and from the Site have the potential to generate noise at existing sensitive receptors, in the immediate vicinity of the local road network. This potential noise impact has been considered against the existing baseline noise levels and vehicle movements within the local area.

The British and International standard Construction & Operational Road Traffic Noise by the UK's Highways Agency Design Manual for Roads and Bridges (DMRB) is widely used as reference for construction noise impact assessments. The DMRB guidance scope of construction noise first assesses if construction noise generated by the Project has the potential to adversely affect any sensitive receptors. Second, the DMRB asks if the scale of the development or receptors warrant there a reasonable stakeholder expectation to undertake a noise assessment. In this case, the answer to both would be yes, therefore a noise assessment must be undertaken.

The DMRB assesses areas based on the baseline noise of an area. The noise assessment will be based on GHD's baseline noise data collected from October 19, 2021 to October 27, 2021, since data from other sources was not sufficient to enable production of a proportionate construction noise assessment.

The DMRB determines significance based on the lowest observed adverse effect level (LOAEL), and the significant observed adverse effect level (SOAEL) as follows:

Table 12.8 Magnitude of impact and construction noise descriptions

Magnitude of Impact	Construction Noise Level
Major	Above or equal to SOAEL +5 dB
Moderate	Above or equal to SOAEL and below SOAEL +5 dB
Minor	Above or equal to LOAEL and below SOAEL
Negligible	Below LOAEL

The DMRB establishes that the LOAEL is the ambient noise level, and the SOAEL is determined by the BS5228-1 threshold value (see Table 12.9).

Construction noise is predicted using the methodology indicated in BS5228-1:2009+A1:2014 for all the main phases of the construction works, including any cumulative noise associated with simultaneous operation of construction activities within different phases.

The results from these predictions are assessed against the ABC methodology within Annex E of this Standard and will be based on the prevailing ambient noise levels measured as part of the study.

Table 12.9 The ABC method of determining the threshold noise levels of potential significant effect at dwellings

Assessment Category and Threshold Value Period	Threshold Value, in decibels (dB), $L_{Aeq,T}$		
	Category A[(A)]	Category B [(B)]	Category C [(C)]
Night-time (23:00 – 07:00)	45	50	55
Evenings and weekends	55	60	65
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)[(D)]	65	70	75
[A)] Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.			

Assessment Category and Threshold Value Period	Threshold Value, in decibels (dB), $L_{Aeq,T}$		
	Category A[(A)]	Category B [(B)]	Category C [(C)]
B) Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as Category A values. C) Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than Category A values. D) 19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays.			

A potential significant effect is indicated if the $L_{Aeq,T}$ noise level arising from the Site exceeds the threshold level for the category appropriate to the ambient noise level. If the ambient noise level exceeds Category C threshold values given in Table 12.9, then a potential significant effect is indicated if the total $L_{Aeq,T}$ noise level for the period increases by more than 3 dB due to site noise. This table applies to residential receptors only.

Chapter 4 of the Environmental Statement specifies that all construction work and ancillary operations that are audible at sensitive receptors shall be carried out between the hours of 8 am – 6 pm. Thus, the daytime values will be determined using this method.

Table 12.10 Threshold limits for noise sensitive receptors

Noise Sensitive Receptor	Daytime Ambient Leq (dBA) (07:00 – 19:00)	Rounded to Nearest 5 dBA	BS-5228 Category	Daytime Threshold (dBA)
NSR1 – Lakeside Development (7.5 m AG)	63	65	B	**70**
NSR2 – Residence on Parkside Cl. (4 m AG)	56	55	A	**65**
NSR3 – Residence on Seymour Rd. (1.5 m AG)	66	65	B	**70**
NSR4 – Cayman International School (4.5 m AG)	60	60	A	**65**
NSR5 – Residence on Woodlake Drive (1.5 m AG)	63	65	B	**70**
NSR6 – Proposed New Health City Camana Bay Medical Campus (7.5 m AG)	60	60	A	**65**

In order to rate the magnitude of potential significant effects, the modelled results are then considered against the criteria in Table 12.11, which specifies a magnitude of change based on the threshold values and temporal considerations.

Table 12.11 Construction noise EIA magnitude of change criteria

EIA Magnitude of change	Criteria
Very High	Exceeds BS 5228 threshold values for one month or more by 10 dB or more or any of the trigger levels for more than nine days in a 15-day period by 10 dB or more.
High	Exceeds BS 5228 threshold values for one month or more by less than 10 dB or any of the trigger levels for more than 9 days in a 15-day period by less than 10 dB.
Medium	Exceeds BS 5228 threshold values or trigger levels by less than temporal criteria of significance.
Low	Is within < 10 dB below BS 5228 threshold values or trigger levels.
Very Low	Is more than 10 dB below BS 5228 threshold values or trigger levels.

Once the magnitude of change is determined, the Significance Evaluation Matrix (Table 12.4) will be consulted to determine the significance of the impact.

12.4.4 Assessment Criteria for Construction Road Traffic Noise

GHD generated the BNL at the NSR locations based on traffic counts to evaluate the existing background noise due to road traffic on the Construction Haul Road that runs from the Facility to the Ports as depicted on Figure 12.5.

Figure 12.5 Construction haul road

The Haul Road includes the following roads: Seymour Road, North Sound Road, Thomas Russel Avenue, Elgin Avenue, Goring Avenue and Harbour Drive. The BNL was predicted using noise emission rates in accordance with CRTN calculations using total flows, mean speed and percent HGVs and can be found in Table 12.6 in Section 12.4.2.

The limits on the in Table 12.6 is used in the significance assessment made against the short-term impact criteria from DMRB. Table 12.12 sets out the relevant impact assessment criteria, which is then be compared against Table 12.4 to determine the significance of the impact.

Table 12.12 Construction traffic short-term impact assessment criteria

EIA Magnitude of Change	Noise Change $L_{A10,18hr}$ (dB) Criteria	DMRB Short-Term Magnitude of Impact
Very High	N/A	N/A
High	5+	Major
Medium	3 – 4.9	Moderate
Low	1 – 2.9	Minor
Very Low	0.1 – 0.9	Negligible
No Change	0	No Change

12.4.5 Assessment Criteria for Construction Vibration

It is expected that during the construction phase there may be some items of plant that could give rise to significant levels of vibration due to activities such as piling if they occur close enough to the sensitive receptors. The assessment criteria given in Table 12.13 has been adopted from Table B.1 of BS5228-2:2009+A1:2014 and should be used to assess the EIA magnitude of change.

Table 12.13 Construction vibration short-term impact assessment criteria

EIA Magnitude of Change	Peak Particle Velocity, PPV (mm/s) Criteria
Very High	> 10 mm/s
High	Between 5 mm/s and 10 mm/s
Medium	Between 1 mm/s and 5 mm/s
Low	Between 0.3 mm/s and 1 mm/s
Very Low	< 0.3 mm/s

Per the ToR for this Project, an evaluation of vibration impacts was excluded due to the ISWMS Site operations not having any significant vibratory potential. Additionally, GHD has screened out potential construction vibratory impacts from the worst-case construction equipment including the use of heavy vibratory equipment sources such as impact hammer pile driving. The assessment of vibration effects was made by using the empirical formulas in Table E.1 of BS5228-2:2009+A1:2014 and by referring to the historic data (or manufacturer's data, where available) within the same standard.

GHD evaluated all surrounding sensitive receptors and determined that all sensitive structures/locations are greater than 846 ft (258 m) away from the closest proposed construction activities. GHD determined that the worst-case construction vibration activities such as the use of heavy vibratory equipment sources (impact hammer pile driving) have a maximum zone of influence of 98 ft (30 m). Based on a significant buffer distance of 748 ft (228 m) from the zone of influence GHD has deemed construction vibration insignificant for all receptors noting an EIA magnitude of change of "very low" as the vibration impacts would be <0.3 mm/s PPV below the LOAEL. Based on this evaluation and the significant buffer distance further vibration assessment is not warranted for this EIA process.

12.5 Assessment methodology

Available secondary sources of information were collected and reviewed to characterize the existing noise conditions within the Study Areas. The following sources of secondary information were collected and reviewed:

- Review of historic complaints.
- Review of current zoning plans, definitions and land use designations.
- Aerial photographic mapping and field reconnaissance to confirm off-Site receptors.
- ISWMS design and operation data and associated topography.
- Cruise Berthing Terminal for Cayman Islands – Final EIA ToR[6].
- Grand Cayman Waste Management Facility Draft Environmental Statement[7] .
- Integrated Solid Waste Management System for the Cayman Islands: Environmental Impact Assessment – ToR.
- Directive for Environmental Impact Assessments Section 43, National Conservation Act[8].
- Proposed Cruise Berthing Facility, Grand Cayman. Environmental and Engineering Consultancy Services: Environmental Statement – Draft[9].
- Environmental Impact Assessment Scoping Opinion (Environmental Assessment Board)[10].

The likely significant noise effects that have been taken forward for assessment are summarised in Table 12.14.

Table 12.14 Likely significant noise effects

Activity	Effect	Receptor
Site Construction	Emission of noise causing effects on health and quality of life at sensitive receptors	Residential properties, schools, commercial sites
Site Operations	Emission of noise causing effects on health and quality of life at sensitive receptors	Residential properties, schools, commercial sites

In summary, the following general noise assessment methodology was followed:

- The assessment considered the baseline noise levels at existing sensitive receptors and the potential effect of the noise from activities associated with the ISWMS at each receptor.
- Unattended background noise monitoring was undertaken during the daytime and night-time periods at locations representative of the existing sensitive receptors surrounding the site.
- The potential noise impact during the construction phase was assessed against the BS5228-1 ABC method. The magnitude of any impacts was established, and the significance of the construction noise impact was determined.
- The potential noise levels from the ISWMS was predicted using noise data provided by the Client. These noise emission levels were used in noise modelling software CadnaA 2023 to create a noise model of the ISWMS and the surrounding area.
- The calculated noise levels were compared against measured baseline noise levels and guidance contained within British Standard 4142 + A1:2019: Methods for rating and assessing industrial and commercial sound (BS4142).
- To reduce potential impacts from operational noise from the Development on existing receptors, mitigation measures were recommended as required.

6 Mott MacDonald. *Cruise Berthing Terminal for Cayman Islands Final EIA Terms of Reference*. 2013.
7 Cayman Islands Department of Environment. *Proposed Waste Management Facility – Draft Environmental Statement Consultation*. 2013. Retrieved April 14, 2023, from https://doe.ky/proposed-waste-management-facility-draft-environmental-statement-consultation/
8 Cayman Islands Government. *Cayman Islands Gazette, Extraordinary No. 50/2016.* 2016.
9 Baird. *Proposed Cruise Berthing Facility, Grand Cayman Environmental Statement.* 2015.
10 Cayman Islands Department of Environment. *EAB Scoping Opinion: Port EIA Update*. 2020.

12.5.1 Noise modelling and prediction methodology

Through this assessment, the Project team has quantified the proposed noise levels in the Study Areas by using the appropriate CadnaA Acoustical Modelling Software (CadnaA) 2023 to model the potential impacts of the significant noise sources based on assumptions of typical equipment numbers and locations. CadnaA uses geographical information to generate a model of the Study Area to generate noise contours. The noise model includes all proposed Site buildings and significant sources of noise associated with the operations of the Facility. CadnaA calculates sound level emissions based on the ISO 9613-2 standard "Acoustics – Attenuation of Sound during Propagation Outdoors".

The worst-case cumulative Site-wide sound levels estimated at the receptor(s) included attenuation effects due to geometric divergence, atmospheric attenuation, barriers/berms, ground absorption and directivity, as applicable significant noise sources at off-Site buildings were input into the model as intervening structures.

CadnaA modelling assumptions applied include the following:

- Noise Sources | All sources were modelled using the 1/1 octave band data from manufacturer's sound level data or reference materials.
- Noise Source Elevation | The heights of the noise sources were modelled at the tallest point to represent the worst-case line of sight and emission of noise.
- Ground Absorption | The model included water (G=0), soft/porous ground (G=1), and gravel/hard ground (G=0.25).
- Receptor elevation | NSR heights were modelled appropriately to represent the worst-case elevation based on one or two-storey residences at the worst-case compass directions from the Site.
- Time-weighted Adjustment | Time-weighted adjustments for sources that do not operate continuously were utilized.
- Tonality | A +5 dBA adjustment was applied for tonal sources, if applicable.
- Building Surfaces | The buildings are modelled as reflective surfaces.
- Foliage | Foliage attenuation was not considered in our analysis as a conservative assumption.

Table 12.15 outlines the acoustic modelling parameters used.

Table 12.15 Acoustic modelling parameters

Item	Model Parameters	Model Setting
1	Temperature	20°C
2	Relative humidity	70 percent
3	Wind speed	Downwind condition; wind speed of 3 m/s
4	Max. Search Radius (m)	6561 ft (2000 m)
5	Noise propagation model	CadnaA (DataKustik 2023)
6	Standard	ISO 9613
7	Terrain parameters	Site Specific topography was used
8	Reflection parameters	one orders of reflection

In order to predict the future worst-case noise impacts from the Project activities, representative octave band noise data was used, measured from construction/processing equipment similar to what is noted to be required for the Project. This data was obtained from Annex C of the British Standard BS5228:2009+A1:2014 Code of Practice for noise and vibration control on construction and open sites – Part 1: Noise. The United States Department of Transportation, Federal Highway Administration (FHWA) document FHWA Roadway Construction Noise Model User's Guide, 2006 as well as GHD's own reference spectra were used as supplemental documents to obtain sound level data for equipment not listed by BS5228.

Site-specific topography was acquired from a photogrammetry survey completed by DECCO Consortium (DC) dated July 16, 2021 and various publicly available LIDAR and geospatial databases including USGS, CGIAR, NASA and NGA.

A 3D noise model was created in CadnaA with each significant noise source, vehicle path and operations building included. Noise prediction calculations have been undertaken to predict the noise levels likely to be generated by typical operational activities associated with the proposed ISWMS and the resultant noise levels at existing sensitive receptor locations.

The calculated noise levels have then been compared against measured background sound levels following the guidance in BS4142, and potential impacts evaluated. The magnitude of any impacts has been established, and the significance of the operational noise impact has been determined. In addition to the operational noise from the ISWMS, vehicle movements to and from the ISWMS Development have the potential to generate additional noise at existing sensitive receptors, in the immediate vicinity of the local road network. This potential noise impact has been considered against existing baseline noise levels and existing vehicle movements within the local area.

The worst-case assessment of all road traffic noise was predicted using noise emission rates from road traffic in accordance with CRTN calculations.

Vibration is not considered to be a significant effect during the operational phase of the proposed development and has been scoped out of the assessment. Mitigation measures will be incorporated within the design of the Facility in order to reduce or remove any vibration that would result from operation of the Site.

The prediction calculations have utilized noise measurement information provided by ReGen. The potential sources of noise associated with the proposed ISWMS are detailed in Section 12.6. The calculations have been carried out in accordance with the prediction methodologies set out in BS5228-1 and BS4142. To reduce the potential impact of operational noise from the ISWMS on existing receptors, mitigation measures will be implemented into the design of the ISWMS, as discussed in Section 12.6.1.

12.6 Noise impact assessment and mitigation

This Section reports the likely effects of the proposed development in terms of noise impacts in the context of the Site and surrounding area, and whether these would be deemed to be significant. In particular it considers the likely effects of noise from the proposed development and its impact on nearby receptors.

12.6.1 Design assumptions and mitigation summary

The following section details assumptions in the current design and operations of the ISWMS with the associated noise mitigation that was incorporated into the acoustical evaluation for future reference during detailed design of the Facility.

12.6.1.1 Energy Recovery Facility (ERF)

The ERF will be in the form of a conventional ERF, which will sustainably manage non-hazardous and non-recyclable residual waste. The ERF will operate 24 hours per day, seven days per week, 365[11] days per year. Non-hazardous commercial, construction and industrial waste will be received on-Site at the ERF between the hours of 07:00 to 18:00 Monday to Friday and 07:00-12:00 on a Saturday.

The waste reception area has been designed to allow ease of access and the most efficient delivery of waste to the facility, which will see waste being delivered via a range of vehicles, including bulk articulated vehicles, refuse collection vehicles, compactors and skip tippers.

Fast acting roller shutter doors will allow multiple delivery vehicles to enter the tipping hall simultaneously. On entering the reception hall vehicles will discharge their payload directly into the waste bunker. Front end loaders will be

[11] With the exception of annual scheduled maintenance

employed to manage the incoming waste where it cannot be discharged directly into the waste bunker, for example where waste must be quarantined within the waste reception hall.

The fast-acting automatic doors for the tipping hall and roller shutter doors and are understood to provide 10 dB and 18 dB noise attenuation respectively. GHD has conservatively assumed that 50 percent of the bay doors will be open at any one time and have modelled the breakout emissions from the open doors only.

The design layout and design measures have been considered to minimize the noise impacts associated with the design of the Facility.

Most of the 'noisy' plant items at the ERF will be installed within the main building and equipped with appropriate noise insulation, if necessary. The air-cooled condensers will be designed to reduce noise and tonal components. If steam bursting discs or pressure relief valves release externally to the building, they will be fitted with appropriate silencers. Doors to the building will be kept closed when not in use in order to prevent noise emissions, with doors to the tipping hall and turbine acoustically rated to appropriate levels.

Vehicle movements at night will be limited where possible and vehicles will be fitted with non-tonal reversing alarms. A one-way system will be in place for HGVs and waste delivery vehicles so they will only reverse once inside the tipping hall. Regular maintenance of plant items will be undertaken in accordance with preventative maintenance procedures.

Any mobile plant to be used on-Site will be operated and maintained in accordance with the manufacturer's instructions, whilst complying with the latest standards including those on noise emissions.

There are many aspects associated with noise mitigation which need to be considered, including the following:

– General approach and experience of the Technology Provider.
– Tonal noise.
– Low frequency noise.
– Noise associated with operational emergency steam relief and commissioning steam venting.
– General design measures.

Plant areas which contain higher than ambient noise sources (e.g., the Turbine Hall, Boiler and Flue Gas Treatment rooms) contain a significant number of individual items of process plant. Trying to abate noise from all of them independently is impracticable, and creates problems with temperature control, access for online operational maintenance, routine observation and ventilation requirements which further limits attenuation at source. Therefore, suitable and efficient layouts and design solutions will be employed, including acoustically designed plant rooms, which will limit noise emissions to the acceptable levels needed comply with all relevant regulations.

The following present details on noise mitigation measures proposed for the ERF.

12.6.1.1.1 Principal noise sources with specific noise mitigation measures incorporated into the design

The principal operational noise sources from the ERF that have noise mitigation included in the design are listed in Table 12.16 along with the mitigation measures assumed in the noise modelling for each. As the design specification for internal and external plant has yet to be finalised, the noise assessment presented in the NVIA utilises operational noise impact information from a similar sized ERF that is available to GHD. For the purposes of the assessment, it has been assumed that the majority of the identified sound sources would operate continuously and simultaneously, during both the daytime and night-time periods. However, at night it has been assumed that there would be no reception of waste, hence it has been assumed that there will be no on-Site vehicle movements for the assessment of night-time operational sound.

The noise assessment concluded that, for the closest residential receptors, the operational noise impact from the ERF will result in a negligible impact. Therefore, no mitigation measures are proposed other than those already embedded within the design of the Facility.

Table 12.16 Principal ERF noise sources with specific noise mitigation measures incorporated into the design

ERF component	Noise source	Type	Mitigation
Building shell & penetrations	Building shell & sidewall air intakes/ exhausts	Daytime and night-time operation and general noise, no tonal or impulse noise emanating from the building enclosure. A sound power level of 90 dBA (~80 dBA at 1m) was assumed in the modelling for any sidewall air intake/exhaust louvres.	Enclosed building using with standard industrial cladding (walls and roof) with acoustic louvres to mitigate the risk of noise 'break-out' or ensure the noise output with ventilation fans that are <85 dBA at 3 ft (1 m). The roof and façades of the main buildings will be constructed from insulated composite profiled cladding with a sound reduction index (RW) of 24dB.
Main stack outlet (and ID fan)	ID fan & stack	Day and night-time operation. General broadband noise – no tonal noise is anticipated, however other characteristic sound from the stack has the potential to be readily distinctive against residual sound levels at night. A sound power level of 104 dBA (93 dBA at 3 ft [1 m]) was assumed in the modelling for both point sources representing the ID fan system and the exhaust point from the main stack.	ID fan to be located outside the ERF building next to the base of the main stack. It is anticipated that the stack will be fitted with a dedicated silencer. The stack will be designed to ensure that the flue gas flow rate is approximately 49 ft/s (15 m/s) but always less than 98 ft/s (30 m/s) (beyond which, in some circumstances, there can be a 'whistle' from the top of the stack). The sound power rating of 104 dBA is expected to be achieved with standard fan systems however if this is not able to be achieved either an acoustical enclosure is required around the main fan with a in line silencer prior to the main stack is required or the selection of low noise equipment meeting this rating.
Turbine hall	Turbine hall including generator within the hall	Day and night-time operation, potential tonal and general noise. Low frequency sound has been considered within the noise assessment and it was concluded that there will be no significant low frequency sound transmission through the building structure and that the proposed mitigation measures will provide the required level of attenuation for low frequency noise transmission. The following sound power levels were assumed in the modelling: – Generator Enclosure Air Inlet with Silencer (102 dBA) – Generator Enclosure Exhaust with Silencer (102 dBA) – Turbine Combustion Air Inlet Stack with Silencer (102 dBA) – Heat Recovery Steam Generator Stack with Silencer (86 dBA) – Turbine Enclosure Exhaust with Silencer (103 dBA)	Constructing turbine hall with materials which have sound reducing properties, such as concrete, or utilising acoustic cladding (walls and roof) to mitigate the risk of noise 'break-out'. Further noise mitigation measures for the turbine hall may include acoustic doors (providing noise attenuation) kept shut except during maintenance or emergency occurrences, the use of a turbine table with mounts to reduce vibration and the location of the turbine hall providing further noise screening. It is expected that each intake and exhaust stack associated with both the HRGS, Turbine and Generator systems are equipped with silencers to achieve the maximum noise ratings detailed above.

ERF component	Noise source	Type	Mitigation
Waste reception area/ tipping hall	Tipping Hall with mobile plant and HGVs operating inside	Potential intermittent impulse noise offloading during daytime only, reversing alarms. A sound power level of 90 dBA (~80 dBA at 1m) was assumed in the modelling for the waste reception area for the tipping hall open bay doors.	Enclosed building using industrial cladding (walls and roof) with acoustic louvres to mitigate the risk of noise 'break-out'. The roof and façades of the main buildings would be constructed from insulated composite profiled cladding with a sound reduction index (RW) of 24dB assumed within the noise assessment. The fast-acting automatic doors for the tipping hall and roller shutter doors and are understood to provide 10 dB and 18 dB noise attenuation respectively. GHD has conservatively assumed that 50 percent of the bay doors will be open at any one time and have modelled the breakout emissions from the open doors only.

12.6.1.1.1.1 Noise associated with operational ERF emergency steam relief and commissioning steam purging

Steam purging (or "steam blowing") is a critical hot commissioning activity that occurs once in the lifetime of the plant following first energization of the plant and following chemical passivation of the boiler internals. Its purpose is to "shock" and remove all internal piping corrosion and scale deposits between the boiler and the steam turbine inlet. The steam purge is a cyclical process of pressuring the boiler at high temperature and pressure. The steam is released in an uncontrolled manner to "blow" through the piping and systems over many cycles. This process, after chemical passivation of the boiler internals, can take up to two weeks to complete and is concluded when an adequate steam quality free of particulate/scale is achieved. The residues within the boiler during construction would causes damage to the steam turbine internal blades if not removed prior to the steam being passed to the turbine for the first time during commissioning. This process is achieved using a temporary commissioning dedicated sacrificial pipework system and silencer that is specifically installed for this process. For the avoidance of doubt, it is not possible to undertake steam purging during normal operation of the plant.

The boiler will be designed strictly in accordance with the Pressure Systems Safety Regulations which require any pressurised system to be fitted with emergency pressure relief valves to prevent over pressurisation and an uncontrolled rupture of the boiler. Pressure relief systems and valves are utilised for emergencies only and are not used for normal operation and control of the boiler meaning their use is to prevent an uncontrolled event. During any normal operation of the plant the pressure relief valves will not need to operate. In an exceptional circumstance (i.e., equipment failure elsewhere within the plant) the control system may not be able to prevent an over pressurisation of the steam system and the last line of defence is the pressure release valves within the boiler which will lift and vent the system pressure. The pressure relief cycle, if initiated, will last for approximately four to six minutes when normal operating pressure limits within the boiler are returned to 'normal' levels and safe shut-down or ongoing operations can be maintained. The pressure relief system will be fitted with silencer(s) specifically designed to reduce noise from this abnormal event to approximately 50 dB at the boundary of the ERF plant. It is understood from previous experience that it is simply not feasible to reduce noise levels below this level given the nature and requirement for this system to be safely effective.

The pressure relief valves will be safety tested on a periodic basis. The frequency of testing will be determined by the Pressure Equipment Directive written scheme of examination, defined within the UK pressure systems regulations. The frequency of testing will be determined by the written scheme of examination. The frequency of testing is usually between 12-24 months.

Steam purging is a planned event that will occur only during commissioning. Testing of the safety relief valves again is a planned operational activity with a frequency driven by legislation. All of these events will be planned to occur during day-time hours.

If there is an exceptional circumstance operationally where the plant control systems and operators cannot rectify an exceptional event, then an unplanned pressure relief event would occur for two to four minutes thereby avoiding a significant incident and risk to personnel safety.

Taking this into consideration and in conclusion, following commencement of operation of the ERF, steam purging will not occur during operation of the ERF. If there is an over pressurisation and uncontrolled event within the pressurised boiler, the pressure relief valve system will function to release the pressure to safe levels within the boiler. If the cause of the over pressurisation has been understood, resolved and stable conditions resumed within the boiler then normal operation will resume. However, if the cause of the over-pressurisation is not resolved, the boiler will shut down safely to enable the issue to be investigated and resolved prior to restarting the plant.

12.6.1.2 Non-Energy Recovery Facilities

The principal operational noise sources from the non-Energy Recovery Facilities that have noise mitigation included in the design are listed in Table 12.17 along with the mitigation measures assumed in the noise modelling for each.

Table 12.17 Principal ERF noise sources with specific noise mitigation measures incorporated into the design

Non-ERF facility	Noise source	Type	Mitigation
Bottom Ash Handling building (BAH)	Bottom ash storage bay doors, sidewall louvres and rubble master	Noise from conveyors generating low-level broad-spectrum noise levels which will not be tonal or impulsive (broadband only). A sound power level of 107.5 dBA was assumed in the modelling for the open bay doors and a sound power level of 112.4 dBA was used for the Rubble Master (mobile Crusher) located outside the building. A sound power level of 90 dBA (approximately 80 dBA at 3 ft (1 m)) was assumed in the modelling for any sidewall air intake/exhaust louvres.	Enclosed building using standard cladding (walls and roof) with acoustic louvres to mitigate the risk of noise 'break-out'. The roof and façades of the main buildings would be constructed from insulated composite profiled cladding with a sound reduction index (RW) of 24 dB assumed within the noise assessment. The sound power levels modelled for the Rubble Master are expected to be the maximum not to exceed values for this equipment/operation. Should this not be practical then lower noise equipment or on-site berms/barriers would be required to block noise emissions to the sensitive receptors to the west of the BAH facility.
Fire Pump Building (FPB)	FPB ventilation systems	Noise from fire pump systems generating low-level broad-spectrum noise levels which will not be tonal or impulsive (broadband only). A sound power level of 97 dB was assumed in the modelling for the fire pump exhaust with a silencer and a sound power level of 92 dBA was used for the fire pump systems sidewall air intake with an acoustical louvre located on the side of the building.	Enclosed building using standard cladding (walls and roof) with acoustic louvres to mitigate the risk of noise 'break-out'. The roof and façades of the main buildings would be constructed from insulated composite profiled cladding with a sound reduction index (RW) of 24dB assumed within the noise assessment. It is expected that each intake and exhaust stack associated with fire pump systems are equipped with silencers/acoustic louvres to achieve the maximum noise ratings detailed above.
Green Waste Facility (GWF)	Mobark 950 tub grinder, Komptech shredder, Screener & front-end loader	Noise from grinding, screening and shredding systems generating low-level broad-spectrum noise levels which will not be tonal or impulsive (broadband only). A sound power level of 112 dBA was assumed in the modelling for the Screener and Shredder and 114 dBA for the Grinder based on each unit operating 30 minutes per hour during the day.	As these significant noise sources have line of sight and exposure to NSR3 and NSR5 GHD recommends re-orientating the GWF operations pad to use the proposed storage area concrete push walls (16 ft (4.9 m) above grade) to block line of sight and noise emissions[12].

[12] Yellow lines in **Appendix 12.A (Noise and Vibration Assessment – Figure 5)** represent the new location for the existing green push walls.

Non-ERF facility	Noise source	Type	Mitigation
Materials Recycling Facility Building (MRF)	MRF Building, Bay Doors and Glass roll off bin	Noise from inside the MRF building will be generating low-level broad-spectrum noise levels which will be tonal or impulsive (broadband only). A sound power level of 107.5 dB was assumed in the modelling for the open bay doors and a sound power level of 117 dBA (including penalty adjustments) was used for the raw glass falling into Roll off Bin located outside the building which was assumed to operate 30 minutes out of each hour during the daytime only.	Enclosed building using standard cladding (walls and roof) with acoustic louvres to mitigate the risk of noise 'break-out'. The roof and façades of the main buildings would be constructed from insulated composite profiled cladding with a sound reduction index (RW) of 24dB assumed within the noise assessment. The sound power levels modelled for the air intakes on the side of the building and glass roll off bin are expected to be the maximum not to exceed values for this equipment/operation. Should this not be practical then lower noise equipment would be required to block noise emissions to the sensitive receptors to the west and south of the MRF. Additionally, a noise barrier is required to protect noise emissions toward the south by erecting a 16 ft (4.9 m) tall, 19 ft (6 m) long noise barrier to provide reduced line of sight and noise towards NSR3 to the southeast[13].

12.6.2 Noise source summary

ReGen and CIG are proposing to construct and operate an ISWMS which will incorporate various on-Site buildings, operations and energy from Waste systems in addition to the landfilling activities which each have the potential to cause an adverse noise impact at receptors.

This NVIA focuses on the sound emissions from the significant noise sources identified at the ISWMS with the potential to adversely impact the sensitive receptors. The significant noise sources are identified in **Appendix 12.A (Noise and Vibration Assessment – Noise Source Summary Table C.1, Appendix C)**. The noise source locations are shown in **Appendix 12.A (Noise and Vibration Assessment – Figures A.1A – A.1G, Appendix A)**.

12.6.2.1 Sitewide Outdoor Truck and Heavy Equipment Volumes

On-Site outdoor truck and heavy equipment activities for operations as well as shipping/receiving loading is summarized in Table 12.18 below:

Table 12.18 Sitewide outdoor truck and heavy equipment volumes

Type of Vehicle/Description	ISWMS Building/ Area	Noise Source ID	Day (07:00 – 19:00) Vehicles / hour	Evening (19:00 – 23:00) Vehicles / hour	Night (23:00 – 07:00) Vehicles / hour
ERF- Inbound/Outbound Truck Route	ERF	ERF_TR1	5	0	0
Green Waste Facility Front End Load Route 1	GWF	GWF_Loader1	20	0	0
Green Waste Facility Front End Load Route 2	GWF	GWF_Loader2	20	0	0

13 Noise barrier location depicted by yellow line in **Appendix 12.A (Noise and Vibration Assessment – Figure 6)**

Type of Vehicle/Description	ISWMS Building/ Area	Noise Source ID	Day (07:00 – 19:00) Vehicles / hour	Evening (19:00 – 23:00) Vehicles / hour	Night (23:00 – 07:00) Vehicles / hour
Green Waste Facility - Inbound/Outbound Truck Route	GWF	GWF_TR1	1	0	0
MRF - Forklift Moving Bails Route1	MRF	MRF_Forklift1	10	0	0
ELV - Inbound/Outbound Truck Route	ELV	ELV_TR1	2	0	0
Maintenance Bldg. - Inbound/Outbound Truck Route	Maintenance	Main_TR1	1	0	0
C&D and BAF - Inbound/Outbound Truck Route	CD	CD_BAF_TR1	6	0	0
Medical Waste Bldg. - Inbound/Outbound Truck Route	MW	MW_TR1	1	0	0
Phase 2 Final Landfill Cell - Inbound/Outbound Truck Route	Phase 2 Landfill Cell	S_TR1	13	0	0
Household Waste Recycling Centre – Container Movements	Household Waste Recycling Centre	HW_TR1	4	0	0

Note: Noise Source Vehicle routes are identified in **Appendix 12.A (Noise and Vibration Assessment – Figure A.1D, Appendix A)**.

Vehicle deliveries and collections will also contribute to the noise climate. However, vehicle movements to and from the Site are not considered to significantly impact on road traffic noise levels.

The significant equipment sources are all either trucking related activities, building penetrations, rooftop equipment or outdoor equipment located beside the buildings. Noise predictions are based on noise data provided by the Client as detailed in Section of this report for the various processes anticipated within the ISWMS buildings.

GHD determined that with standard industrial building construction that the building cladding would be an insignificant source of noise and were therefore not modelled in detail as they would provide a minimum sound insulation of 24 dB Rw resulting in minimal off-Site impacts.

The proposed buildings at the Site will be made of standard industrial construction materials. The other noise sources at the Facility have not been included since they are considered insignificant contributors to the overall Facility noise level at the sensitive receptors which are expected to contribute less than 25 dBA at the worst-case receptor.

Some of the proposed ISWMS buildings do have significant interior noise sources resulting in breakout noise from passive sidewall air intake louvres, exhaust points and open bay doors which were modelled in detail.

Noise radiating through the passive louvres or bay doors were modelled as point sources or vertical area source. GHD expects that the Facility will provide GHD with updated equipment selections and specifications following final selection of any proposed equipment to confirm that the noise levels meet the maximum not to exceed noise criteria as specified in this NVIA by proper selection or equivalent noise mitigation measures.

A detailed summary of sound power levels in full octave band centre frequencies for the equipment is presented in **Appendix 12.A (Noise and Vibration Assessment – Table C.1, Appendix C)**.

Noise level checks may be carried out regularly in operational areas where high noise levels may be present, with early warning of increasing noise levels resulting in a noise reduction or mitigation program.

Each potential source of significant operational noise is identified below for each building/operational area:

12.6.2.2 Energy Recovery Facility (ERF)

The ERF area of the main building includes the following significant outdoor noise sources:

- 1 x Turbine Hall Generator Air Inlet Stack (103 dBA)
- 1 x Turbine Hall Generator Air Exhaust Stack (103 dBA)
- 1 x Turbine Hall Combustion Air Inlet Stack (103 dBA)
- 1 x Turbine Hall Heat Recovery Steam Generator Stack (86 dBA)
- 1 x Turbine Hall Turbine Enclosure Exhaust Stack (103 dBA)
- 1 x Turbine Hall After Cooler (96 dBA)
- 1 x Turbine Hall Oil Cooler (96 dBA)
- 1 x Air Cooled Condenser Unit (97 dBA)
- 14 x Air Sidewall Intake/Exhaust Louvres (96 dBA)
- 2 x Tipping Hall Bay Doors – Open (90 dBA)
- 1 x Silo Loading - Blower Truck (106 dBA)
- 2 x Compressor Intake Louvre (97 dBA)
- 2 x Compressor Exhaust Louvre (97 dBA)
- 2 x Rooftop General Exhaust Fans (85 dBA)
- 1 x Main Stack ID Fan (104 dBA)
- 1 x Main Stack Exhaust (104 dBA)

12.6.2.3 Site Weighbridges

The weighbridge area includes the following significant outdoor noise sources:

- 2 x Idling Trucks (96 dBA) – Day only

12.6.2.4 Green Waste Processing Facility

The Green Waste Processing Facility includes the following significant outdoor noise sources:

- 1 x Komptech Shredder (112 dBA) – Day only (30 mins/hr)
- 1 x Mobark 950 Tub Grinder (114 dBA) – Day only (30 mins/hr)
- 1 x Screener (112 dBA) – Day Only (30 mins/hr)
- 1 x Front End Loader Route 1 on Shredder Pad (20 trips/hr) – Day only
- 1 x Front End Loader Route 2 in Composting area (20 trips/hr) – Day only

12.6.2.5 Construction and Demolition Waste Processing Facility

The Construction and Demolition Waste Processing Facility includes the following significant outdoor noise sources:

- 2 x Rooftop General Exhaust Fans (85 dBA)
- 2 x Bay Doors – Open (108 dBA) – Day only
- 4 x Sidewall Exhausts (85 dBA)
- 1 x Front End Loader Operating in Material Handling Area (104 dBA)
- C&D and BAF – Rubble Master (Mobile Crusher) (112 dBA) – Day only (30 mins/hr)

12.6.2.6 Bottom Ash Processing Facility

The Bottom Ash Processing Facility includes the following significant outdoor noise sources:

– 2 x Rooftop General Exhaust Fans (85 dBA)
– 2 x Bay Doors – Open (108 dBA) – Day only
– 4 x Sidewall Air Intake Louvre (96 dBA)
– 1 x Front End Loader Operating in Material Handling Area (104 dBA)

12.6.2.7 Abandoned and End-of-Life / Scrap Metal Processing Facility

The Abandoned and End-of-Life / Scrap Metal Processing Facility includes the following significant outdoor noise sources:

– 2 x Rooftop General Exhaust Fans (85 dBA)
– 2 x Bay Doors – Open (98 dBA) – Day only
– 1 x Torch Cutting Area (100 dBA) – Day only
– 1 x Hydraulic Shear/Baler (107 dBA) – Day only
– 1 x Excavator w/ Grapple Moving Vehicles (100 dBA) – Day only
– 1 x Idling Truck (96 dBA) – Day only
– 1 x Front End Loader Operating in Material Handling Area (104 dBA)

12.6.2.8 Medical Waste Facility

The Medical Waste Facility includes the following significant outdoor noise sources:

– 2 x Rooftop HVAC (86 dBA)

12.6.2.9 Materials Recycling Facility

The Materials Recycling Facility includes the following significant outdoor noise sources:

– 2 x Rooftop HVAC (86 dBA)
– 2 x Bay Doors – Open (98 dBA) – Day only

12.6.2.10 Household Waste Recycling Centre

The Household Waste Recycling Centre includes the following significant outdoor noise sources:

– 2 x Rooftop HVAC (86 dBA)

12.6.2.11 Landfill Gas Facility

The Landfill Gas Facility includes the following significant outdoor noise sources:

– 1 x Landfill Gas Flare System (95 dBA)

12.6.2.12 Admin Building

The Admin Building includes the following significant outdoor noise sources:

– 2 x Rooftop HVAC (86 dBA)

12.6.2.13 Maintenance Building

The Maintenance Building includes the following significant outdoor noise sources:

- 2 x Rooftop HVAC (86 dBA)
- 2 x Bay Doors – Open – Impact Guns, Air Compressors (112 dBA) – Day only

12.6.2.14 Future Phase 2 Residual Waste Landfill Operations

The Phase 2 Residual Waste Landfill Operations includes the following significant outdoor noise sources:

- 1 x Bulldozer (106 dBA) – Day only
- 1 x Landfill Compactor (103 dBA) – Day only
- 1 x Landfill Excavator Unloading Trucks (110 dBA) – Day only

12.6.2.15 Construction Noise Source Summary

Equipment and activities associated with Phases 1 to 3 for the construction of the ISWMS (Project) have the potential to produce noise emissions in the vicinity of the Project above the documented baseline limits. Changes to ambient noise levels and vibrations have the potential to impact existing sensitive receptors. The construction phase of any project is typically considered temporary or short-term relative to the entire life cycle of a project and mostly limited to daytime construction hours. It is anticipated that any construction or operational noise will be at or below the BS threshold limits at the worst-case receptor locations. Should levels above the threshold limits occur, noise mitigating controls will be considered.

The following Section details an updated analysis, parameters or assumptions used in the noise evaluation of the construction noise analysis.

Noise Source Operating Parameters/Assumptions

In order to predict the future worst-case noise impacts from the Project activities, representative octave band noise data was used or measured from construction/processing equipment similar to what is noted to be required for the Project. This data was obtained from the tables in the annexes of BS 5228-1:2009+A1:2014. GHD's noise source library was used as a supplemental document to obtain sound level data for equipment not listed in the BS5228-1 Standard.

Annex F of BS5228-1 specifies in its calculation method that the sound power levels of equipment should be adjusted based on the expected percentage of time that the equipment will actually be operational and emitting significant noise. This was accomplished using the "Acoustical Usage Factors" obtained from the United States Department of Transportation, Federal Highway Administration (FHWA) document FHWA Roadway Construction Noise Model User's Guide, 2006. If an acoustical usage factor was not available, the default value of 50 percent is used.

The equipment to be used during each phase of construction is listed in the table below, along with their sound power levels and acoustical usage factors.

Table 12.19 Estimated sound power level and equipment list for each phase of construction

Equipment	Sound Power Level (dBA)	Acoustical Usage Factor	Phase 1 – Earthworks	Phase 2 – Piling / Concrete	Phase 3 – MEP / Paving
Angle Grinder	112	50 percent			4
Backhoe	98	40 percent	1		1
Bulldozer	106	40 percent	1		1
Concrete Saw	124	20 percent		5	2
Compactor	112	20 percent	1		

Equipment	Sound Power Level (dBA)	Acoustical Usage Factor	Phase 1 – Earthworks	Phase 2 – Piling / Concrete	Phase 3 – MEP / Paving
Concrete Mixer (Small)	93	50 percent		3	3
Concrete Mixer Truck	111	40 percent		8	
Concrete Pump (Truck)	111	20 percent		4	
Core Drill	116	50 percent		5	1
Crane (150 Ton)	109	16 percent	1	1	1
Crane (60 Ton)	108	16 percent	1	1	1
Crane (30 Ton)	101	16 percent	1	1	1
Dump Truck	116	40 percent	3	3	3
Drill Rig	105	20 percent	5	5	
Excavator	108	40 percent	1	1	1
Excavator (Mini)	99	40 percent		4	2
Skid Steer	110	40 percent	2		
Fuel Tanker Lorry	107	50 percent			2
Gas Cutter	96	40 percent		5	
Generator	105	50 percent	1	2	5
Grader	117	40 percent	1		
Loader	110	40 percent			4
Hammer Rig (Piling)	120	20 percent		4	
Paver	115	50 percent			2
Pneumatic Tool	117	50 percent			5
Poker Vibrator	110	50 percent		5	
Road Planer	113	50 percent			3
Road Planer (Mini)	98	50 percent			2
Roller	105	20 percent	1		2
Scissor Lift	98	50 percent			1
Telescopic Handler	110	50 percent			1
Water Pump	96	50 percent		1	1
Welder	105	40 percent		5	5
Wheel Wash Station	103	50 percent	1	1	1

There are no other significant noise generating activities or equipment.

12.6.3 Assessment of effects

12.6.3.1 Impact of the operations associated with the ISWMS

Noise modelling has been undertaken to predict the noise emissions from the ISWMS at receptors. The predicted noise levels of each process within the ISWMS buildings, operations and vehicle movements have been calculated to provide the total cumulative noise level at each receptor, during typical daytime and night-time periods.

The noise modelling considers that most on-Site buildings and operations operate during the daytime only, landfill operates during the daytime and evening, and the ERF process equipment and main stack operates continuously.

The results of the modelling for the operation of the Site-wide ISWMS at each receptor are shown in Table 12.20:

Table 12.20 Predicted noise levels generated by the operations of the ISWMS at sensitive receptor locations

NSR	Day (07:00 – 18:00) (dBA 1 hr L_{Aeq})	Evening (18:00 – 23:00) (dBA 1 hr L_{Aeq})	Night (23:00 – 07:00) (dBA 1 hr L_{Aeq})
NSR1 – Lakeside Development (7.5 m AG)	56	40	40
NSR2 – Residence on Parkside Cl. (4 m AG)	39	31	31
NSR3 – Residence on Seymour Rd. (1.5 m AG)	52	45	45
NSR4 – Cayman International School (4.5 m AG)	39	29	29
NSR5 – Residence on Woodlake Drive (1.5 m AG)	56	47	47
NSR6 - Proposed New Health City Camana Bay Medical Campus (7.5 m AG)	42	35	35

Estimated Noise Contours for day and night-time operations are shown in Figure 12.6 and Figure 12.7 below.

Figure 12.6 Noise contour plot – operations, daytime

Figure 12.7 *Noise contour plot – operations, night*

12.6.3.2 Off-site vehicle movements due to operations of the ISWMS

There will be additional traffic movements as a result of the proposed ISWMS. Following a review of the information from the National Roads Authority of the Grand Cayman and traffic count data from APEC, the increase in traffic is understood to be approximately two percent on the sections of the Esterly Tibbetts Highway to the west. The increase in HGVs is understood to be around three percent on the section of the North Sound Road to the southwest of the ISWMS and up to 16 percent on the sections of the Seymour Road to the southeast of the ISWMS.

The Design Manual for Roads and Bridges (DMRB) Volume 11 Section 3 Part 7 HD 213/11 defines the threshold for determining whether a traffic noise assessment is required. If during the daytime and night-time period there is a permanent change in magnitude of 3 dBA in the long term (typically 15 years after project opening), then a detailed assessment is required. HD213/11 Chapter 3 Table 3.2 defines a change in noise of 3 dBA or less has a negligible impact in the long term. HD213/11 Annex 1 – Assessment Approach paragraph A1.8(ii) states that "a change in noise level of 3 dBA is equivalent to a 100 percent increase… in traffic flow".

Table 12.21 Operational route traffic noise change due to operations traffic

Noise Sensitive Receptor	Existing 18 hr Operational Route Traffic Noise (dBA)	Operational 18 hr Haul Route Traffic Noise (dBA)	Change Due to Operation (dBA)	Long-Term Magnitude of Impact
Seymour Rd	65.4	67.9	2.5	Negligible
N Sound Rd. (West)	71.3	72.8	1.5	Negligible
N Sound Rd. (East)	70.6	72.4	1.8	Negligible
Thomas Russel Ave.	75.8	76.1	0.3	Negligible
Elgin Ave.	71.4	72.2	0.8	Negligible
Goring Ave.	71.4	72.2	0.8	Negligible
Harbour Dr.	74.0	74.4	0.4	Negligible
Esterly Tibbets Highway	76.7	77.0	0.3	Negligible

A two to three percent increase in traffic flow to the primary and secondary arterials around the Site and 16 percent increase in traffic flow to the collector roads would cause a change of noise level approximately in the order of 3 dBA or less on the road network leading away from the site entrance. The impact of increased traffic can be considered to be negligible and has not been assessed further in the long-term.

12.6.3.3 Noise Impact Assessment – BS4142 Assessment

In accordance with BS4142, an industrial noise assessment has been carried out to assess the impact of sound from the proposed ISWMS on existing sensitive receptors.

12.6.3.3.1 Rating level

Acoustic Feature Correction

BS4142 includes guidance on the application of an additional weighting which should be applied to the specific sound level should the industrial noise be tonal, impulsive, or intermittent, as experienced at proposed receptors.

All proposed plants operations would run continuously during their periods of operations and therefore no penalty for impulsivity or intermittency has been applied. It is assumed all proposed plants within the ISWMS would be designed with mitigation, such that sound breakout would not be tonal at the existing sensitive receptors. Therefore, no correction has been applied to the specific sound level.

All HGV movements at the facility would be similar to road traffic on the Esterly Tibbetts Highway, which is the dominant noise source heard at all receptors. Therefore, no penalty has been applied to the specific sound level.

Selection of the Background Sound

Section 8 of BS4142 provides guidance on the selection of the background sound to be used in the assessment. BS4142 states that the background sound levels should be representative of the period being assessed (i.e., daytime or night-time periods), and that there is no "single" background sound level.

For the purpose of the assessment the range of background sound levels during the day and night-time periods, measured at monitoring locations 1-4, have been used. The data collected and presented within Section 12.3.2 details the representative $L_{A90,11hour}$ daytime, $L_{A90,5hour}$ evening and $L_{A90,8hour}$ night-time, background sound levels at existing sensitive receptors.

12.6.3.3.2 Comparison of the Background Sound and Rating Levels

Daytime Assessment

In accordance with BS4142, the rating level of industrial noise at the existing receptors has been compared with the representative background sound levels. HGV deliveries and most operations associated with the ISWMS will cease at approximately 18:00, therefore, a separate assessment has been undertaken for daytime (07:00 - 18:00) evening (18:00-23:00), and night-time (23:00-07:00). The results for each receptor location are shown in Table 12.22, Table 12.23 and Table 12.24 for the daytime, evening and night-time period respectively.

Table 12.22 Comparison of rating level and background sound levels for daytime operations (07:00 and 18:00)

NSR	NSR1 – Lakeside Development	NSR2 – Residence on Parkside Cl	NSR3 – Residence on Seymour Rd.	NSR4 – Cayman International School	NSR5 – Residence on Woodlake Drive	NSR6 – Proposed New Health City Camana Bay Medical Campus
Modelled ISWMS Daytime Noise Level, 1-hour L_{Aeq} (dBA)	56	40	52	39	56	42
Acoustic Feature Correction	0	0	0	0	0	0
Calculated Rating Level (dBA)	56	40	52	39	56	42
Measured Background Sound Level at Each Receptor Location $LA90_{11\ hour}$ (dBA)	51-59	43-46	53-57	43-52	51-59	43-52
Lowest Excess of rating over Background level	-3	-6	-5	-13	-3	-10
Highest Excess of rating over Background level	5	-3	-1	-4	5	-1

Table 12.23 Comparison of rating level and background sound levels for evening operations (18:00 and 23:00)

NSR	NSR1 – Lakeside Development	NSR2 – Residence on Parkside Cl	NSR3 – Residence on Seymour Rd.	NSR4 – Cayman International School	NSR5 – Residence on Woodlake Drive	NSR6 - Proposed New Health City Camana Bay Medical Campus
Modelled ISWMS Evening Noise Level, L_{Aeq} (dBA)	43	33	46	32	50	35
Acoustic Feature Correction	0	0	0	0	0	0
Calculated Rating Level (dBA)	43	33	46	32	50	35
Measured Background Sound Level at Each Receptor Location $LA90_{5\ hour}$ (dBA)	49-54	40-43	52-54	42-45	49-54	42-45
Lowest Excess of rating over Background level	-11	-10	-8	-13	-4	-10
Highest Excess of rating over Background level	-6	-7	-6	-10	1	-7

Table 12.24 Comparison of rating level and background sound levels for night-time operations (23:00 and 07:00)

NSR	NSR1 – Lakeside Development	NSR2 – Residence on Parkside Cl	NSR3 – Residence on Seymour Rd.	NSR4 – Cayman International School	NSR5 – Residence on Woodlake Drive	NSR6 - Proposed New Health City Camana Bay Medical Campus
Modelled ISWMS Night-Time Noise Level, L_{Aeq} (dBA)	43	33	46	32	50	35
Acoustic Feature Correction	0	0	0	0	0	0
Calculated Rating Level (dBA)	43	33	46	32	50	35

NSR	NSR1 – Lakeside Development	NSR2 – Residence on Parkside Cl	NSR3 – Residence on Seymour Rd.	NSR4 – Cayman International School	NSR5 – Residence on Woodlake Drive	NSR6 - Proposed New Health City Camana Bay Medical Campus
Measured Background Sound Level at Each Receptor Location $L_{A90\ 8\ hour}$ (dBA)	45 - 47	36-40	49-53	38-41	45 - 47	38-41
Lowest Excess of rating over Background level	-4	-7	-7	-9	3	-6
Highest Excess of rating over Background level	-2	-3	-3	-6	5	-3

The results in Table 12.22, Table 12.23 and Table 12.24 indicate that during the daytime, evening and night-time hours, the predicted rating level likely to be generated by the operations of the proposed ISWMS Development will be below the highest existing background noise level at all existing sensitive receptor locations during all periods with the exception of NSR 5 (Woodlake Dr.). NSR5 may experience +3 dBA impacts over the highest background during the night.

Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context. However, during the quieter periods of the daytime, evening and night-time, the predicted rating level likely to be generated by the operations of the proposed development will be above the lowest background noise level at NSR1 and NSR5 during the day by +5 dBA. Additionally, NSR5 may have noise impacts above the lowest background noise level of + 1 dBA during the evening and by +5 dBA during night-time. In accordance with BS4142, a difference of around >5 dB is an indication of an adverse impact, and +10 dB is likely to be an indication of a significant adverse impact, depending on context.

In accordance with BS4142 an assessment of the context in which the industrial sound resides must be undertaken to determine the potential noise impact.

12.6.3.3.3 BS4142 Context Assessment

BS4142:2014 states "*The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound sources exceeds the background sound level and the context in which the sound occurs*".

The first requirement of this statement has been determined within the noise impact assessment section above. To determine the context in which the industrial sound will reside, three factors must be considered, these are:

- The absolute level of sound.
- The character and level of the residual sound compared to the character and level of the specific sound.
- The sensitivity of the receptor.

Absolute Level of Sound

To determine the first context test in BS4142 it is necessary to determine whether the residual and background sound levels are high or low. Section 11 of BS4142 states:

> *"Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night.*

Where residual sound levels are very high, the residual sound might itself result in adverse impacts or significant adverse impacts, and the margin by which the rating level exceeds the background might simply be an indication of the extent to which the specific sound source is likely to make those impacts worse."

As shown in Table 12.22, Table 12.23 and Table 12.24 (Comparison of Rating Level and Background Sound Levels), the background sound levels and rating levels at each receptor are relatively high. Therefore, in accordance with BS4142, the absolute level is as, or more, relevant when establishing a potential impact.

In order to assess the proposed ISWMS in the context of its environment and that of each of the existing sensitive receptors, the predicted specific sound level from the ISWMS have been added to the measured average ambient noise levels to give the absolute level of noise at receptors with the ISWMS operating.

This future absolute noise level has been compared against the existing ambient noise level, and the predicted change in noise has been stated. The results for the NSR's for daytime, evening and night-time periods are detailed within Table 12.25, Table 12.26 and Table 12.27 respectively.

Table 12.25 Context assessment at existing sensitive receptors for daytime operations of the ISWMS (07:00 and 18:00)

NSR	NSR1 – Lakeside Development (dB $L_{Aeq\ 11hr}$)	NSR2 – Residence on Parkside Cl. (dB $L_{Aeq11hr}$)	NSR3 – Residence on Seymour Rd. (dB $L_{Aeq11hr}$)	NSR4 – Cayman International School (dB $L_{Aeq11hr}$)	NSR5 – Residence on Woodlake Drive (dB $L_{Aeq11hr}$)	NSR6 - Proposed New Health City Camana Bay Medical Campus
Average Measured Ambient Noise Level i.e. Existing sound level without the proposed ISWMS operations	63	56	66	61	63	61
Predicted Specific Noise i.e. Operational noise level of the ISWMS only	56	40	52	39	56	42
Total absolute level of sound i.e. Existing sound level plus ISWMS sound level	64	56	66	61	64	61
Difference between existing ambient sound levels and predicted future sound levels	1	0	0	0	1	0

Table 12.26 Context assessment at existing sensitive receptors for evening operations of the ISWMS (18:00 and 23:00)

NSR	NSR1 – Lakeside Development (dB L_{Aeq5hr})	NSR2 – Residence on Parkside Cl. (dB L_{Aeq5hr})	NSR3 – Residence on Seymour Rd. (dB L_{Aeq5hr})	NSR4 – Cayman International School (dB L_{Aeq5hr})	NSR5 – Residence on Woodlake Drive (dB L_{Aeq5hr})	NSR6 - Proposed New Health City Camana Bay Medical Campus
Average Measured Ambient Noise Level (i.e., Existing sound level without the proposed ISWMS operations)	58	48	57	54	58	54
Predicted Specific Noise (i.e., Operational noise level of the ISWMS only)	41	31	45	30	48	35

NSR	NSR1 – Lakeside Development (dB L_{Aeq5hr})	NSR2 – Residence on Parkside Cl. (dB L_{Aeq5hr})	NSR3 – Residence on Seymour Rd. (dB L_{Aeq5hr})	NSR4 – Cayman International School (dB L_{Aeq5hr})	NSR5 – Residence on Woodlake Drive (dB L_{Aeq5hr})	NSR6 - Proposed New Health City Camana Bay Medical Campus
Total absolute level of sound (i.e., Existing sound level plus ISWMS sound level)	58	48	57	54	58	54
Difference between existing ambient sound levels and predicted future sound levels	0	0	0	0	0	0

Table 12.27 Context assessment at existing sensitive receptors for night-time operations of the ISWMS (23:00 and 07:00)

NSR	NSR1 – Lakeside Development (dB L_{Aeq8hr})	NSR2 – Residence on Parkside Cl. (dB L_{Aeq8hr})	NSR3 – Residence on Seymour Rd. (dB L_{Aeq8hr})	NSR4 – Cayman International School (dB L_{Aeq8hr})	NSR5 – Residence on Woodlake Drive (dB L_{Aeq8hr})	NSR6 - Proposed New Health City Camana Bay Medical Campus
Average Measured Ambient Noise Level i.e. Existing sound level without the proposed ISWMS operations	58	44	57	51	58	51
Predicted Specific Noise i.e. Operational noise level of the ISWMS only	41	31	45	30	48	35
Total absolute level of sound i.e. Existing sound level plus ISWMS sound level	58	44	57	51	58	51
Difference between existing ambient sound levels and predicted future sound levels	0	0	0	0	0	0

The assessment of the absolute level of noise shows that the proposed ISWMS will not lead to any increase in the existing ambient noise levels at the nearby sensitive receptors during the daytime period with the exception of NSR1 and NSR5 which may experience up to +1 dBA when adding the ISWMS impacts to the existing background.

The assessment of the absolute level of noise shows that the proposed ISWMS will not lead to any increase in the existing ambient noise levels at the nearby sensitive receptors during the evening and night-time period.

A change in noise of up to 3 dBA is generally regarded as a negligible change and not perceivable by most people. Therefore, it is unlikely that this increase will be noticeable to residents. This is a positive indication that noise from the ISWMS will not be significant at the existing sensitive receptor locations.

Therefore, the potential noise impact of the ISWMS at NSRs is likely to be less than is suggested by Table 12.22, Table 12.23 and Table 12.24 (Comparison of Rating Level and Background Sound Levels).

Character and Level of Residual and Specific Sound

The character of the residual sound, which contains mid frequency noise from road traffic and industrial noise from the existing industrial area to the south and Esterly Tibbetts Highway to the east means that the character of the specific sound of the proposed development will be very similar to existing conditions and in keeping with the immediate area.

The assessment shows that the average level of the residual sound and the calculated level of the specific sound are similar. In addition, they are both considered to be relatively high.

This is a positive indication that the noise impact from the proposed development would be less than is suggested by Table 12.22, Table 12.23 and Table 12.24 (Comparison of Rating Level and Background Sound Levels).

Sensitivity of Receptor and Existing Acoustic Conditions

With regard to pertinent factors to be taken into consideration, Section 11 of BS4142 states;

> *"The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as:*
>
> *i. facade insulation treatment;*
>
> *ii. ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation;*
>
> *iii. and acoustic screening."*

The proposed receptors will have moderate sensitivity given their residential nature, as in accordance with Table 12.3, except for NSR4 and NSR6 which are high sensitivity.

Additionally, there appears to be no screening or shielding effect of the proposed ISWMS for sensitive receptors at the residential locations.

Summary of BS4142 Context Assessment

The context assessment shows that the measured, existing ambient sound level is very similar to the predicted ambient sound level with the ISWMS in place and that the character of the specific sound is very similar to the residual sound in the surrounding area. It can be concluded that the effect of the proposed development is overstated slightly by the exceedance of the background noise levels by the specific noise from the proposed ISWMS.

In order to determine the significance of the noise levels with the proposed ISWMS in place, the absolute noise levels have been compared to guideline noise levels, as detailed in BS8233.

12.6.3.3.4 BS8233 Context Assessment

Based on Site observations and local knowledge, some existing sensitive receptors appear to be naturally ventilated with no specific mitigation measures to control noise ingress from the surrounding area with the exception of the Cayman International School and the proposed New Health City Medical Campus which were assumed to be climate-controlled buildings with closed windows providing 23 dBA attenuation. For the purposes of the assessment, it was conservatively assumed that residential areas will have windows open and the attenuation provided by the façade will be approximately 13 dBA.

In order to assess the proposed ISWMS in the context of its environment and that of each of the existing sensitive receptors, a comparison of the absolute noise level and guideline noise levels has been undertaken, for both external and internal living areas, as shown in Table 12.28 and Table 12.29 below.

Table 12.28 Comparison of absolute noise levels at sensitive receptor locations and guideline noise levels - external areas

NSR	NSR1 – Lakeside Development Day (07:00 – 18:00) (dB $L_{Aeq\ 11hr}$)	NSR2 – Residence on Parkside Cl. Day (07:00 – 18:00) (dB $L_{Aeq11hr}$)	NSR3 – Residence on Seymour Rd. Day (07:00 – 18:00) (dB $L_{Aeq11hr}$)	NSR4 – Cayman International School Day (07:00 – 18:00) (dB $L_{Aeq11hr}$)	NSR5 – Residence on Woodlake Drive Day (07:00 – 18:00) (dB $L_{Aeq11hr}$)	NSR6 - Proposed New Health City Camana Bay Medical Campus
Absolute Noise Level, LAeq (dB)	64	56	66	61	64	61
Attenuation, L_{Aeq} (dB)	0	0	0	0	0	0
Desirable Noise Guideline Level stated in BS8233, L_{Aeq} (dB)	50	50	50	50	50	50
Upper Noise Guideline Level stated in BS8233, L_{Aeq} (dB)	55	55	55	55	55	55
Comparison between absolute level and desirable guideline level	14	6	16	11	14	11
Comparison between absolute level and upper guideline level	9	1	11	6	9	6

Table 12.29 Comparison of absolute noise levels at sensitive receptor locations and guideline noise levels - internal areas

NSR	NSR1 – Lakeside Development			NSR2 – Residence on Parkside Cl.			NSR3 – Residence on Seymour Rd.			NSR4 – Cayman International School			NSR5 – Residence on Woodlake Drive			NSR6 - Proposed New Health City Camana Bay Medical Campus		
	D (07:00 -18 :00)	E (18:00 -2 3:00)	N (23:00 -07 :00)	D (07:00 - 18:00)	E (18:00 -23:00)	N (23:00 -07 :00)	D (07:00 -1 8:00)	E (18:00 -23 :00)	N (23:00 -07 :00)	D (07:00 -18 :00)	E (18:00 -23 :00)	N (23:00 -07 :00)	D (07:00 -18 :00)	E (18:00 -23 :00)	N (23:00 - 07:00)	D (07:00 -18 :00)	E (18:00 -23: 00)	N (23:00 -0 7:00)
Absolute Noise Level, LAeq (dB)	64	58	58	56	48	44	66	57	57	61	54	51	64	58	58	61	54	51
Façade Attenuation, LAeq (dB)	13									23			13			23		
Calculated Internal Noise Level, LAeq (dB)	51	45	45	43	35	31	53	44	44	38	31	28	51	45	45	38	31	28
Noise Guideline Level Stated in BS8233, LAeq (dB)	35		30	35		30	35		30	35		30	35		30	35		30
Comparison between calculated level and guideline level	16	10	15	8	0	1	18	9	14	3	-4	-2	16	10	15	3	-4	-2

Table 12.28 shows that during the daytime, in external areas, the absolute sound level would above the upper guideline noise level of 55 dBA and above the desirable noise guideline level of 50dBA at all NSRs. However, as shown in Table 12.25 (Context Assessment at Existing Sensitive Receptors), the measured ambient noise levels at all receptors are close to the same or less than the absolute level shown in Table 12.28 above. Therefore, the impact of the ISWMS is negligible.

Table 12.29 above shows that during the daytime, evening and night-time, with windows open (conservative assumption), the absolute sound level would exceed internal noise guideline levels in living rooms and bedrooms of NSRs. However, as shown in Table 12.25 (Context Assessment at Existing Sensitive Receptors), the measured ambient noise levels at all receptors already exceed internal noise levels, without the proposed ISWMS in place, and therefore the impact of the ISWMS is negligible.

Taking this context into consideration, the impact at the NSR's during the daytime, evening and night-time is considered is likely to be significantly less than is suggested in Table 12.22, Table 12.23 and Table 12.24 (Comparison of Rating Level and Background Sound Levels).

12.6.3.3.5 Summary of BS4142 Assessment

In summary, we have found that noise from the ISWMS, on occasions, would exceed the background sound level at receptors. However, both the background sound levels are low, and noise from the ISWMS will not significantly change the existing ambient sound levels at receptors. In addition, noise from the ISWMS is thought to be in keeping with the current character of noise at the receptors. Ambient noise levels which include noise from the ISWMS, are significantly above the internal and external noise guideline levels stated in BS8233 when considering a conservative attenuation scenario of open windows.

Therefore, when considering the context of the sound from the ISWMS, the overall noise impact is considered to be low during the daytime and medium moderate during the quiet parts of the evening and night-time.

In any case, mitigation measures will be incorporated into the Site design to reduce noise emissions where feasible and Best Available Technology (BAT) will be adopted, which will further reduce noise from the ISWMS at receptors.

The affected sensitive receptors are considered to be of medium sensitivity in accordance with Table 12.3. It is considered that the magnitude will be low in accordance with Table 12.2 as the activities will cause a change in the baseline environment and may cause an exceedance of guideline objectives. The impact is therefore considered to be moderate, however with mitigation measures in place the impact is seen as minor or negligible.

12.6.3.4 Construction Noise Assessment

It is expected that noise generated during the construction phase will propagate beyond the Site boundary and be audible at the nearest NSRs.

The amount and types of equipment used in the construction of the ISWMS will change over the construction process, and so the profile of the noise propagating off-site will also change. In order to capture the changing noise profile, three evaluations were done at three different phases of construction, with different equipment being used in each evaluation, representing the worst-case months (most equipment) during the different phases:

1. Phase 1 – Earthworks
2. Phase 2 – Piling and Concrete Works
3. Phase 3 – MEP (Mechanical, Electrical, Plumbing), Paving, Completion of Concrete

Construction is expected to occur during daytime hours, with after-hours work reserved for limited, low-noise work. The equipment is classified as "stationary sources" of sound.

The worst-case assessment of steady-state noise sources at the selected points-of-reception was based on measured sound pressure levels. CadnaA version 2023 was used to model the potential impacts of the significant construction noise sources.

The magnitude of noise impacts associated with construction will be dependent upon a number of factors including:

– The intensity of construction activities.
– The location of construction activities.
– The type of equipment used.
– Existing local noise sources.
– Intervening terrain.
– The prevailing weather conditions.

The resulting noise levels at the NSRs and the corresponding impact during each phase are shown below:

Table 12.30 Resulting noise levels for each phase of construction at each NSR

Worst-case NSR	Phase 1 (Earthworks)		Phase 2 (Piling / Concrete)		Phase 3 (MEP / Paving)	
	Predicted Level (dBA)	Magnitude of Change	Predicted Level (dBA)	Magnitude of Change	Predicted Level (dBA)	Magnitude of Change
NSR1 – Lakeside Development (7.5 m AG)	51	Very Low	58	Low	59	Low
NSR2 – Residence on Parkside Cl. (4 m AG)	41	Very Low	49	Very Low	49	Very Low
NSR3 – Residence on Seymour Rd. (1.5 m AG)	48	Very Low	55	Very Low	56	Low
NSR4 – Cayman International School (4.5 m AG)	38	Very Low	46	Very Low	47	Very Low
NSR5 – Residence on Woodlake Drive (1.5 m AG)	55	Very Low	63	Low	63	Low
NSR6 – Hospital on Minerva Drive (7.5 m AG)	45	Very Low	54	Very Low	54	Very Low

The modelled noise impacts associated with each stage of construction meet the daytime threshold limit of 65/70 dBA $L_{eq,T}$ and in many instances will be much lower than that. Since the selected instances represent the worst case for each phase of construction, it can be considered that the magnitude of change at each NSR will be Low or Very Low throughout the entire construction process. At the high sensitivity receptor (NSR6), the magnitude of change is always Very Low.

The magnitude of impact at each NSR, according to Table 12.4, is therefore found to be Minor or Negligible, and thus considered Not Significant. In no scenario does the noise impact created by the construction site meet the threshold limit set out by the BS5228 ABC method.

Estimated Noise Contours for each construction phase are shown in Figures 12.8 to 12.10 below.

Figure 12.8 Noise contour plot – construction, phase 1

Figure 12.9 Noise contour plot – construction, phase 2

Figure 12.10 Noise contour plot – construction, phase 3

12.6.3.5 Construction Traffic Noise Assessment

The worst-case assessment of construction traffic noise at the selected points-of-reception was based on the change sound pressure levels after adding the additional construction traffic.

The total number of increased trucks per hour includes a maximum of three dump trucks and four cement/concrete trucks for a total of seven additional heavy trucks per hour. The predicted change in noise levels at the NSRs is as follows:

Table 12.31 Haul route traffic noise change due to construction traffic – Day

Noise Sensitive Receptor	Existing 18 hr Haul Route Traffic Noise (dBA)	Construction 18 hr Haul Route Traffic Noise (dBA)	Change Due to Construction (dBA)	Magnitude of Impact
Seymour Rd	65.4	66.3	0.9	Negligible
N Sound Rd.	71.3	72.2	0.9	Negligible
Thomas Russel Ave.	75.8	75.9	0.1	Negligible
Elgin Ave.	71.4	71.6	0.2	Negligible
Goring Ave.	71.4	71.6	0.2	Negligible
Harbour Dr.	74.0	74.1	0.1	Negligible

Table 12.32 Haul route traffic noise change due to construction traffic – night

Noise Sensitive Receptor	Existing 6 hr Haul Route Traffic Noise (dBA)	Construction 6 hr Haul Route Traffic Noise (dBA)	Change Due to Construction (dBA)	Magnitude of Impact
Seymour Rd	58.2	61.1	2.9	Minor
N Sound Rd.	64.1	65.7	1.6	Minor
Thomas Russel Ave.	64.8	65.7	0.9	Negligible
Elgin Ave.	60.5	62.4	2.0	Minor
Goring Ave.	60.5	62.4	2.0	Minor
Harbour Dr.	63.5	64.6	1.1	Minor

As expected, Seymour Road was the most affected road. As traffic volumes on Seymour Road are the lowest compared to all other roads along the Haul route it is expected that the change in traffic noise due to construction will be Negligible or have No Change.

12.6.4 Noise mitigation measures

12.6.4.1 Noise from the ISWMS operations

As part of the safe and on-going operation of the ISWMS, BAT will be implemented. This will help to ensure that the noise impact of the operational activities of the ISWMS on existing receptors is further reduced.

Using BAT, specific mitigation will be applied to the operating machinery within the internal areas of the ISWMS buildings. It is understood that these mitigation measures will be put in places to comply with worker hearing protection standards. Once implemented, these measures will ensure that the noise levels within the vicinity of the operational plant buildings associated with the ISWMS will be 80 dBA or less. This will have a positive effect on the noise impact experienced at existing sensitive receptors and can be confirmed through compliance testing at existing sensitive receptors once the ISWMS is in full operation.

Other mitigation measures will include the implementation of best working practice to ensure that the impact of the operational activities of the proposed facilities on existing receptors is minimised. These include:

- All plant and machinery will be regularly maintained to control noise emissions, with particular emphasis on lubrication of bearings and the integrity of silencers.
- Broadband reversing alarms will be chosen instead of tonal alarms.
- Site staff will be aware that they are working in the vicinity of residential properties and avoid all unnecessary noise due to misuse of tools and equipment, unnecessary shouting and radios. Noisy external activities such as cleaning and maintenance will be scheduled to avoid night-time working in the vicinity of sensitive receptors where possible.
- All works and ancillary operations that are audible at sensitive receptors outside the Site boundary shall be carried out only during hours of 8am till 6pm.
- All equipment and machinery in use shall be properly silenced where practicable and economic and maintained in accordance with the manufacturer's instructions.
- Any emergency deviation from these conditions shall be reported to the Contractor without delay.
- All vehicles to switch off engines upon arrival at site. The Site is to be a no-idling site.
- The majority of lorry movements will be carried out in forward gear in order to minimise noise associated with vehicle manoeuvring.

Noise management objectives will be established in accordance with the Environmental Management Plan as follows:

- 65 dBA at a distance of one meter from existing building facades.
- 75 dBA at the site boundaries neighbouring roads and car parks.
- 80 dBA at all other site boundaries.

12.6.4.2 Noise from construction phase activities

To minimise the potential levels of noise generated by the construction works, best working practice would be put in place, where possible. The construction works will follow the guidelines in BS5228-1 and the guidance in BRE Controlling Particles, Vapour and Noise Pollution from Construction Sites, Parts 1 to 5, 2003.

The following measures will be put in place to minimise noise emissions:

- All plant and machinery will be regularly maintained to control noise emissions, with particular emphasis on lubrication of bearings and the integrity of silencers.
- Broadband reversing alarms will be chosen instead of tonal alarms.
- Site staff will be made aware that they are working adjacent to a residential area and avoid all unnecessary noise due to misuse of tools and equipment, unnecessary shouting and radios.
- A further measure to reduce noise levels at the sensitive receptors will include, as far as possible, the avoidance of two noisy operations occurring simultaneously in close proximity to the same sensitive receptor.
- Adherence to the restriction of operating hours.
- Ensure engines are turned off when possible.
- Should construction activities need to be carried out during night-time hours, this will be discussed with the Cayman Islands Government, which may include a requirement for advance notice and details of any night working to provided.
- The majority of lorry movements will be carried out in forward gear in order to minimise noise associated with vehicle manoeuvring.

Construction management procedures will be used to minimise noise associated with construction activity. This is likely to include the application of techniques in accordance with BS 5228: 2009 (Code of practice for noise and vibration control on construction and open sites). Such measures will, where necessary, include:

- Use of mufflers or silencers on tools and plant.
- Where practicable and economic, electrically powered equipment will be used in preference to diesel or gasoline, as it is quieter.
- Low noise emissions and white noise reversing alarms on vehicles that are procured for the Works Period.
- Shut down (or throttle down) of machines in intermittent use in periods between work.
- Use of acoustic fencing or stockpiles for screening sound.
- Particularly noisy activities will be limited to certain periods of the day where appropriate.
- ReGen will keep neighbours informed regarding the work that is to be undertaken on site and the associated duration.
- Prior to commencement of particularly noisy operations, an environmental procedure detailing the method of works, program of work, predicted noise levels and manufacturers specifications for equipment and machinery will be submitted to the Contractor by the Construction Sub-Contractors for acceptance.
- Where practicable noisy equipment will be located away from sensitive noise boundaries.
- Loading and unloading of vehicles, dismantling of site equipment such as scaffolding or moving equipment or materials around site will be conducted in such a manner as to reduce noise generation and where practicable will be conducted away from noise sensitive areas.
- If elevated noise / vibration levels are encountered, the source of noise or vibration is to be identified and alternative methods or additional control measures are to be implemented.
- A maximum speed limit of 5 mph (8 kph) will apply on the site for the safety of the workforce and to minimize disturbance from noise and vibration in dusty areas. During regular operations on paved roads a maximum speed limit of 13 mph (20 kph) will apply.

12.6.5 Residual effects

Given compliance with the above measures, in particular the proper maintenance of equipment and of the access road surface, there will be no significant residual impact from noise on nearby existing sensitive receptors.

12.6.6 Inter-related effects

The NSRs most susceptible to inter-related effects involving noise are NSR1 (Lakeside Residential Development) and NSR5 (Woodside Drive/Glenwood Drive Residence), as these are the receptors most affected by noise during both the construction and operational phase. Residents at these receptors may experience a slightly higher background noise level for some hours of the day during both the construction and operational phases of the ISWMS (though the adverse effects have been determined to be not significant). However, these receptors are well outside of the potential zone of influence for vibration from the Facility; the local roads connecting to these residences do not lie upon the operational and haul routes for the ISWMS, so they will not be significantly impacted by traffic changes; according to the Quantitative Air Quality Assessment, air quality effects were determined to be insignificant, and odour in the area is actually expected to improve due to diversion of waste from the landfill; and view of the significant noise sources at the ISWMS from these receptors will be obscured or blocked completely by trees and other buildings, as the top ten significant noise sources are located at ground level and not the visible ISWMS rooftops. Thus, it has been determined that these receptors will not experience any significant inter-related effects due to a combination of noise effects with other environmental impacts such as terms of vibration, traffic, air quality or visual amenity.

12.7 Conclusions

The NVIA describes an assessment of the potential noise impacts associated with the proposed ISWMS construction and operation.

The sound characteristics and existing ambient acoustical environment at the four noise monitoring locations are characterized by road traffic noise attributed to the Esterly Tibbetts Highway, the Cayman International Airport, local commercial/industry areas to the southeast and the natural environment. The baseline noise data collected is a good representation of typical existing sound characteristics around the ISWMS development.

GHD has measured the existing noise levels in the Study Area based on the baseline noise monitoring program described in this report. This assessment confirms that the sound levels in the Study Area's near the Esterly Tibbets Highway are generally high during the day and low at night, residential receptors close to commercial industries generally experience higher sound levels during the day and night, and residential areas removed from road traffic and industry areas generally experience lower sound levels, consistent with an urban area. These documented baseline sound levels were used for comparison to the predicted noise impacts during the construction and operation phases of the proposed ISWMS Project to determine the potential for noise impacts.

The potential noise impacts affecting existing sensitive receptors with regard to construction and operational activities associated with the Facility have been considered and have been assessed using appropriate guidance. A robust, 'worst- case' scenario has been considered (i.e., ISWMS Facility at full operation).

Where mitigation measures are required to control potential noise levels from the ISWMS, details of such measures have been provided in outline terms.

With the implementation of the mitigation measures proposed, the results of the NVIA indicate the following:

- Noise from the proposed ISWMS operations is considered low/minor.
- Noise from ISWMS-generated road traffic is considered negligible.
- Noise from construction phase activities has a minor or negligible impact at all sensitive receptors.
- Vibration from construction phase activities has been determined to be insignificant for all receptors.
- Noise from construction traffic along the defined haul route will have a non-significant impact overall.

No significant residual impact from noise and vibration on nearby existing sensitive receptors is anticipated with implementation of proposed mitigation measures.

13. Traffic and Transport

13.1 Purpose of chapter

APEC was retained by ReGen and the Cayman Islands Government (CIG) as approved by the Environmental Assessment Board (EAB) to undertake a Traffic Statement (TS) as part of the Environmental Impact Assessment (EIA) process to assess the likely impacts of the ISWMS development on the surrounding road network. As noted in the Terms of Reference (ToR), it has been previously established that the Cayman Islands National Road Authority (NRA) consider that the activity is likely to be a low traffic generator and, as such, a Traffic Impact Assessment was not required in support of the EIA, rather those elements of a transport assessment approach needed to inform the operational assessments of the EIA are instead contained within the TS (see **Appendix 13.A [Traffic Statement]**).

The TS that informs this chapter has been prepared with input from the NRA and the Department of Environmental Health (DEH) which operates the existing George Town Landfill (GTLF). The TS is organized to set out the existing situation, present the proposed development and determine what impact, if any, the site-generated traffic will have on the surrounding road network. In line with the Terms of Reference (ToR) for this project, this chapter describes the findings of the TS, including analysis of existing and predicted future traffic flows, and outlines the potential traffic and transport impacts of the ISWMS Site.

13.2 Study Area and background information

The proposed ISWMS Site is located at the north end of Seymour Road in the Industrial Park area of George Town. The Site is accessible only via Seymour Road, a cul-de-sac road off North Sound Road.

The Study Area for this impact assessment consists of an area stretching from the north end of Seymour Road at the entrance to the Site, south along Seymour Road and encompass the intersection of Seymour Road with North Sound Road. The Study Area also extends east to the intersection of North Sound Road and Dorcy Drive and west to the approach to the 'Bank of Butterfield' (BOB) roundabout, where North Sound Road intersects with the Esterly Tibbetts Highway and Godfrey Nixon Way. The BOB roundabout was modelled to measure its impact on the roads within the Study Area.

All roads within the Study Area are two-way single carriageway roads. The intersection of Seymour Road (SR) and North Sound Road (NSR), and the intersection of NSR and Dorcy Drive (DD) are both unsignalized mini roundabouts. The BOB roundabout, a large two-lane roundabout exists at the western extent of the Study Area, where the North Sound Road intersects with the Esterly Tibbetts Highway and Godfrey Nixon Way. Refer to Figure 13.1 showing the Study Area and location plan.

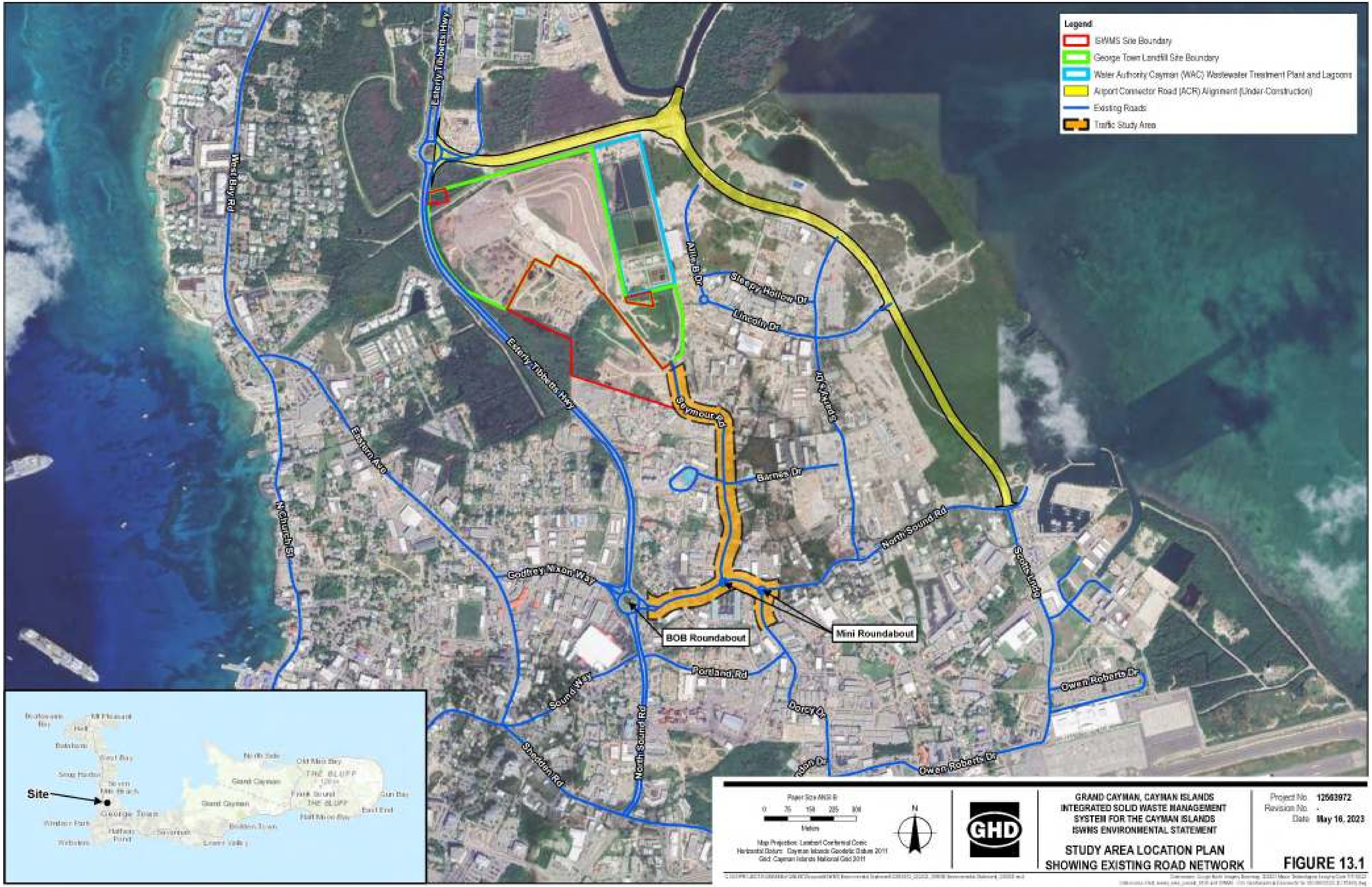


Figure 13.1 Study Area location plan showing existing road network

13.2.1 Public transport

An existing bus service exists within the Study Area. According to the Public Transport Unit within CIG (CaymanTransport.ky), bus 5A travels along North South Road passing the south end of Seymour Road. The frequency of the bus service is not known. There are no bus stops within the Study Area, however the bus service in Cayman typically stops upon request of the passengers.

13.2.2 Pedestrian/ bicycle facilities

There are currently limited pedestrian facilities within the Study Area. There are isolated sections of sidewalks along both sides of North Sound Road. There is a limited section of sidewalk on one side of Seymour Road at a concrete batching facility.

There are no dedicated facilities for bicycles within the Study Area.

13.3 Applicable standards and guidelines

The following guidance was relied upon in carrying out the Traffic and Transport Assessment:

- Cayman Island EIA Regulations: National Conservation Council Directive for Environmental Impact Assessments Section 43, National Conservation Law, Extraordinary No.50/2016, June 2016.
- Terms of Reference and Guidelines for Conduct of TIS in Cayman Islands, Transportation & Planning Unit, National Roads Authority (March 2013).
- 1993 Institute of Environmental Assessments (IEA) publication 'Guidance Notes No. 1: Guidelines for the Environmental Assessment of Road Traffic' (the IEMA guidelines).

13.4 Methodology

The following methodology was applied to establish baseline conditions within the identified Study Area for the ISWMS Site, predict future traffic conditions, quantify the impact of ISWMS-associated traffic on Seymour Road, North Sound Road, Dorcy Drive, and BOB Roundabout, and determine the significance of effects from the ISWMS Site on future traffic conditions within the Study Area.

13.4.1 Baseline conditions

Traffic data

Data on the existing traffic flows on the surrounding road network within the Study Area was gathered by way of a combination of automatic traffic counters[1] and turning movement counts undertaken by APEC staff (refer to Figure 13.2 for traffic count locations). Existing traffic data was also provided by the NRA, mainly from a 2017 island-wide traffic count study.

[1] PicoCount 2500 counter with pneumatic road tubes

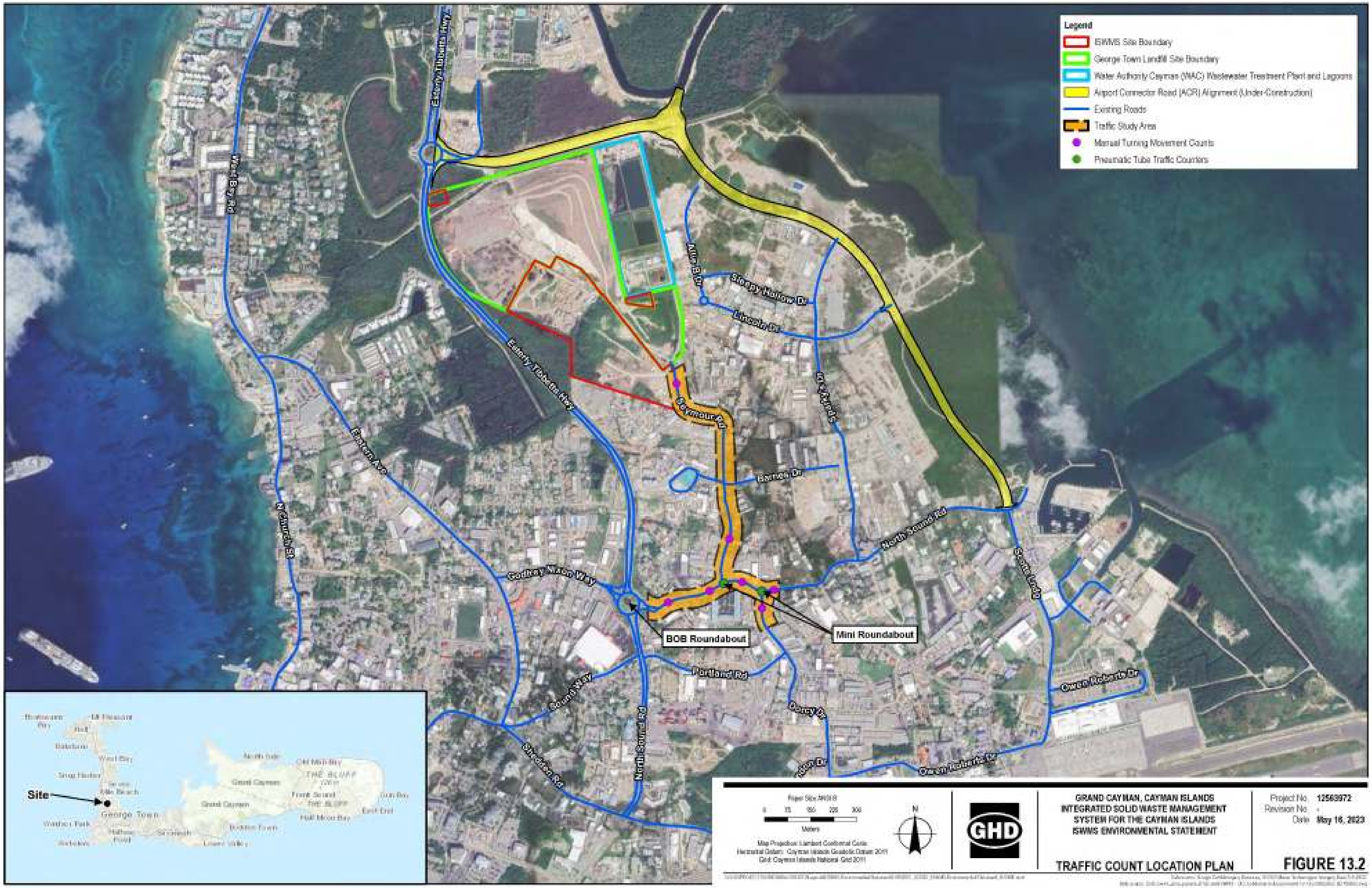


Figure 13.2 Traffic Count Location Plan

Existing traffic volumes – automatic traffic counters

Traffic data from automatic traffic counters was collected at seven locations between December 2 and 16, 2022.

- North Sound Road (East of BOB roundabout / Agave) – 7 complete days of data (5 weekdays)
- North Sound Road (East of Tony's Toys Lot) – 7 complete days of data (4 weekdays)
- North Sound Road (Paramount / between SR & DD) – 9 complete days of data (6 weekdays)
- Dorcy Drive (Ashley furniture) – 8 complete days of data (6 weekdays)
- North Sound Road (East of Dorcy Drive intersection) – 11 complete days of data (7 weekdays)
- Seymour Road (North of intersection with NSR) – 16 complete days of data (12 weekdays)
- Seymour Road (South of GTLF entrance) – 16 complete days of data (12 weekdays)

In addition, reference has been made to traffic flow data from 2012 on Seymour Road at the GTLF entrance.

Existing traffic volumes – manual turning movement counts

Manual turning movement counts were undertaken on three dates as follows:

- North Sound Road / Seymour Road mini-roundabout – December 15, 2022 (Morning peak)
- North Sound Road / Seymour Road mini-roundabout – January 26, 2023 (Afternoon/Evening peak)
- North Sound Road / Dorcy Drive mini-roundabout – March 15, 2023 (Morning peak)
- North Sound Road / Dorcy Drive mini-roundabout – December 14, 2022 (Afternoon/Evening peak)

Existing traffic volumes – NRA traffic counts

Existing traffic flow data has been received from the NRA[2] for the following locations in and around the Study Area:

- North Sound Road (South of Godfrey Nixon Way) – 2019
- Esterly Tibbetts Highway (by Lakeside Development) – 2019
- Godfrey Nixon Way (east of Eastern Avenue) – 2019
- North Sound Road (Tony's Toys Lot) – 2017
- Dorcy Drive (south of Ashley furniture) – 2017
- North Sound Road (East of Dorcy Drive intersection) – 2017
- Intersection Turning Movement Count for BOB roundabout – 2016
- Intersection Turning Movement Count for North Sound Road / Dorcy Drive – 2016

The turning movement count data for Bank of Butterfield roundabout is presented in **Appendix 13.A (Traffic Statement – Appendix E).**

Traffic data from the 2016 turning movement count at BOB roundabout were used to establish peak period traffic flows through the intersection. The data from 2016 were increased in line with NRA established growth rates (see Section 13.6.1.2) to provide 'base year', 2022, traffic flows. The classification of vehicles utilizing the roundabout intersection was taken from the data provided by the 2016 count.

Existing/ base year peak hour traffic flow analysis

Analysis of the existing traffic flows within the Study Area to establish the current Level of Service (LOS) on the surrounding roads was undertaken. This analysis is based on several available data sets:

- Turning Movement Count data for 'BOB' roundabout made available by the NRA – 2016
- Manual Traffic Count undertaken at North Sound Road / Seymour Road mini-roundabout – 2022

2 Additional traffic data was received from the NRA but was deemed not relevant for this traffic study

– Manual Traffic Count undertaken at North Sound Road / Dorcy Drive mini-roundabout – 2022

Interrogation of the available data has established the traffic flows on the surrounding road network during both the morning and afternoon/evening peak hours. While the peak periods of each intersection do not necessarily match, the worst-case peak has been used to provide a robust analysis. The vehicle classification information from the available data was used to apportion heavy goods vehicles (HGVs), buses, bicycle / motorcycles and passenger cars on the road network within the analysis models. The focus of this analysis review is on roads within the Study Area.

Operation of existing GTLF facility

In order to estimate the volume of vehicles accessing the proposed ISWMS Site, it was necessary to undertake some analysis of the current operation and usage of the GTLF. The automatic traffic count undertaken in December 2022 gathered traffic flow data on Seymour Road just south of the existing entrance to the GTLF.

13.4.2 Impact assessment and mitigation

Future conditions

To predict future traffic flows, as part of assessing the impacts of the ISWMS Site on the surrounding road network, it was necessary to make assumptions related to trip generation and distribution, establish assessment year horizons, and identify proposed road developments within the Study Area.

Traffic analysis

Analysis of the predicted future traffic flows on the surrounding network was then undertaken for the established assessment year horizons.

Construction impacts

Impacts to traffic within the Study Area related to the construction phase of the ISWMS Project were also considered as part of the assessment.

Impact analysis

As identified in the ToR, the proposed initial receptors and estimated sensitivity for the traffic assessment were as follows:

– Seymour Road (from North Sound Road to the entrance to the Site) – **Low sensitivity** due to adjacent industrial land uses
– North Sound Road (between Seymour Road and Esterly Tibbetts Highway) – **Medium/High sensitivity** due to adjacent urban / town centre land uses

The North Sound Road receptor has been extended to the southeast to include the area from Dorcy Drive to the approach to the 'Bank of Butterfield' (BOB) roundabout at Esterly Tibbetts Highway.

The likely significant transport effects reported in the ToR are summarised in Table 13.1.

Table 13.1 Likely significant transport effects

Activity	Effect	Receptor
Operation and construction traffic increases on local road network	Visual effects	Local road users Adjacent land uses to the carriageway Pedestrian and cyclists

Activity	Effect	Receptor
Operation and construction traffic increases on local road network	Driver severance[3] and delay	Other vehicles using the local road network
Operation and construction traffic increases on local road network	Pedestrian severance and delay	Pedestrian using the local roads
Operation and construction traffic increases on local road network	Pedestrian amenity[4] and intimidation	Pedestrian using the local roads
Operation and construction traffic increases on local road network	Accidents and safety	Local road users Adjacent land uses to the carriageway Pedestrian and cyclists
Operation and construction traffic increases on local road network	Hazardous and dangerous loads	Local road users Adjacent land uses to the carriageway Pedestrian and cyclists

As noted in the ToR, the following effects have been scoped out from further assessment:

– Decommissioning of the facility;
– Capacity of local highways junctions; and
– Ability to convey abnormal loads to site if required.

Traffic and pedestrian construction and operational impacts identified for assessment in the ToR include:

– Driver severance and delay – at junctions or links subject to traffic flow increases which are either approaching capacity, or are over capacity (or delays resulting from traffic diversions);
– Pedestrian severance and delay – at locations where physical obstructions or increases in traffic flows more than 30 percent are forecast to result in an increase in severance;
– Pedestrian amenity / intimidation – at junctions or links subject to substantial increases in traffic flow in conjunction with any changes in footway widths or crossing facilities. The presence of sensitive user groups will also be considered;
– Accidents and safety – links and junctions (for which data is available) with existing accident rates more than national averages which may be subject to an increase in traffic flows; and
– Hazardous and dangerous loads – consideration of estimated number and composition of loads and assessment of accident risk if considered significant.

The criteria for evaluation are based on the receptors identified above for sensitivity and Table 13.2 for the magnitude of change.

Table 13.2 Guidelines for the assessment of impact magnitude

Magnitude of change	Magnitude of impact			
	Very low	Low medium	Medium	High
Severance	Change in total traffic or HGV flows of less than 30 percent	Change in total traffic or HGV flows of 30 percent to 60 percent	Change in total traffic or HGV flows of 60 per cent to 90 percent	Change in total traffic or HGV flows of over 90 percent
Pedestrian and Cycle Delay	A professional judgement based on the routes in the context of the individual characteristics			

3 Perceived division that can occur within a community when it becomes separated by a major traffic artery and is used to describe the factors that separate people from other people and places (IEMA guidelines, Paragraph 4.27).

4 Relative pleasantness of a journey and is considered to be affected by traffic flow, traffic composition and pavement width/separation from traffic (IEMA guidelines, Paragraph 4.35). The IEMA guidelines note that changes in pedestrian amenity may be considered significant where the traffic flow is halved or doubled, with the former leading to a beneficial effect and the latter an adverse effect

Magnitude of change	Magnitude of impact			
	Very low	Low medium	Medium	High
Pedestrian Amenity	Change in total traffic or HGV flow of <100 percent		A professional judgement based on the routes with >100 percent change in context of the individual characteristics	
Cyclist Amenity	Change in total traffic or HGV flow of < 100 percent		A professional judgement based on the routes with >100 percent change in context of the individual characteristics	
Accidents and Safety	A professional judgement based on the level of baseline collision numbers and severity of collisions as well as the predicted change in collisions			

Identified adverse effects are categorised as 'slight', 'moderate' or 'substantial' as appropriate using the matrix presented in Table 13.3 with substantial, moderate/substantial and moderate classed as significant.

Table 13.3 Establishing the level of effect

Magnitude of change	Sensitivity of receptors		
	High	Medium	Low
High	Substantial	Moderate/Substantial	Moderate
Medium	Moderate/ Substantial	Moderate	Slight/Moderate
Low medium	Moderate	Slight/Moderate	Slight
Very low	Slight	Slight/Negligible	Negligible

13.5 Baseline conditions

13.5.1 Existing traffic volumes – automatic traffic counters

As noted above, traffic data from automatic traffic counters was collected at seven locations between December 2 and 16, 2022 (see Figure 13.5) and reference has been made to traffic flow data from 2012 on Seymour Road at the GTLF entrance.

The baseline traffic flow in the Study Area was established in order to assess the impact of the proposed ISWMS Site on the surrounding road network. Table 13.4 through Table 13.10 present a summary of the results from the automatic traffic counts.

Table 13.4 North Sound Road (Agave) traffic volume[5]

	Eastbound	Westbound	Combined
Average Weekday Morning (AM) Peak 08:30 – 09:30	518	496	1014
Average Weekday Afternoon/Evening (PM) Peak 17:45 – 18:45	373	272	645
Average Weekday Average Daily Traffic (ADT)	5816	4654	10470

[5] Some traffic flow data was not recorded by the automatic traffic counters due to slow-moving nature of traffic during peak periods and the counters missing these vehicles. The automatic count data was supplemented by data from the NRA and manual turning movement counts.

Table 13.5 North Sound Road (East of Tony's Toy's Lot) traffic volume

	Eastbound	Westbound	Combined
Average Weekday Morning (AM) Peak 09:00 – 10:00	50	511	561
Average Weekday Afternoon/Evening (PM) Peak 18:30 – 19:30	82	439	521
Average Weekday ADT	1222	5760	6982

Table 13.6 North Sound Road (Paramount) traffic volume

	Eastbound	Westbound	Combined
Average Weekday Morning (AM) Peak 06:45 – 07:45	469	219	688
Average Weekday Afternoon/Evening (PM) Peak 12:30 – 13:30	516	101	617
Average Weekday ADT	6782	2142	8924

Table 13.7 Dorcy Drive (Ashley Furniture) traffic volume

	Northbound	Southbound	Combined
Average Weekday Morning (AM) Peak 07:15 – 08:15	308	284	592
Average Weekday Afternoon/Evening (PM) Peak 18:00 – 19:00	214	226	440
Average Weekday ADT	2809	3779	6588

Table 13.8 North Sound Road (East of Dorcy Drive intersection) traffic volume[9]

	Eastbound	Westbound	Combined
Average Weekday Morning (AM) Peak 06:45 – 07:45	292	214	506
Average Weekday Afternoon/Evening (PM) Peak 12:00 – 13:30	211	200	411
Average Weekday ADT	3006	2646	5652

Table 13.9 Seymour Road (North of intersection with North Sound Road) traffic volume

	Northbound	Southbound	Combined
Average Weekday Morning (AM) Peak 06:45 – 07:45	205	164	389
Average Weekday Afternoon/Evening (PM) Peak 12:00 – 13:00	134	200	334
Average Weekday ADT	1908	2648	4556

Table 13.10 Seymour Road (South of GTLF Entrance) traffic volume

	Northbound	Southbound	Combined
Average Weekday Morning (AM) Peak 06:45 – 07:45	55	50	105
Average Weekday Afternoon/Evening (PM) Peak 14:45 – 15:45	44	62	106
Average Weekday ADT	531	656	1187

The data from the automatic traffic counters has been included in **Appendix 13.A (Traffic Statement – Appendix C)**.

6 Ibid.
7 Ibid.
8 Ibid.
9 Ibid.

The data gathered from the automatic counters and provided by the NRA were used to establish the morning (AM) and afternoon/evening (PM) peak periods. These were later verified by way of manual traffic counts at intersections within the Study Area – refer to Section 13.5.3.

13.5.2 Traffic speeds

The automatic traffic data was interrogated to calculate the average travel speed at each of the counter locations. The following table summarises the average travel speed and the posted speed limit at each counter location.

There are no visible speed limit signs within the Study Area. The speed limits shown were taken from The Traffic (Speed Limits in Grand Cayman) Regulations, 2016. There was no speed limit shown for Seymour Road. It has been assumed that the speed limit on Seymour Road is a continuation of the applicable speed limit on North Sound Road.

Table 13.11 Average travel speed & posted speed limit

	Average Travel Speed (mph)	Posted Speed Limit (mph)
North Sound Road (East of BOB roundabout / Agave)	22.1	25
North Sound Road (East of Tony's Toys Lot)	19.1	25
North Sound Road (Paramount / between SR & DD)	19.4	25
Dorcy Drive (Ashley furniture)	19.1	25
North Sound Road (East of Dorcy Drive intersection)	20.3	25
Seymour Road (North of intersection with NSR)	16.9	25
Seymour Road (South of GTLF entrance)	18.7	25

The data from the automatic traffic counters have been included in **Appendix 13.A (Traffic Statement– Appendix C)**.

13.5.3 Existing traffic volumes – manual turning movement counts

As noted above, manual turning movement counts were undertaken on three dates as follows:

- North Sound Road / Seymour Road mini-roundabout – December 15, 2022 (Morning peak)
- North Sound Road / Seymour Road mini-roundabout – January 26, 2023 (Afternoon/Evening peak)
- North Sound Road / Dorcy Drive mini-roundabout – March 15, 2023 (Morning peak)
- North Sound Road / Dorcy Drive mini-roundabout – December 14, 2022 (Afternoon/Evening peak)

The traffic data gathered during the manual turning movement counts is summarized in the figures below.

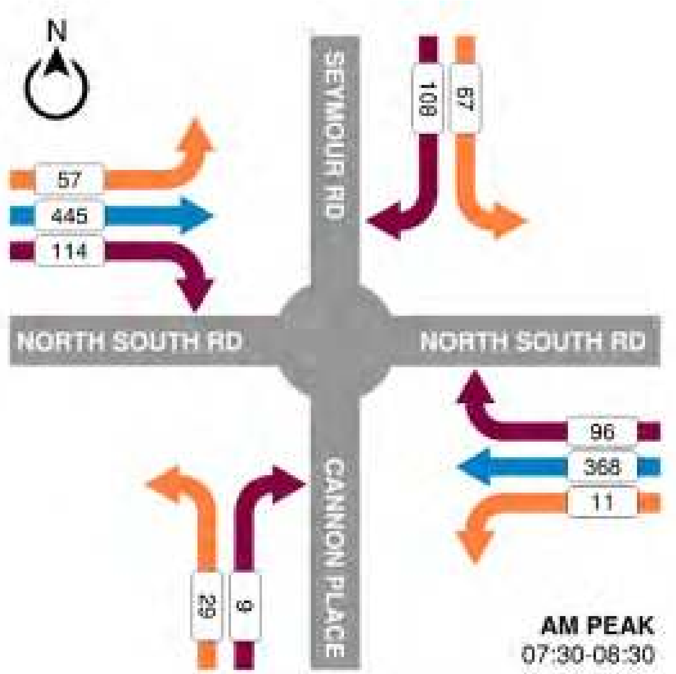


Figure 13.3 Intersection of North Sound Road & Seymour Road – Morning Peak

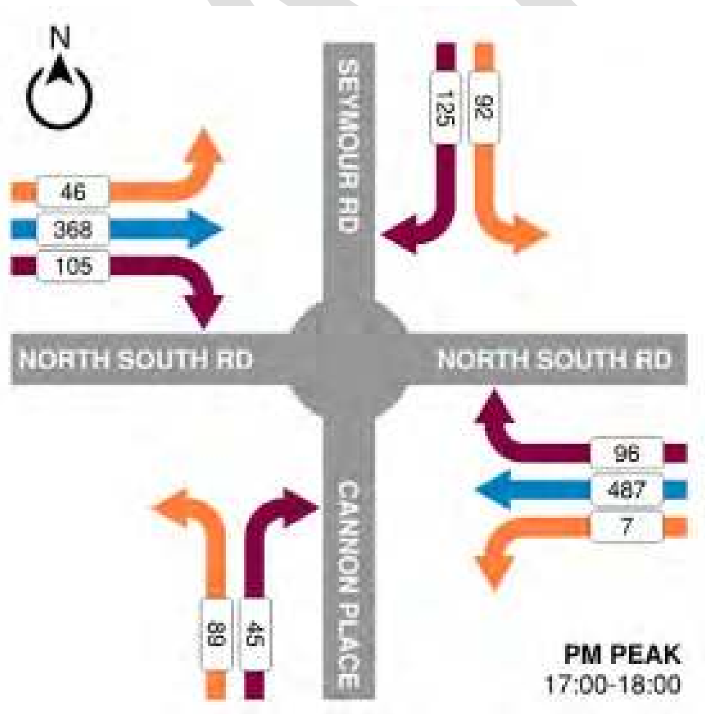


Figure 13.4 Intersection of North Sound Road & Seymour Road – Afternoon/Evening Peak

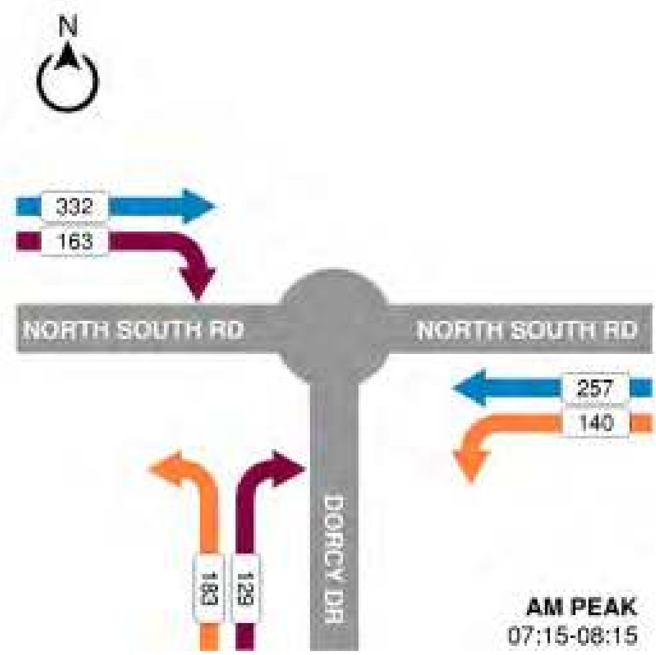


Figure 13.5 Intersection of North Sound Road & Dorcy Drive – Morning Peak

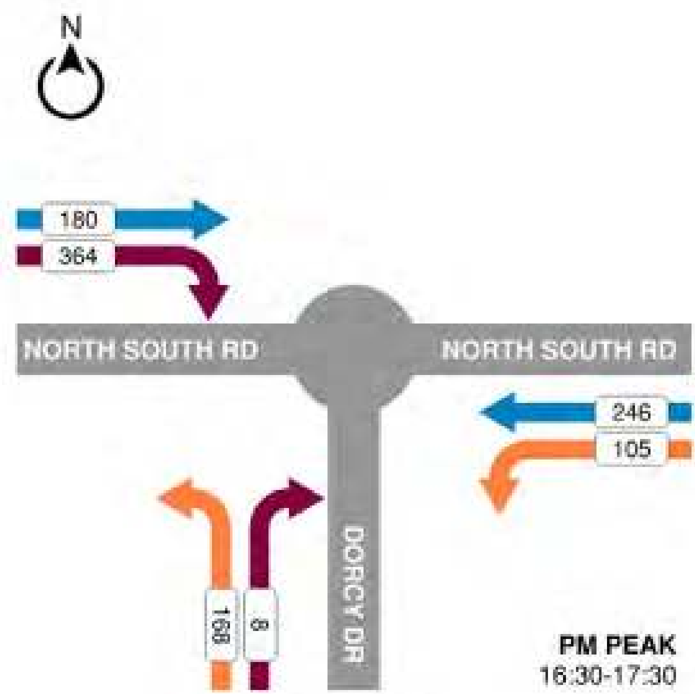


Figure 13.6 Intersection of North Sound Road & Dorcy Drive – Afternoon/Evening Peak

13.5.4 Traffic classification

The results from the manual traffic counts were interrogated to quantify the classification of vehicles at each of the intersection approaches. The following tables summarise the vehicle classification.

Table 13.12 North Sound Road (West of intersection with SR) Traffic Classification

	Bicycles/Motorcycles	Cars/Pick-ups	Buses	Trucks/HGVs
Percentage	2 percent	93 percent	1 percent	4 percent

Table 13.13 Seymour Road (at intersection with NSR) Traffic Classification

	Bicycles/Motorcycles	Cars/Pick-ups	Buses	Trucks/HGVs
Percentage	1 percent	90 percent	0 percent	9 percent

Table 13.14 North Sound Road (between SR and DD intersections) Traffic Classification

	Bicycles/Motorcycles	Cars/Pick-ups	Buses	Trucks/HGVs
Percentage	2 percent	91 percent	1 percent	6 percent

Table 13.15 Dorcy Drive (at intersection with NSR) Traffic Classification

	Bicycles/Motorcycles	Cars/Pick-ups	Buses	Trucks/HGVs
Percentage	1 percent	91 percent	1 percent	8 percent

Table 13.16 North Sound Road (East of Intersection with DD) Traffic Classification

	Bicycles/Motorcycles	Cars/Pick-ups	Buses	Trucks/HGVs
Percentage	2 percent	90 percent	1 percent	7 percent

This manual traffic count is included in **Appendix 13.A (Traffic Statement – Appendix D)**.

The results from the automatic traffic counter located south of the entrance to the GTLF were interrogated to quantify the classification of vehicles. The following table summarise the vehicle classification.

Table 13.17 Seymour Road (South of GTLF entrance) Traffic Classification

	Bicycles/Motorcycles	Cars/Pick-ups	Buses	Trucks/HGVs
Percentage	2 percent	76 percent	1 percent	21 percent

13.5.5 Existing traffic volumes – NRA traffic counts

The calculated morning and afternoon/evening peak flow data for the 2022 Base Year, as described in Section 13.4.2.3, are summarized in Figure 13.7 and Figure 13.8.

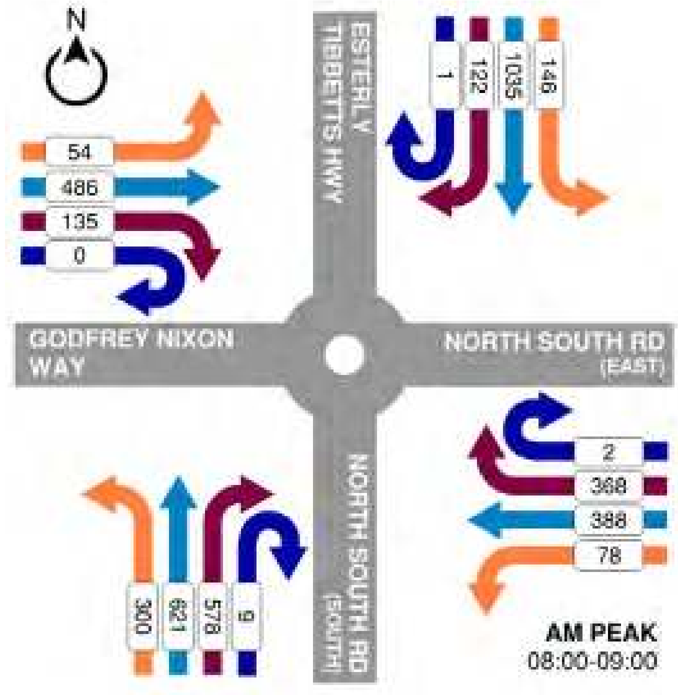


Figure 13.7 Bank of Butterfield roundabout – Morning Peak

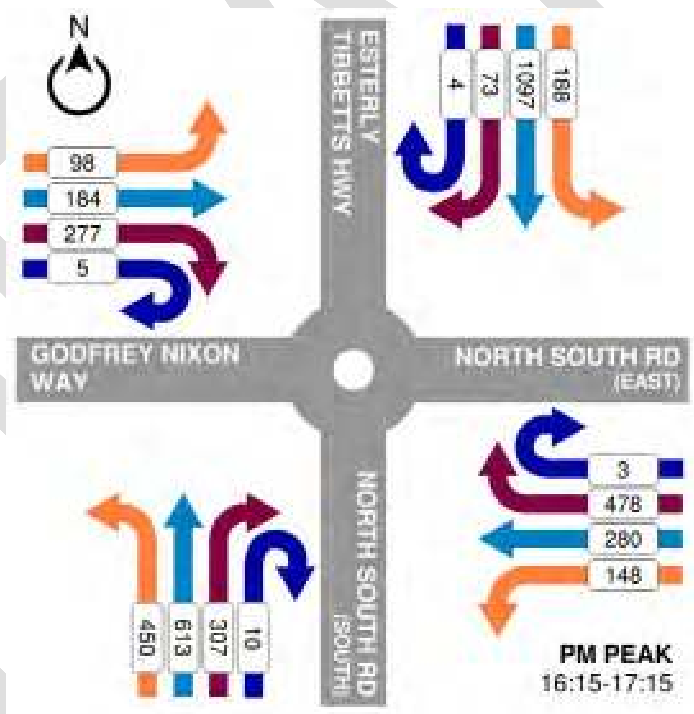


Figure 13.8 Bank of Butterfield roundabout – Afternoon/Evening Peak

13.5.6 Existing/ base year peak hour traffic flow analysis

Level of service (LOS) is a term used to qualitatively describe the operating conditions of a roadway based on measures related to speed and travel time, freedom to maneuver, traffic interruptions, and comfort and convenience.

The LOS ranges from A (least congested) to F (most congested). Figure 13.18 shows the definitions of each level of service.

Table 13.18 General definitions of levels of service

Level of Service	General Operating Conditions
A	Free flow
B	Reasonably free flow
C	Stable flow
D	Approaching unstable flow
E	Unstable flow
F	Forced or breakdown flow

Based on pervious discussions with the NRA, the minimum LOS standard for roads within the Cayman Islands is LOS "D". Any step below LOS "D" would require mitigation action to improve the traffic flow.

The traffic flow data was analyzed using Sidra Intersection[10], version 7 using Highway Capacity Manual 2010 capacity calculations. The three main intersections on the surrounding road network were analyzed individually and as well as part of the overall North Sound Road network. Refer to Figure 13.9 through Figure 13.16 showing the resulting Level of Service for each approach / lane of each intersection during both the morning and evening peak hours.

The LOS is color-coded on the following diagrams as follows:

The approach / lane LOS for the BOB roundabout during the morning peak is shown on Figure 13.9. The results show that the North Sound Road (East) approach, as well as other approaches, experience LOS F during the morning peak period. Additional results from the Sidra analysis show that the 95-percentile queue length on the North Sound Road (East) approach is 154 vehicles, equating to an estimated distance of 0.7 miles (1.12 km). The analysis shows that this intersection is currently operating above capacity during the morning peak period.

10 Sidra Intersection is a software package used for intersection and network capacity, level of service and performance analysis, and signalised intersection and network timing calculations by traffic design, operations and planning professionals.

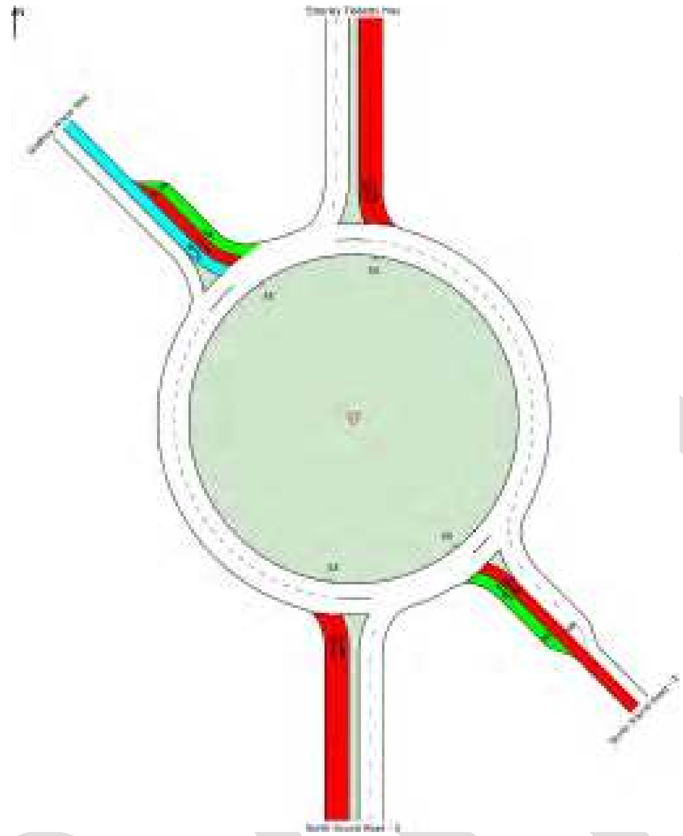


Figure 13.9 Sidra Model – Bank of Butterfield roundabout – 2022 – AM Peak – Lane LOS

The approach / lane LOS for the BOB roundabout during the afternoon/evening peak is shown on Figure 13.10. The results show that the North Sound Road (East) approach, as well as other approaches, experience LOS F during the afternoon/evening peak period. Additional results from the Sidra analysis show that the 95-percentile queue length on the North Sound Road (East) approach is 375 vehicles, equating to an estimated distance of nearly 1.7 miles (2.74 km) – longer than the entire length of North Sound Road therefore this shows that the queue extends onto other roads upstream. The analysis shows that this intersection is currently operating beyond capacity during the afternoon/evening peak period.

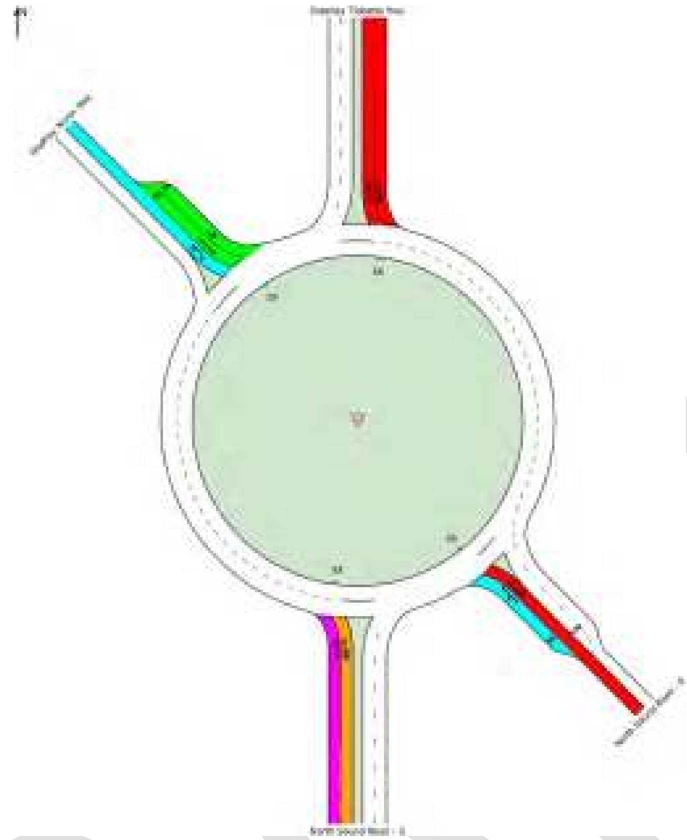


Figure 13.10 Sidra Model – Bank of Butterfield roundabout – 2022 – PM Peak – Lane LOS

The approach/lane LOS for the North Sound Road/ Seymour Road mini roundabout during the morning peak is shown on Figure 13.11. The results indicate that all roundabout approaches operate at LOS A during the morning peak period.

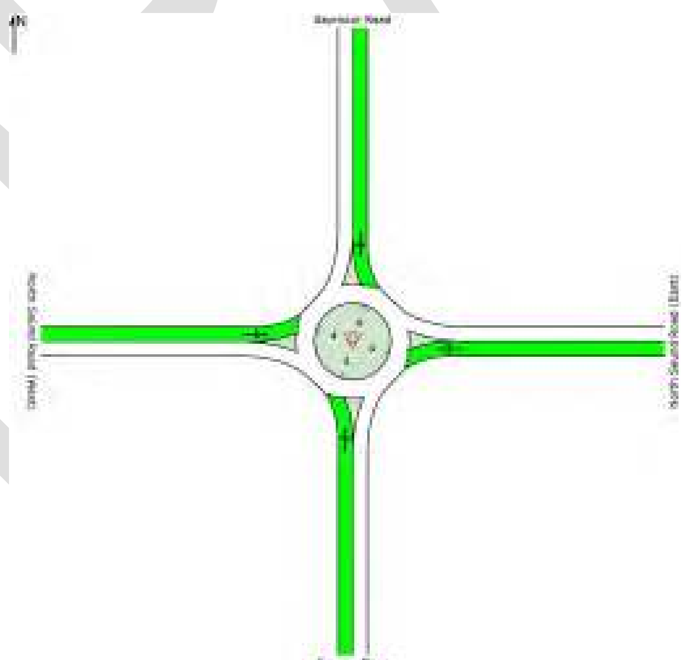


Figure 13.11 Sidra Model – Seymour Road roundabout – 2022 – AM Peak – Lane LOS

The approach/lane LOS for the North Sound Road / Seymour Road mini-roundabout during the afternoon/evening peak is shown on Figure 13.12. The results show that the Seymour Road approach experiences LOS B, with the remaining approaches operating at LOS A during the afternoon/evening peak period.

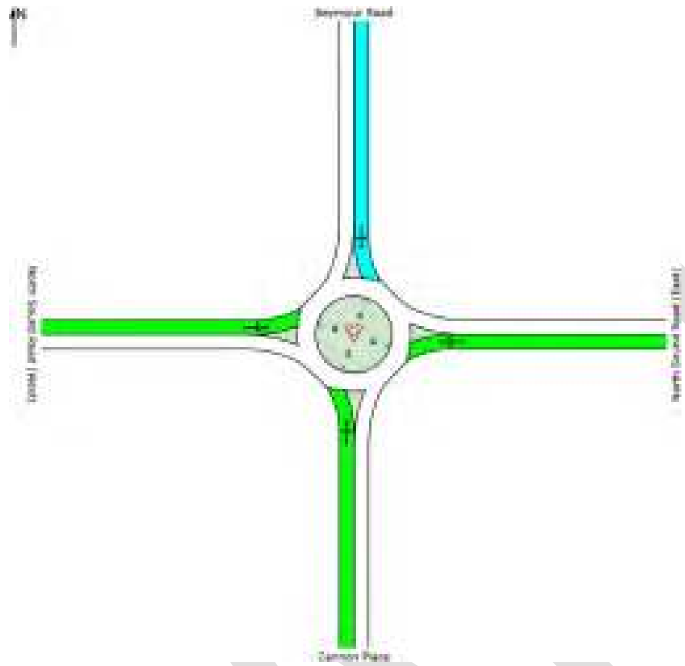


Figure 13.12 Sidra Model – Seymour Road roundabout – 2022 – PM Peak – Lane LOS

The approach/lane LOS for the North Sound Road/Dorcy Drive mini roundabout during the morning peak is shown on Figure 13.13. The results show that all approaches operate at LOS A during the morning peak period.

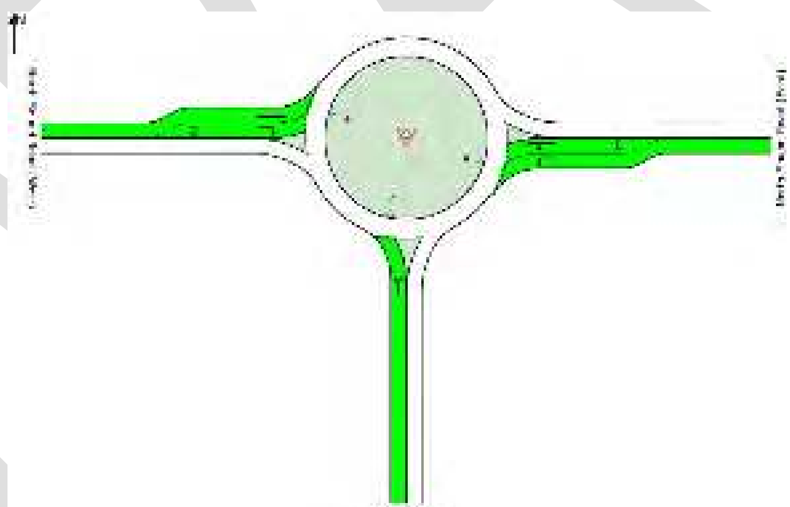


Figure 13.13 Sidra Model – Dorcy Drive roundabout - 2022 - AM Peak - Lane LOS

The approach/lane LOS for the North Sound Road/Dorcy Drive mini roundabout during the afternoon/evening peak is shown on Figure 13.14. The results show that all approaches also operate at LOS A during the afternoon/evening peak period.

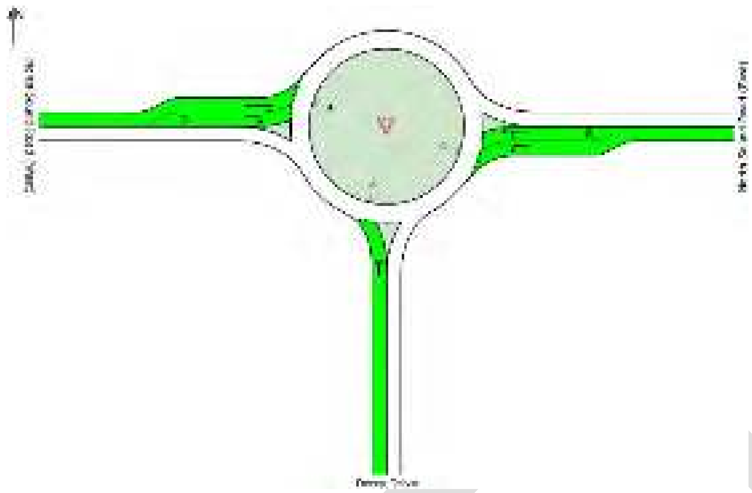


Figure 13.14 Sidra Model – Dorcy Drive roundabout – 2022 – PM Peak – Lane LOS

The analysis of the surrounding road network as a whole, which includes the three intersections above, shows that much of the network is affected by the BOB roundabout. During the morning peak the queue length (circa 0.7 miles [1.12 km]) on the North Sound Road (East) approach to the BOB roundabout affects the upstream intersections as can be seen on Figure 13.15. The queue length results in a LOS F for the section of North Sound Road between BOB roundabout and Seymour Road, and LOS B for a section of North Sound Road east of Seymour Road.

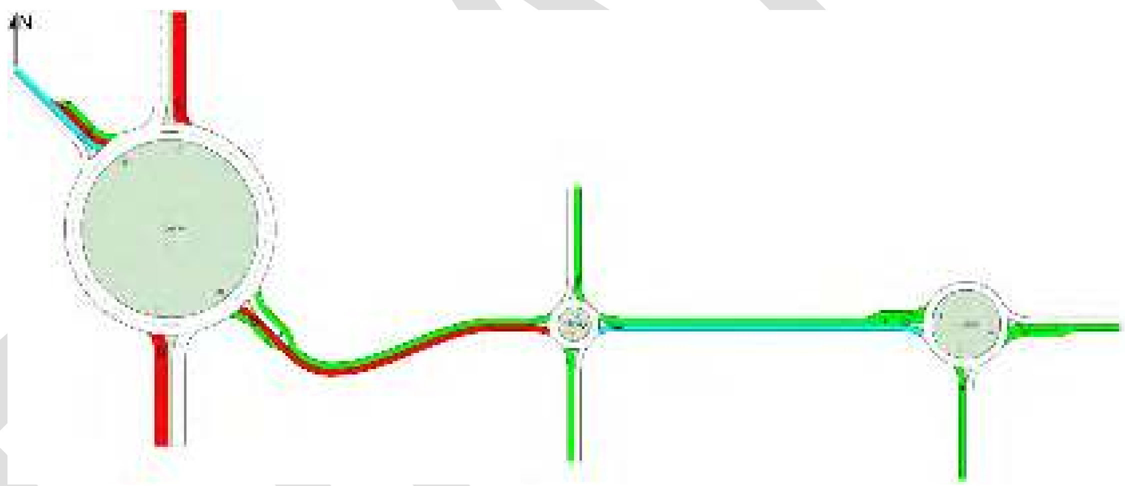


Figure 13.15 Sidra Model – North Sound Road Network 2022 – AM Peak – Lane LOS

The analysis of the surrounding road network also shows that much of the network is affected by the BOB roundabout during the afternoon/evening peak period. The queue length (circa 1.7 miles [2.74 km]) on the North Sound Road (East) approach to the BOB roundabout affects the upstream intersections as can be seen on Figure 13.16. The queue length results in a LOS F on North Sound Road. Further, empirical evidence would suggest that this queue and resulting capacity issues are experienced further upstream on North Sound Road and on side roads – Seymour Road and Dorcy Drive.

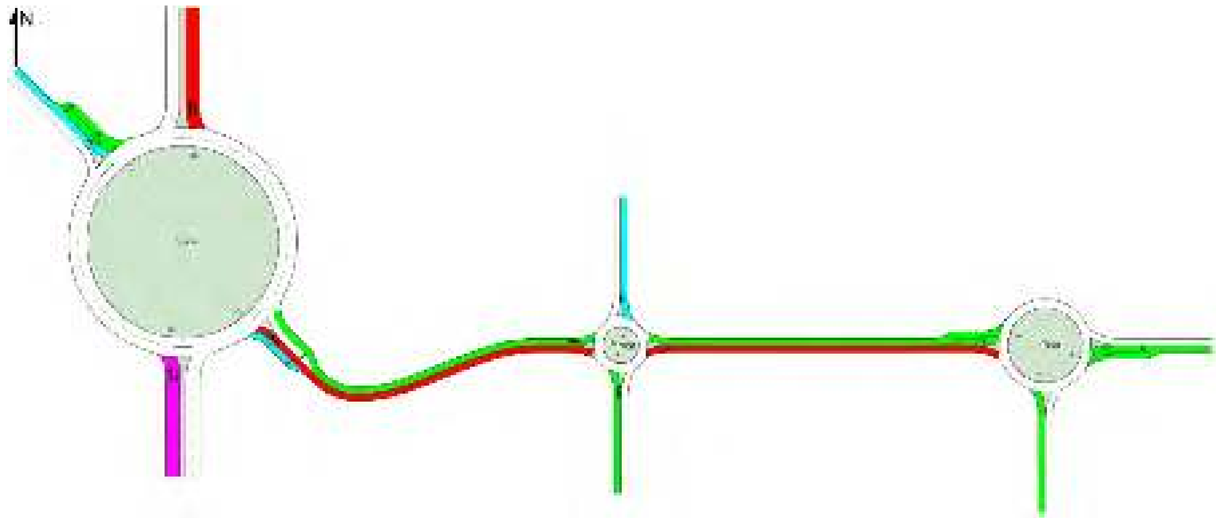


Figure 13.16 Sidra Model – North Sound Road Network – 2022 – PM Peak – Lane LOS

13.5.7 Operation of existing GTLF facility

As noted above, in order to estimate the volume of vehicles accessing the proposed ISWMS Site, it is necessary to undertake some analysis of the current operation and usage of the GTLF. There are two main types of waste generator that use the existing GTLF, namely civic amenity drop-offs by the public, and waste collection provided by the DEH Waste Collection Service (WCS) or private waste haulers.

The civic amenity drop-off area is for use by the general public with any light / medium vehicles such as a car, pickup or van. The public can dispose of any form of waste including household, vegetation, construction, metal, etc. in large skips located adjacent to the entrance to the landfill. Once filled, these skips are transported to and disposed of in the main landfill area. Household hazardous waste, car batteries etc., are collected separately and stored at the GTLF for later transportation overseas.

The posted operational hours for acceptance of bulk waste are 07:00 to 18:30 Monday to Saturday. The civic amenity drop-off area is open 24 hours, seven days per week. DEH has previously noted that, on infrequent occasions, the GTLF landfill is opened on Sundays for bulk waste when special demolition projects are underway that require access to the landfill.

The automatic traffic count undertaken in December 2022 gathered traffic flow data on Seymour Road just south of the existing entrance to the GTLF. Table 13.10 summarizes the traffic flow along that section of Seymour Road. The data shows that on average 50 – 60 vehicles arrive and depart the GTLF during the morning and afternoon/evening peak periods. The traffic data from 2012, reinforced with the data from 2022 shows that the peak traffic flows associated with the GTLF occur mostly outside the peak traffic periods of the surrounding intersections / roads.

13.5.8 Traffic collision records

Collision data for the Study Area roads for the years 2018 to 2023 was provided by the Royal Cayman Islands Police Service (RCIPS) Crime Analyst Team on June 1, 2023 and presented below:

North Sound Road motor vehicle accidents (MVA) [11]

- 2018 – 155
- 2019 – 178
- 2020 – 133
- 2021 – 197
- 2022 – 184
- 2023 – 88

Seymour Road MVA

- 2018 – 6
- 2019 – 2
- 2020 – 11
- 2021 – 6
- 2022 – 6
- 2023 – 4

13.6 Impact Assessment and Mitigation

13.6.1 Future conditions

The ISWMS Site is anticipated to open in 2026 per the layout provided on Figure 13.17. The proposed ISWMS is described in detail in Chapter 4.

The proposed working hours for the ISWMS Site facilities will vary based on the specific work demands and needs, as well as differing hours for both the public and companies using the facilities. The following information is presented in Chapter 4 of the Environmental Statement:

- ERF – the ERF will be functioning 24/7 (except for of approx. 10 days of planned annual maintenance) with opening hours from 04:00-18:00 Monday to Friday, 06:00- 16:00 Saturday and Bank Holidays, and closed Sunday, Christmas Day, Good Friday
- MRF, C&D, ELV, RWL, and Green Waste Facilities – will generally operate normal business hours
- Medical Waste Facility – will be open for 2 days per week, as required
- HWRC – will be open to the public for 52 hours per week but the hours will include weekends

[11] RCIPS note: *these figures relate to all of the North Sound Road. We rely on the exact location of the incident being recorded correctly to isolate the area between the roundabout and Dorcy Drive. I can confidently say that for the entirety of the Cayman Islands, the junction of North Sound Road, where it meets the Bank of Butterfield Roundabout, has consistently been in the top three motor vehicle accident hotspots over the last five years.*

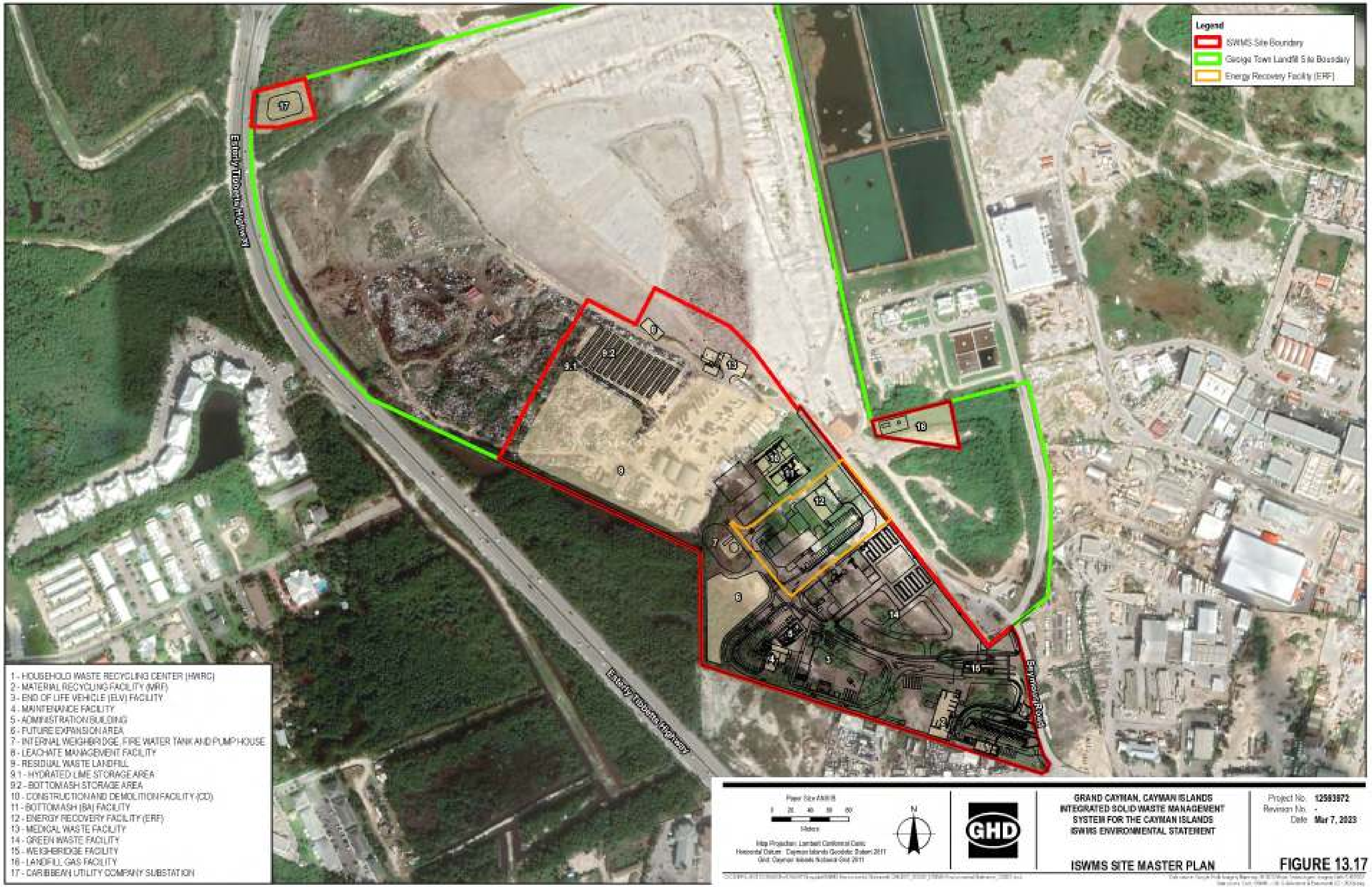


Figure 13.17 Proposed ISWMS Site layout

There are expected to be some 70 full-time staff working on the ISWMS Site. This is comparable to the existing staffing level at the GTLF, which is currently at 99 employees. Staff parking, including disabled parking, will be provided on site. As noted in Chapter 4, the site layout has been designed to allow free flow of vehicles that access both the public and back-of-house areas. Vehicle swept path movements have been tested using Autodesk's Vehicle Tracking software to ensure that sufficient space has been provided for turning maneuvers. Pedestrian sidewalks will be provided throughout much of the site to ensure safe access for staff and patrons. There are no plans currently to modify or augment the current public transport provisions within the Study Area.

As per the overall ISWMS proposal, the waste management procedures for the Sister Islands (Cayman Brac and Little Cayman) will change. It is proposed that waste will be collected and bulked in Cayman Brac before shipping to Grand Cayman for treatment at the ISWMS Site. As a worst-case estimate, it is expected that shipments will occur weekly with up to 10 truck movements per shipment to transport the waste from the port in George Town to the ISWMS Site at the opening year and up to 19 truck movements forecast by 2050.

13.6.1.1 Trip generation/ attraction

In order to assess the impact of the ISWMS Site on the surrounding road network, it is first necessary to estimate the likely Site trip generation during the peak hour. The proposed ReGen public / private agreement will not alter how waste is collected on Grand Cayman. It will arrive at the ISWMS Site in the same manner as currently managed. It is therefore assumed that the trips generated by the ISWMS Site will be similar to the trips currently generated by the GTLF.

13.6.1.2 Assessment year horizons

As part of the impact assessment of the proposed ISWMS, the analysis has identified three assessment year horizons in order to fully evaluate the potential impacts. These horizons are the Opening Year of the ISWMS Site, the Near-Term Year (five years after opening) and Medium-Term Year (10 years after opening). It is expected that the Opening Year of the ISWMS Site will be **2026**, therefore giving a Near-Term assessment year of **2031** and Medium-Term Year assessment of **2036**. The Base Year for traffic flow is **2022**, the year traffic data was predominately gathered.

In addition to the ISWMS related trips, other factors combine to generate future traffic flows. These include background traffic increases based on population growth and increased car ownership. The NRA developed a Travel Demand Model (TDM) following their island-wide traffic study in 2017. Based on this model and the anticipated population growth on island, the NRA predicts annual growth in traffic flow to be four percent on arterial roads such as the Esterly Tibbetts Highway and the 4 lane North Sound Road continuing south, and two percent on other roads. Based on this, the traffic flows on the surrounding arterial and other road network can be expected to increase from the Base Year by the growth rates outlined in Table 13.19. It is anticipated that waste generation and the traffic flows on Seymour Road associated with the ISWMS facilities will increase in a similar manner to those outlined above, at two percent per annum.

Based on a comparison of the recent traffic count data with data from a 2012 traffic count on Seymour Road (at the GTLF entrance), it has been noted that traffic flows to / from the GTLF have increased at an average rate of 3.6 percent per annum for the past 10 years. This is likely due to an increase in waste generation from ongoing development and population increase. In order to provide a robust analysis it has been assumed that the traffic associated with landfill facility will continue to grow at four percent per annum.

In addition to the growth in landfill related traffic and the trips associated with transporting sister-island waste from the port to the ISWMS Site, there will be a marginal increase in staff numbers when the ISWMS Site becomes operational. The forecast increase in traffic flow at the GTLF entrance (due to 4 per cent growth in landfill related traffic and the additional staff) equates to approximately 3 percent growth rate on the Seymour Road traffic at the NSR / SR roundabout - a 3 percent growth rate has therefore been employed locally on the associated approaches to this intersection. Refer to Table 13.19 for the forecast growth for the assessment years and Table 13.20 for the HGV forecast growth.

Table 13.19 Assessment year growth rates

Assessment Year Horizon	Growth Rate		
	Arterial Roads (4 per cent per annum)	Other Roads (2 per cent per annum)	Seymour Road (3 per cent per annum)
Opening Year 2026	17 percent	8 percent	13 percent
Near-Term 2031	42 percent	20 percent	30 percent
Medium-Term 2036	73 percent	32 percent	51 percent

Table 13.20 Assessment year GTLF HGV classification

Assessment Year Horizon	Grand Cayman Traffic (4 percent per annum)	Sister Island Trans-shipment	ISWMS Traffic (HGV Classification)
Base Year 2022	-	-	21 percent
Opening Year 2026	17 percent	10	22 percent
Near-Term 2031	42 percent	12	22 percent
Medium-Term Year 2036	73 percent	14	22 percent

13.6.1.3 Trip distribution

It is expected that traffic accessing the ISWMS Site will travel to the site in a similar manner as they currently access the GTLF Site. Waste collections will not alter significantly from the current arrangement. For this reason, it is assumed that trip distribution on the surrounding road network will be in line with current distribution of traffic associated with the GTLF.

13.6.1.4 Proposed road developments in Study Area

The Airport Connector Road is a new two-way median divided road that will connect the Esterly Tibbetts Highway (south of Camana Bay) to the north end of Sparky Drive. The road will travel adjacent the northern boundary of the ISWMS Site, however no access will be available to the site from the road. Part of this road is currently under construction. The expected completion date of this road is unknown. It is expected that this road will divert a significant proportion of the traffic to the airport and eastern parts of the Industrial Area that is currently traveling along North Sound Road. An assessment of any rearrangement of traffic distribution is outside the scope of this report.

The TS does not include an assessment of future developments within the Study Area other than the ISWMS Site. It is assumed that any such development will be subject to separate assessment and permitting processes, however it is assumed that traffic flow from any such development will be in line with background growth as outlined above.

13.6.1.5 Future traffic data

The following section presents the predicted traffic flows within the Study Area and adjacent intersection for the three assessment years outlined above. The traffic flows have been calculated using the traffic data presented in Section 13.5 and the growth rates identified in Table 13.19.

Traffic impact assessments such as this would typically measure impacts of a proposed development based on two scenarios – with and without development. These scenarios draw traffic flow comparisons between the scenario where the development is realized and a scenario where the development does not proceed. In the case of the proposed ISWMS Site, the with and without development scenarios are the same. This is due to the prediction that traffic flows generated by the ISWMS Site are expected to be similar to those generated by the GTLF site. For this reason, the future traffic flows presented here are confined to the horizon years outlined above, based on the predicted growth in traffic flows on the surrounding road network.

13.6.1.5.1 Opening year – 2026

The following figures summarize the predicted peak hour traffic flows on intersections within the Study Area during the Opening year, 2026.

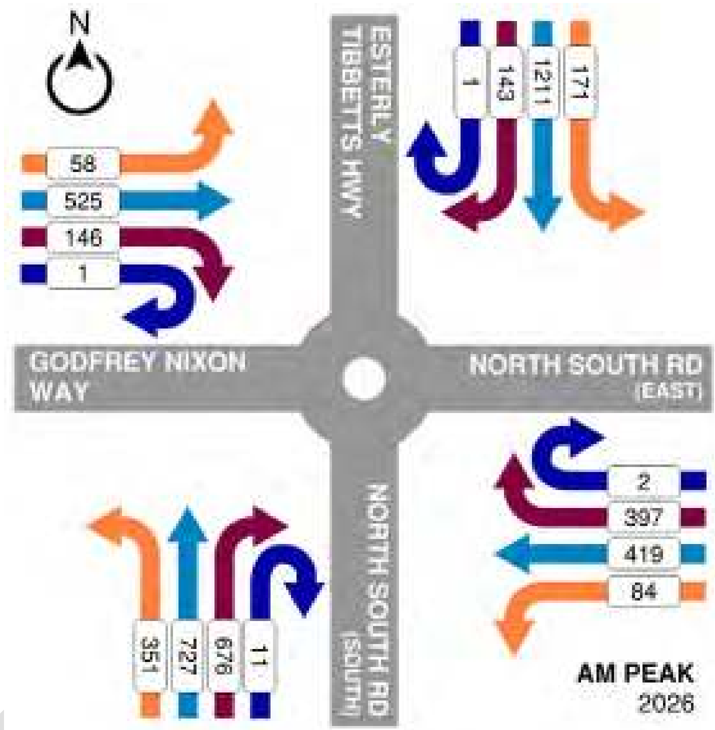


Figure 13.18 Bank of Butterfield roundabout – Morning Peak – 2026

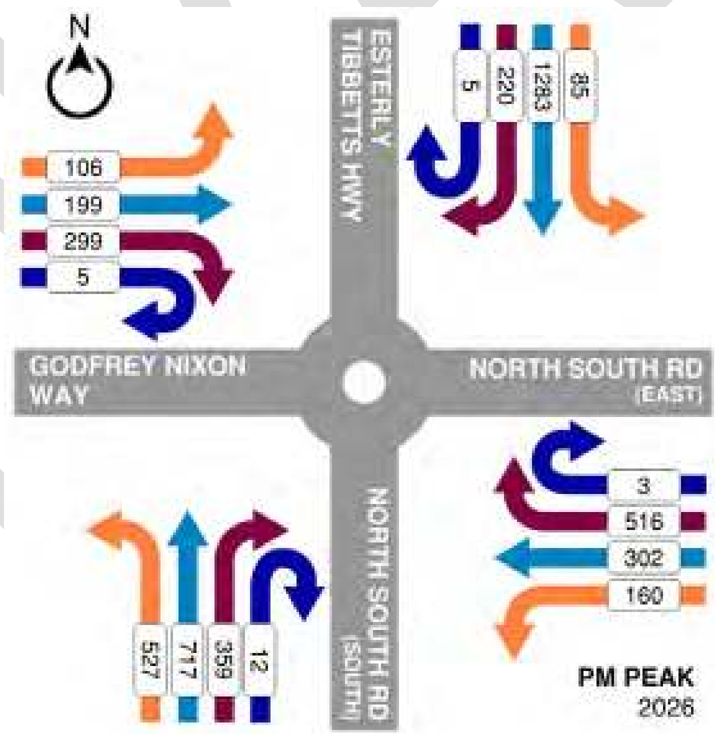


Figure 13.19 Bank of Butterfield roundabout – Afternoon/Evening Peak – 2026

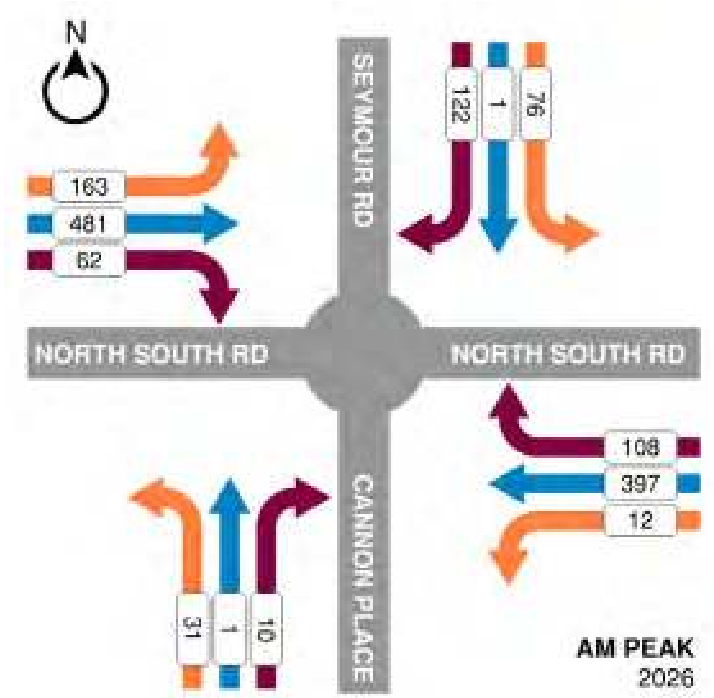


Figure 13.20 Intersection of North Sound Road & Seymour Road – Morning Peak – 2026

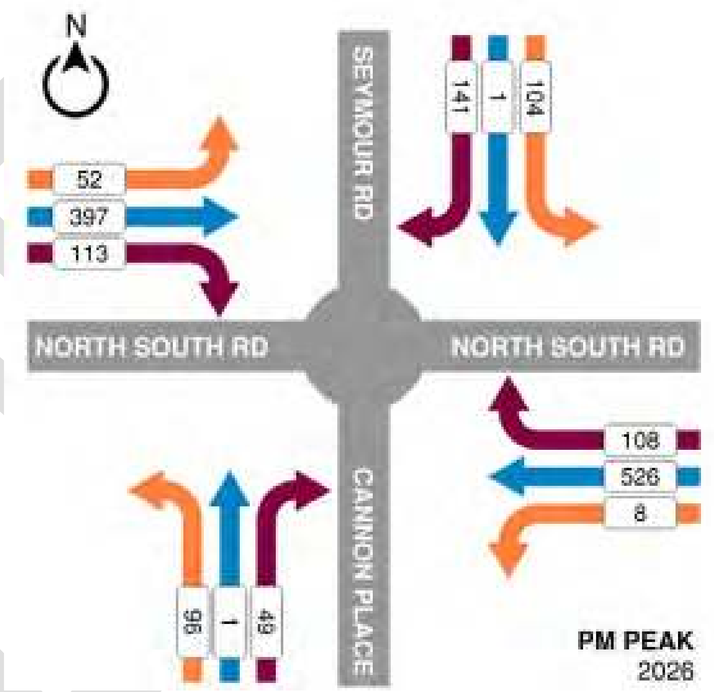


Figure 13.21 Intersection of North Sound Road & Seymour Road – Afternoon/Evening Peak – 2026

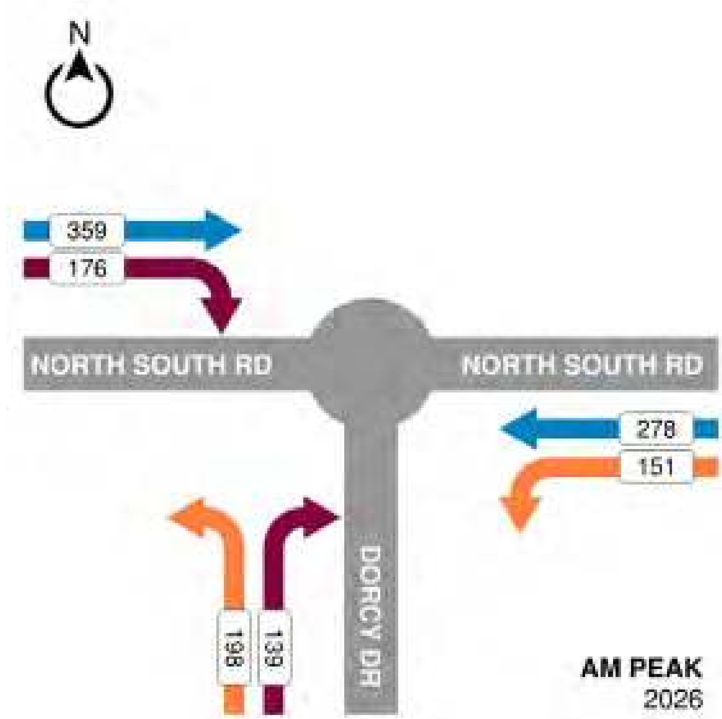


Figure 13.22 Intersection of North Sound Road & Dorcy Drive – Morning Peak – 2026

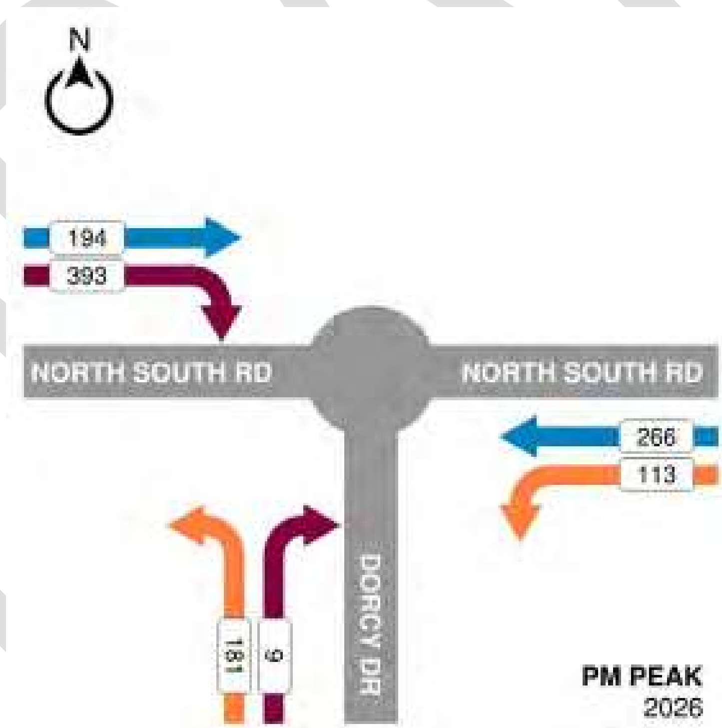


Figure 13.23 Intersection of North Sound Road & Dorcy Drive – Afternoon/Evening Peak – 2026

13.6.1.5.2 Near-term year – 2031

The following figures summarize the predicted peak hour traffic flows on intersections within the Study Area during the near-term year, 2031.

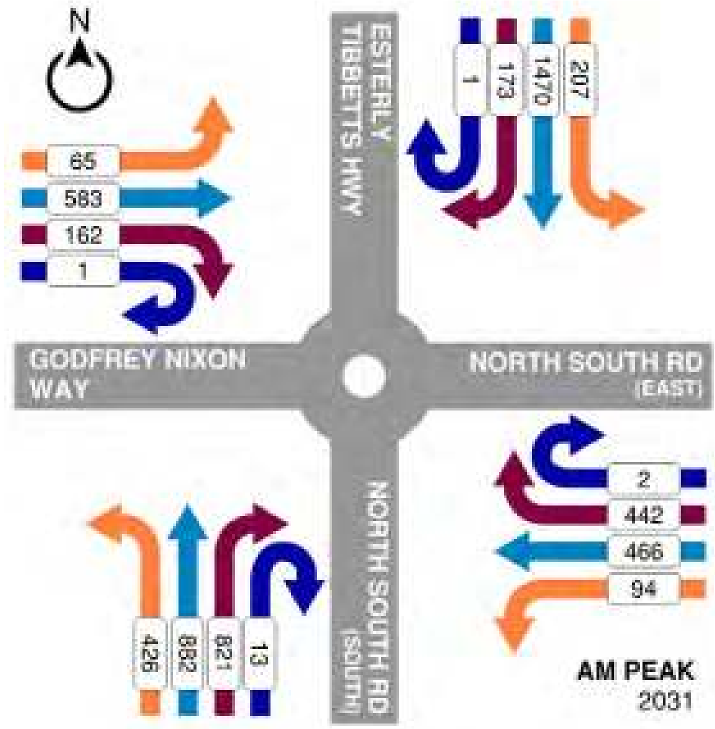


Figure 13.24 Bank of Butterfield roundabout – Morning Peak – 2031

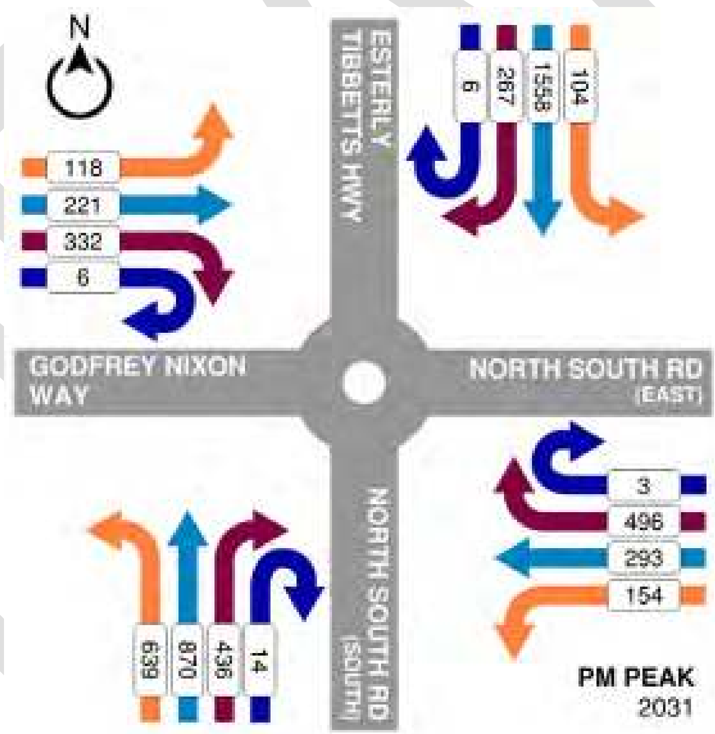


Figure 13.25 Bank of Butterfield roundabout – Afternoon/Evening Peak – 2031

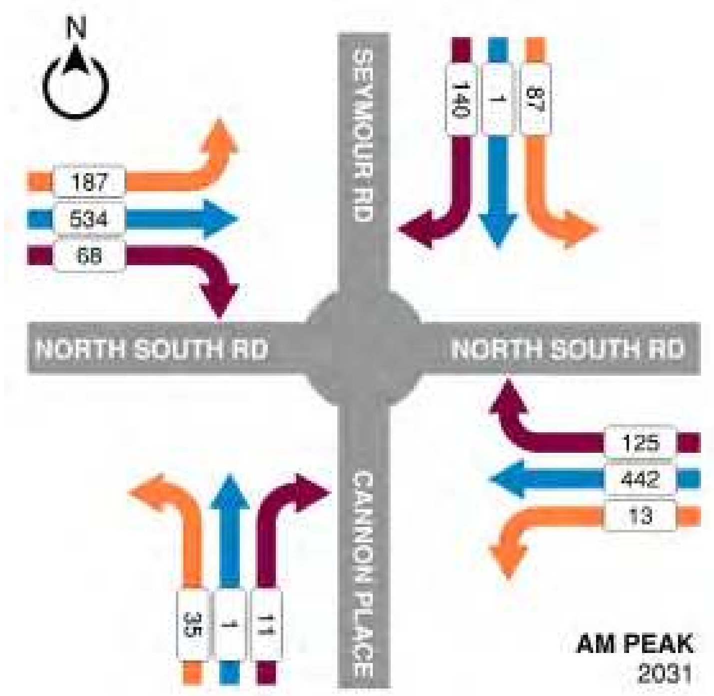


Figure 13.26   Intersection of North Sound Road & Seymour Road – Morning Peak – 2031

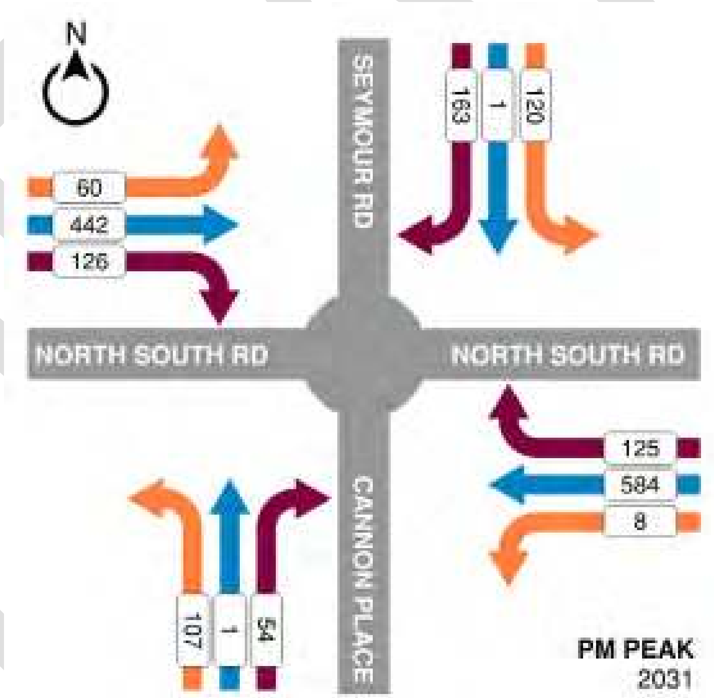


Figure 13.27   Intersection of North Sound Road & Seymour Road – Afternoon/Evening Peak – 2031

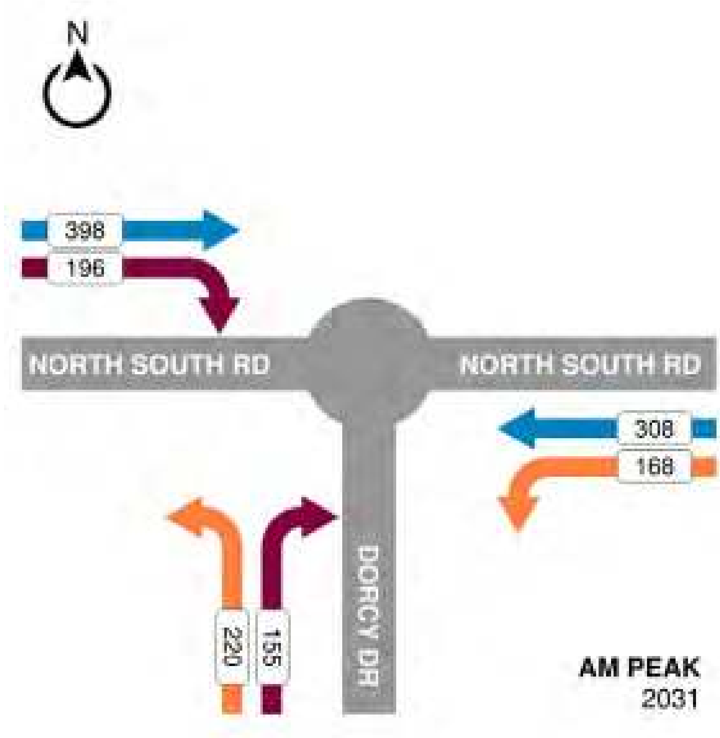


Figure 13.28 Intersection of North Sound Road & Dorcy Drive – Morning Peak – 2031

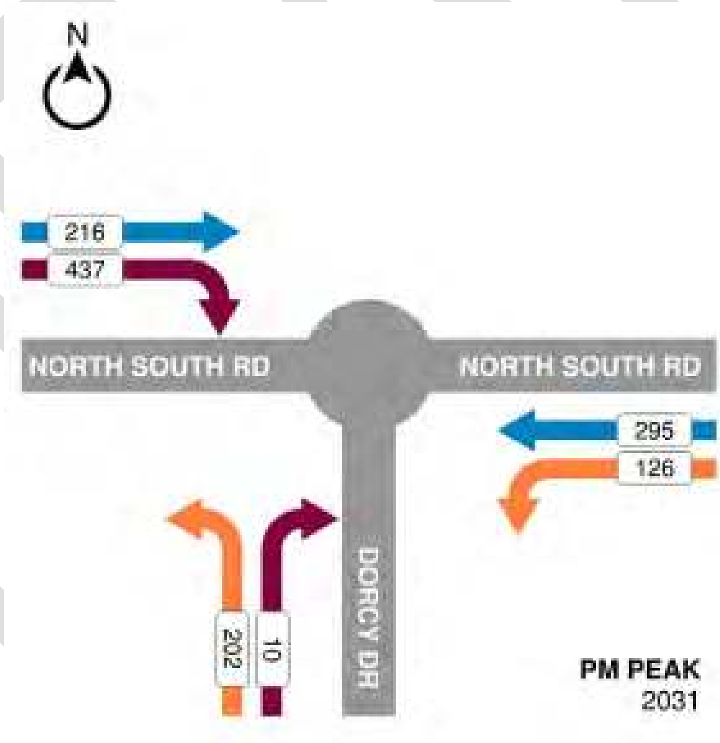


Figure 13.29 Intersection of North Sound Road & Dorcy Drive – Afternoon/Evening Peak – 2031

13.6.1.5.3 Medium-term year – 2036

The following figures summarize the predicted peak hour traffic flows on intersections within the Study Area during the medium-term year, 2036.

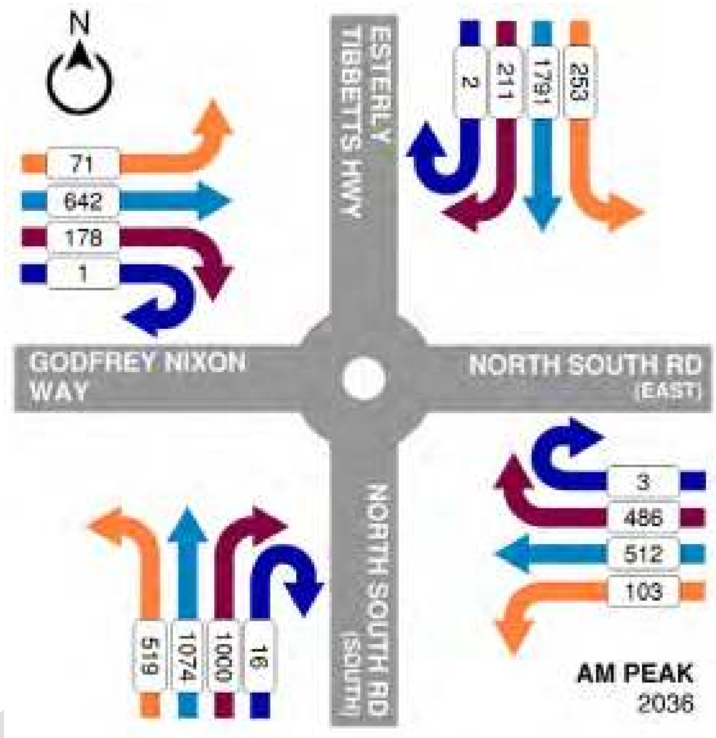


Figure 13.30 Bank of Butterfield roundabout – Morning Peak – 2036

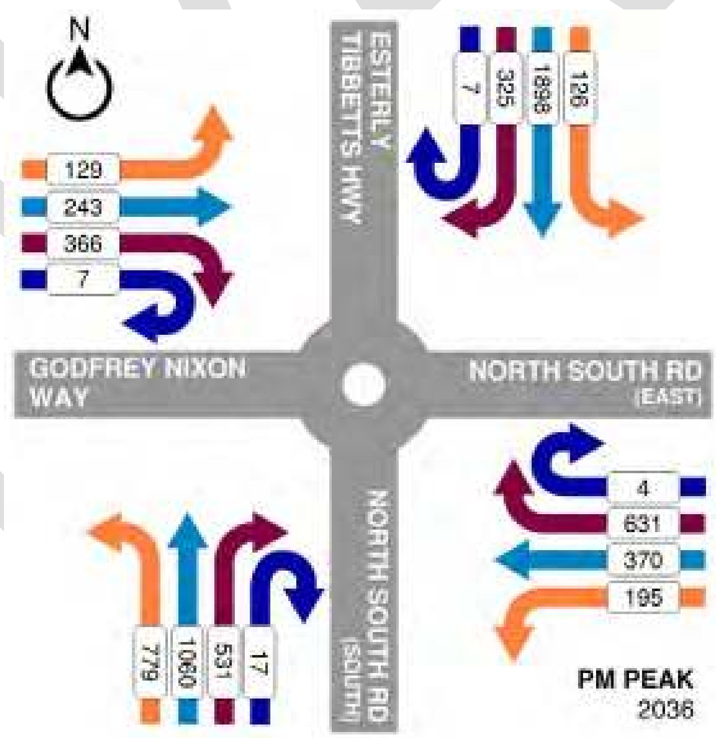


Figure 13.31 Bank of Butterfield roundabout – Afternoon/Evening Peak – 2036

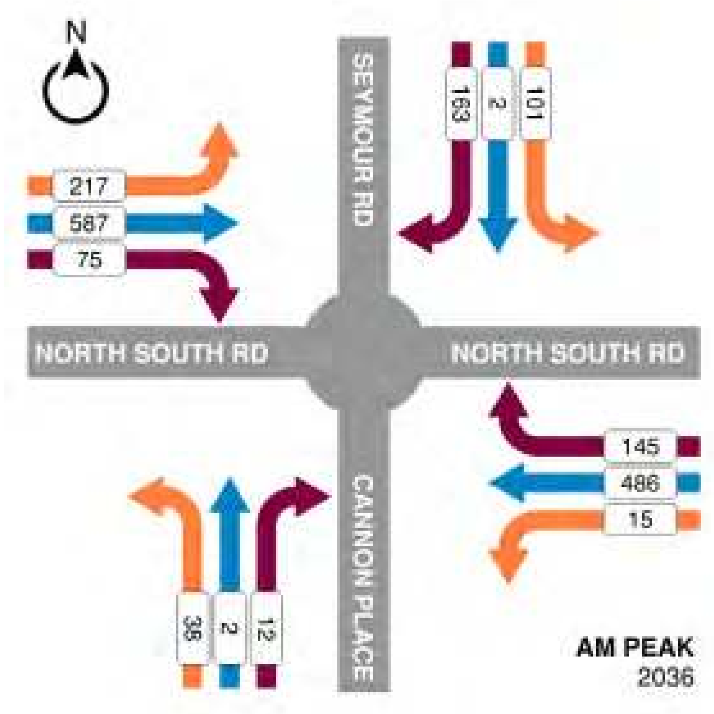


Figure 13.32 Intersection of North Sound Road & Seymour Road – Morning Peak – 2036

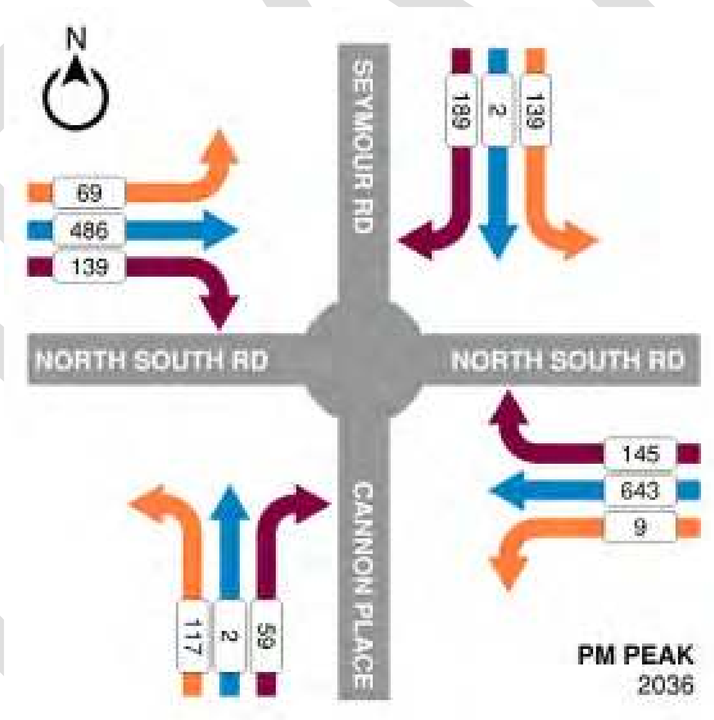


Figure 13.33 Intersection of North Sound Road & Seymour Road – Afternoon/Evening Peak – 2036

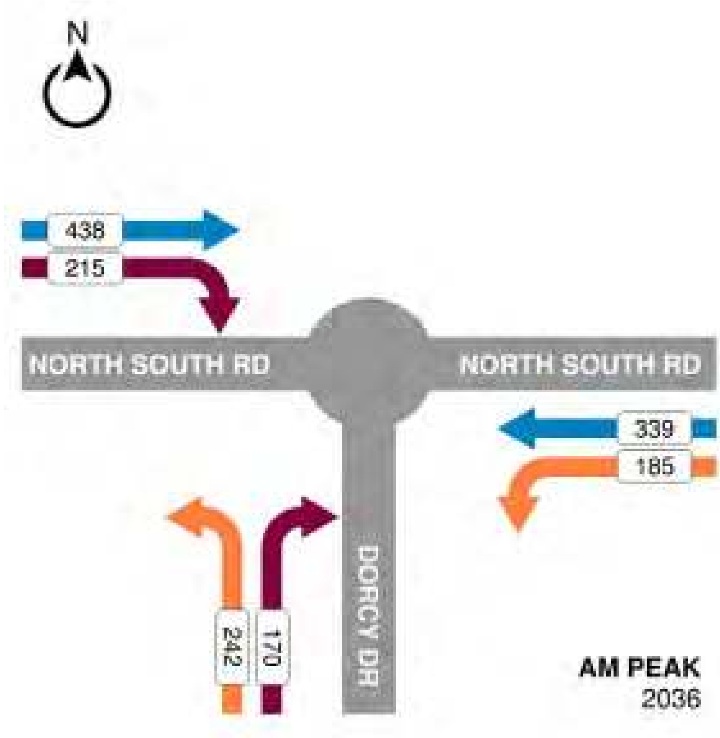


Figure 13.34 Intersection of North Sound Road & Dorcy Drive – Morning Peak – 2036

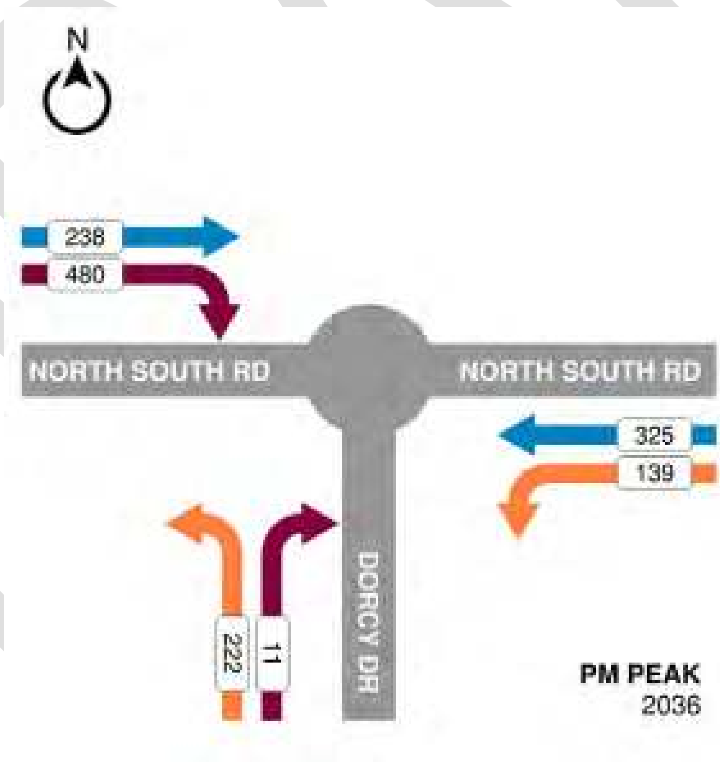


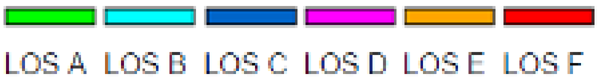
Figure 13.35 Intersection of North Sound Road & Dorcy Drive – Afternoon/Evening Peak – 2036

13.6.2 Traffic analysis

Analysis of the predicted future traffic flows on the surrounding network has been undertaken. As outlined above, the predicted future traffic flows are due to background growth on the network and are not directly related to the development of the ISWMS Site – they are predicted to occur whether the ISWMS Site is constructed or not.

Traffic analysis has been undertaken for the three Assessment Horizons – Opening Year (2026), Near-Term Year (2031) and the Medium-Term Year (2036). The traffic flow data was analyzed using Sidra Intersection software, as it was for the Base Year Peak Hour Traffic Flow Analysis in Section 13.4.1 Findings are presented based on the analysis undertaken.

A reminder that the LOS is colour-coded on the following diagrams as follows:



13.6.2.1 Opening year assessment horizon – 2026

The three main intersections on the surrounding road network were analyzed individually and as well as part of the overall North Sound Road network. Refer to Figure 13.36 through Figure 13.43 showing the predicted Level of Service for each approach / lane to each intersection for the 2026 Near-Term assessment horizon.

The approach / lane LOS for BOB roundabout during the morning and afternoon/evening peaks are shown on Figure 13.36 and Figure 13.37, respectively. The results show that most approaches to the intersection will continue to experience significant capacity issues due to background traffic growth. In particular, the northbound approach for North Sound Road (South) degrades from LOS D & E in 2022 to LOS F in 2026.

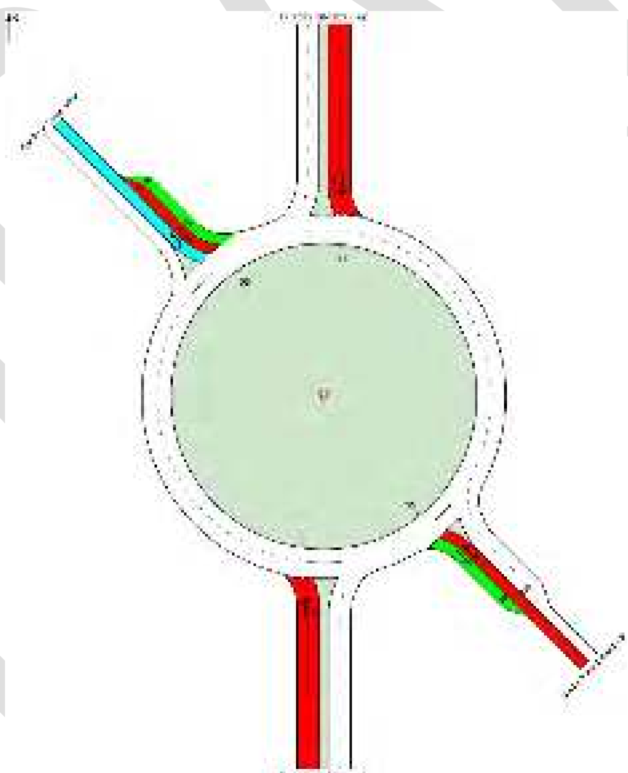


Figure 13.36 Sidra Model – Bank of Butterfield roundabout – 2026 – AM Peak – Lane LOS

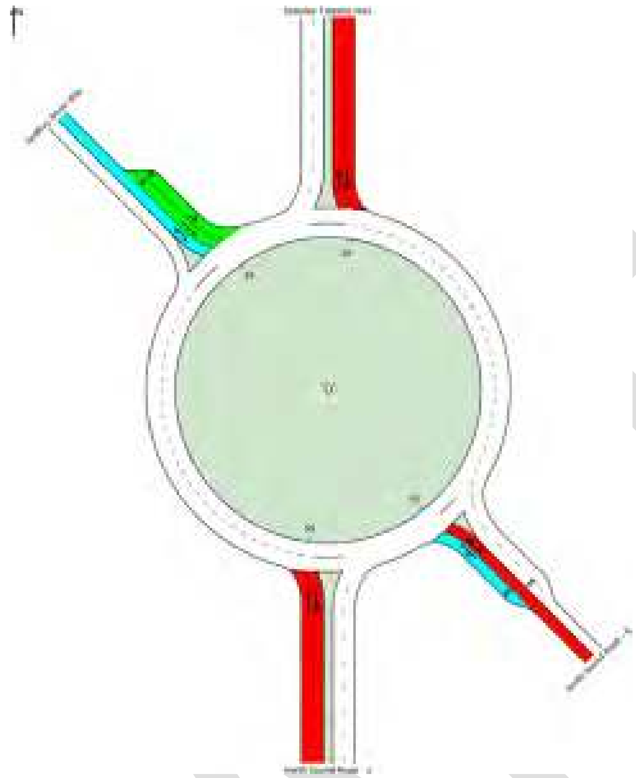


Figure 13.37 Sidra Model – Bank of Butterfield roundabout – 2026 – PM Peak – Lane LOS

The approach/lane LOS for the North Sound Road / Seymour Road mini-roundabout during the morning and afternoon/evening peaks are shown on Figure 13.38 and Figure 13.39. The results show that the Seymour Road and North Sound Road (East) approaches are predicted to degrade in the peak periods in the coming years.

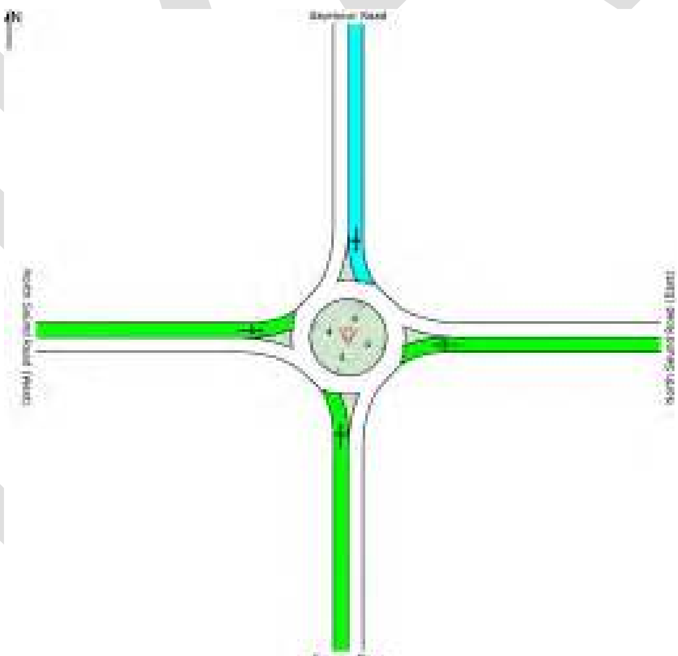


Figure 13.38 Sidra Model – Seymour Road roundabout – 2026 – AM Peak – Lane LOS

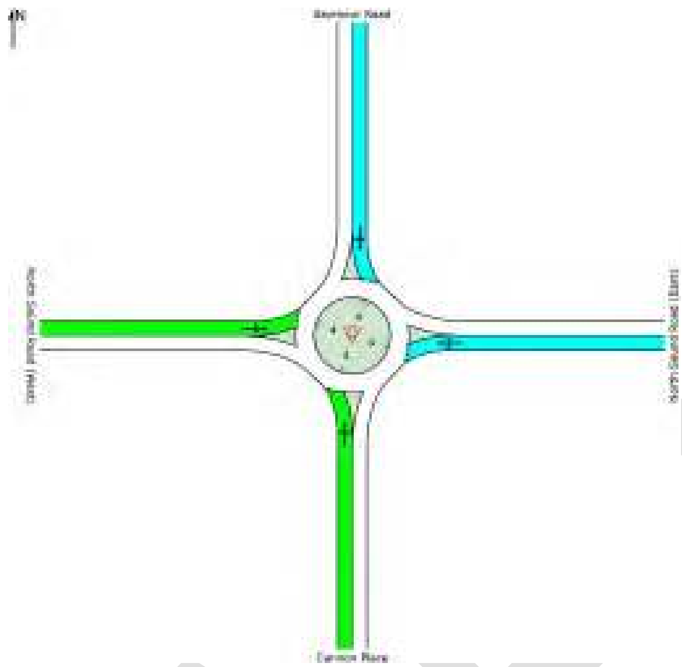


Figure 13.39 Sidra Model – Seymour Road roundabout – 2026 – PM Peak – Lane LOS

The approach/lane LOS for the North Sound Road / Dorcy Drive mini-roundabout during the morning and afternoon/evening peaks are shown on Figure 13.40 and Figure 13.41. The results show that all approaches are predicted to continue to operate at LOS A during the peak periods.

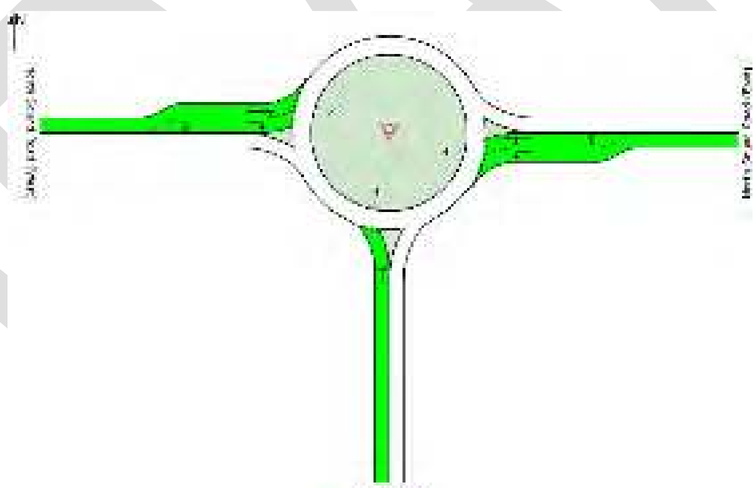


Figure 13.40 Sidra Model – Dorcy Drive roundabout – 2026 – AM Peak – Lane LOS

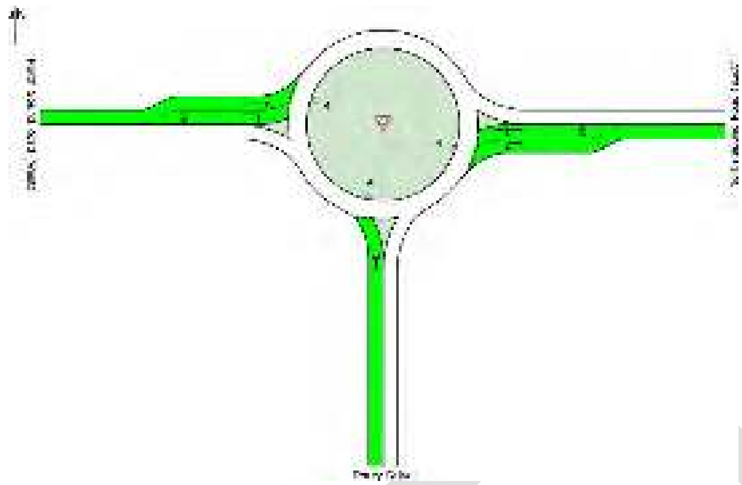


Figure 13.41 Sidra Model – Dorcy Drive roundabout – 2026 – PM Peak – Lane LOS

The analysis of the North Sound Road network as a whole, which includes the three intersections, shows that the network will continue to be affected by the capacity issues at BOB roundabout. Refer to Figure 13.42 for the morning peak hour analysis results and Figure 13.43 for the afternoon/evening peak hour results. Interrogation of the analysis results shows that the 95-percentile queue length on the North Sound Road (East) approach is predicted to increase to 220 vehicles during the morning peak hour, equating to an estimated distance of over 1.0 mile (1.6 km) and 441 vehicles during the morning peak hour, equating to an estimated distance of nearly 2.0 miles (3.21 km). This will significantly impact the operation of North Sound Road through the Study Area.

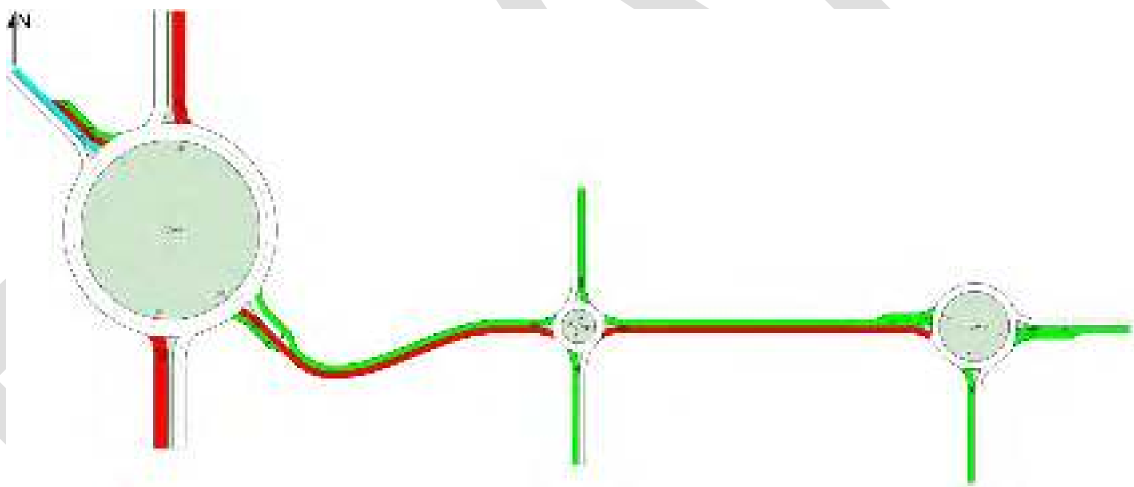


Figure 13.42 Sidra Model – North Sound Road Network – 2026 – AM Peak – Lane LOS

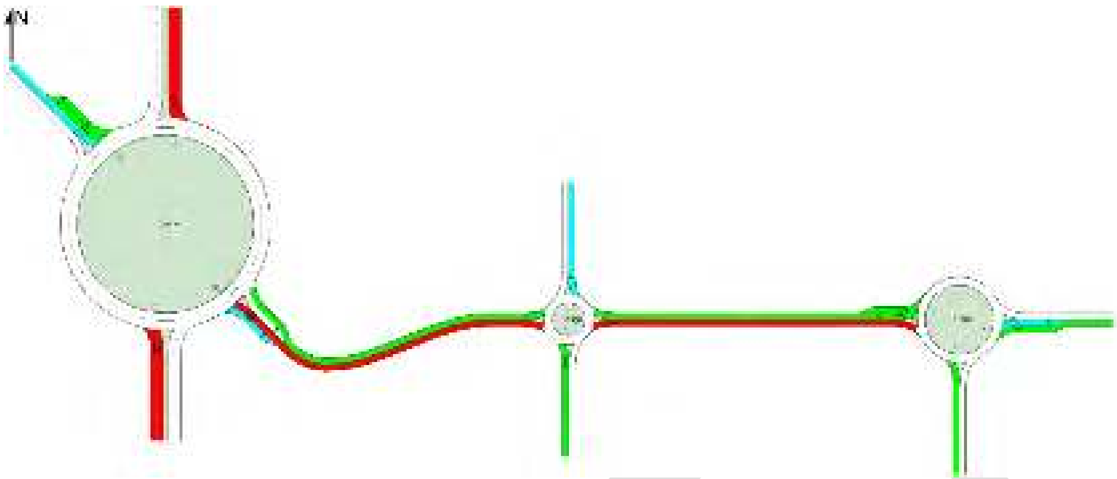


Figure 13.43 Sidra Model – North Sound Road Network – 2026 – PM Peak – Lane LOS

13.6.2.2 Near-term assessment horizon – 2031

The three main intersections on the surrounding road network were analyzed individually and as well as part of the overall North Sound Road network. Refer to Figure 13.44 through Figure 13.51 showing the predicted Level of Service for each approach / lane to each intersection for the 2031 Near-Term assessment horizon.

The approach / lane LOS for BOB roundabout during the morning and afternoon/evening peaks are shown on Figure 13.44 and Figure 13.45, respectively. The results show that the North Sound Road (East) approach, as well as other approaches, will continue to experience significant capacity issues due to background traffic growth.

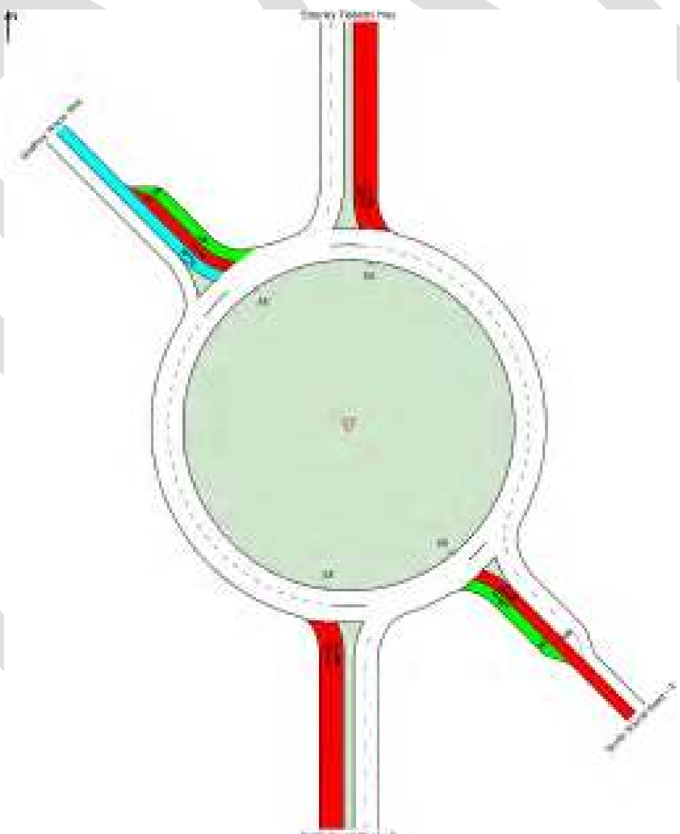


Figure 13.44 Bank of Butterfield roundabout – 2031 – AM Peak – Lane LOS

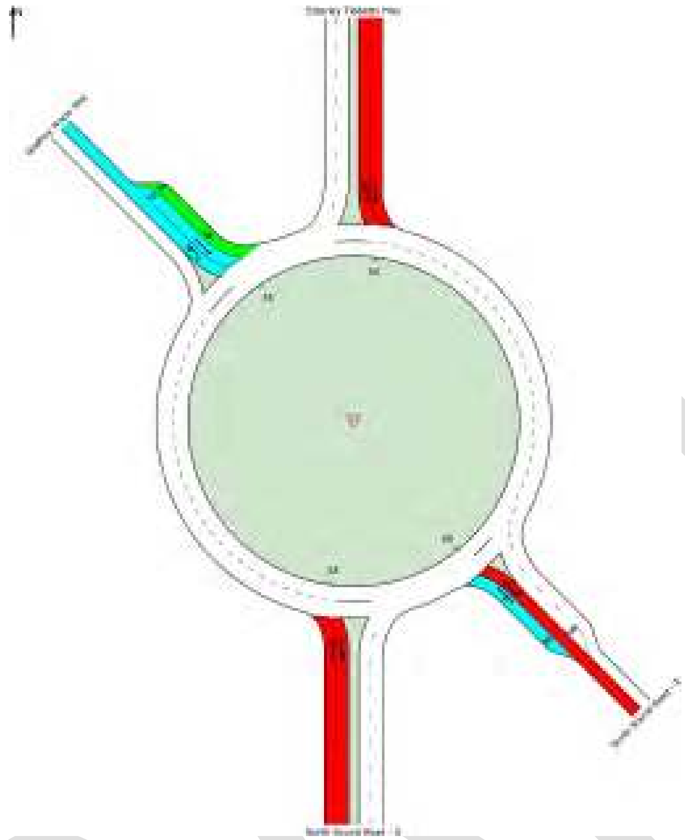


Figure 13.45   Bank of Butterfield roundabout – 2031 – PM Peak – Lane LOS

The approach/lane LOS for the North Sound Road / Seymour Road mini-roundabout during the morning and afternoon/evening peaks are shown on Figure 13.46 and Figure 13.47. The results show that the Seymour Road and North Sound Road (East) approaches are predicted to experience LOS B with other approaches operating at LOS A.

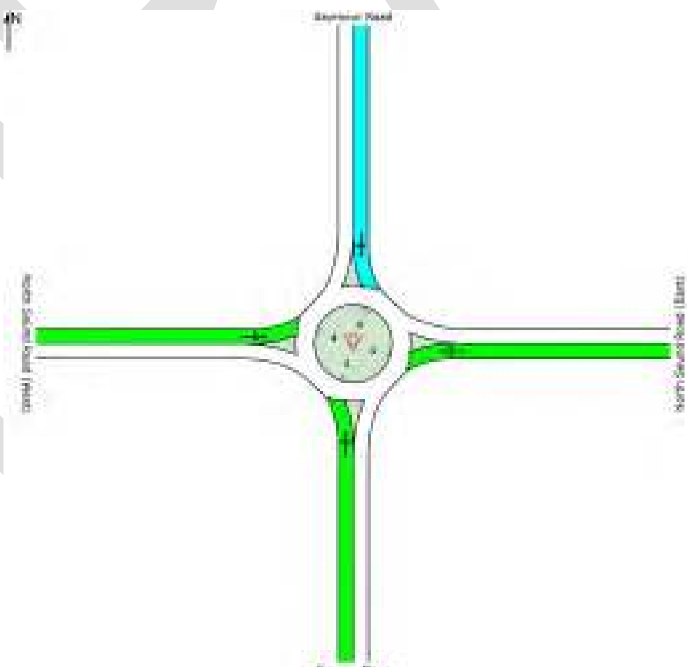


Figure 13.46   Sidra Model – Seymour Road roundabout – 2031 – AM Peak – Lane LOS

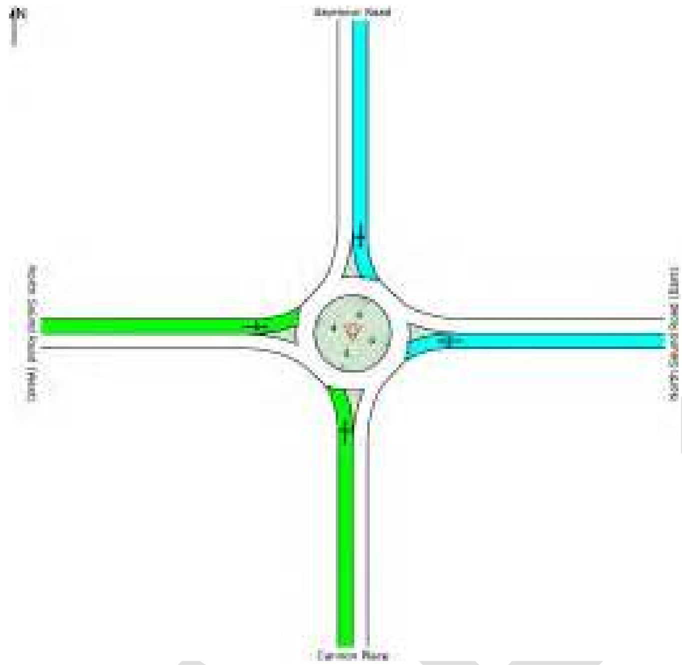


Figure 13.47 Sidra Model – Seymour Road roundabout – 2031 – PM Peak – Lane LOS

The approach/lane LOS for the North Sound Road / Dorcy Drive mini-roundabout during the morning and afternoon/evening peaks are shown on Figure 13.48 and Figure 13.49. The results show that all approaches will continue to operate at LOS A during the peak periods.

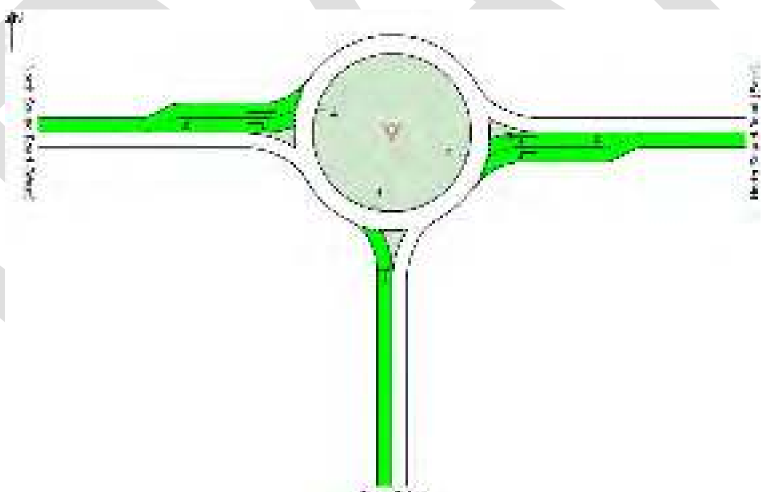


Figure 13.48 Sidra Model – Dorcy Drive roundabout – 2031 – AM Peak – Lane LOS

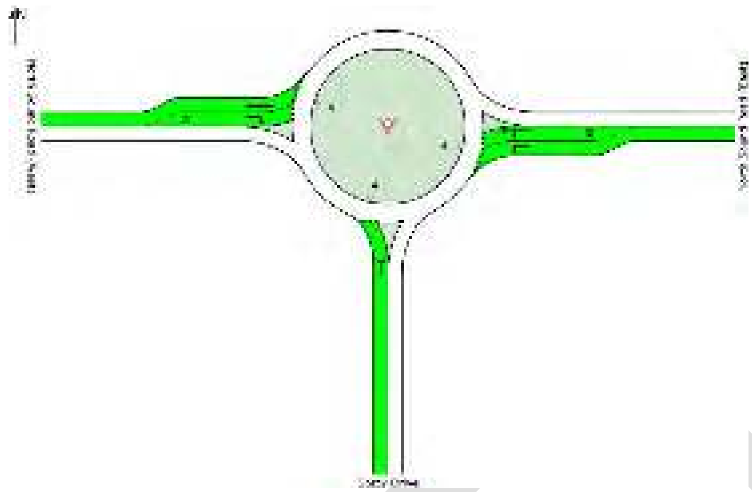


Figure 13.49 Sidra Model – Dorcy Drive roundabout – 2031 – PM Peak – Lane LOS

The analysis of the North Sound Road network as a whole shows that the network will continue to be affected by the capacity issues at BOB roundabout. Refer to Figure 13.50 for the morning peak hour analysis results and Figure 13.51 for the afternoon/evening peak hour results.

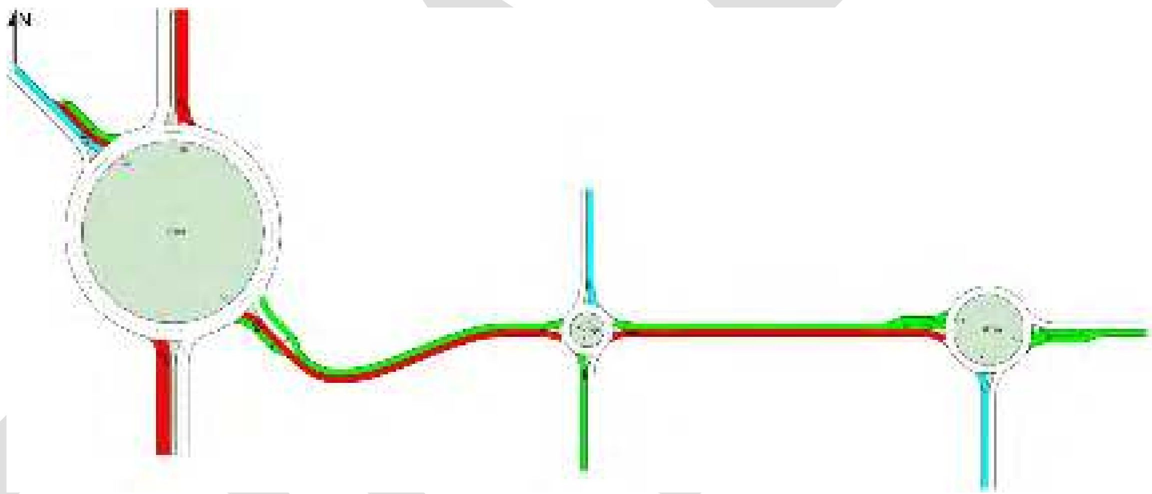


Figure 13.50 Sidra Model – North Sound Road Network – 2031 – AM Peak – Lane LOS

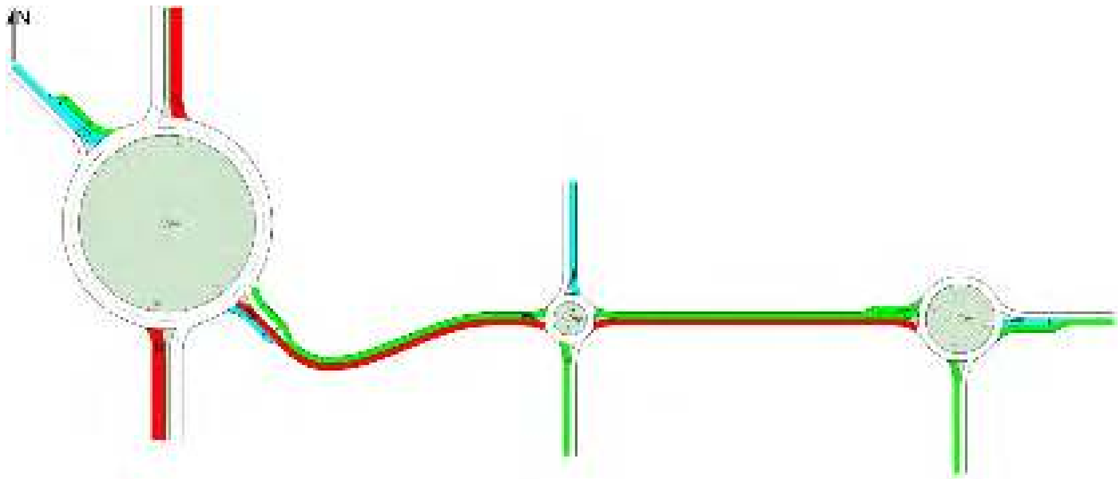


Figure 13.51 Sidra Model – North Sound Road Network – 2031 – PM Peak – Lane LOS

13.6.2.3 Medium-term year assessment horizon – 2036

The three main intersections on the surrounding road network were analyzed individually and as well as part of the overall North Sound Road network. Refer to Figure 13.52 through Figure 13.59 showing the predicted Level of Service for each approach/lane to each intersection for the 2036 Near-Term assessment horizon.

The approach/lane LOS for BOB roundabout during the morning and afternoon/evening peaks are shown on Figure 13.52 and Figure 13.53, respectively. The results show that the North Sound Road (East) approach, as well as other approaches, will continue to experience significant capacity issues due to background traffic growth.

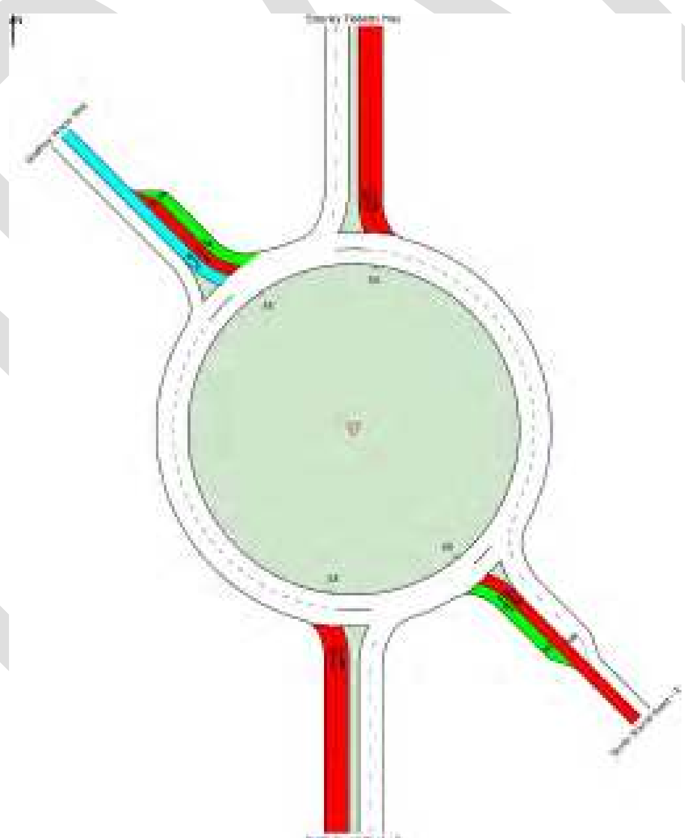


Figure 13.52 Sidra Model – Bank of Butterfield roundabout – 2036 – AM Peak – Lane LOS

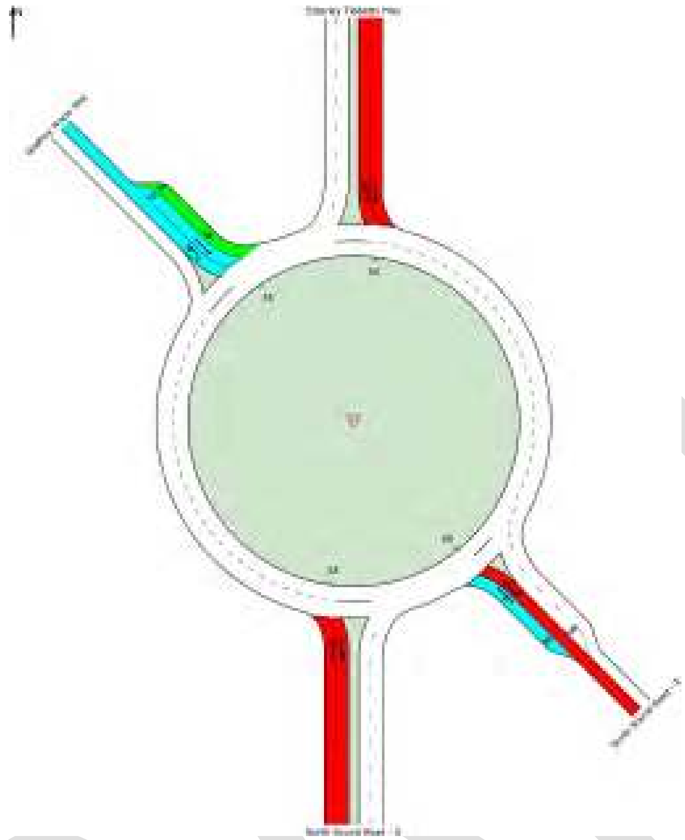


Figure 13.53 Sidra Model – Bank of Butterfield roundabout – 2036 – PM Peak – Lane LOS

The approach/lane LOS for the North Sound Road / Seymour Road mini-roundabout during the morning and afternoon/evening peaks are shown on Figure 13.54 and Figure 13.55. The results show that most approaches will reduce to LOS B during the peak periods, with the North Sound Road (East) approach degrading to LOS E during the afternoon/evening peak.

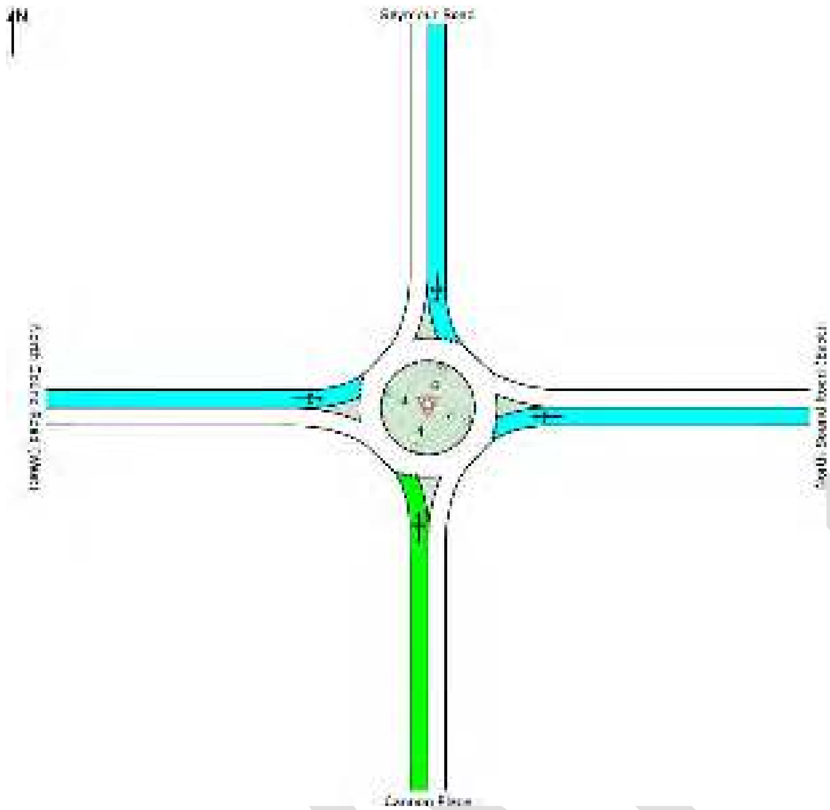


Figure 13.54 Sidra Model – Seymour Road roundabout – 2036 – AM Peak – Lane LOS

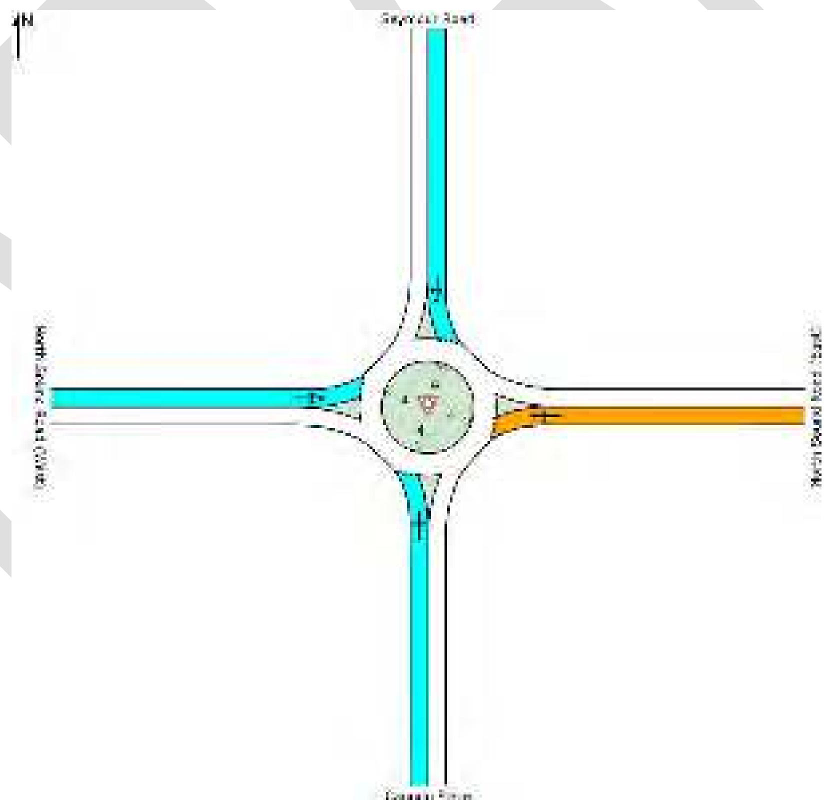


Figure 13.55 Sidra Model – Seymour Road roundabout – 2036 – PM Peak – Lane LOS

The approach/lane LOS for the North Sound Road / Dorcy Drive mini-roundabout during the morning and afternoon/evening peaks are shown on Figure 13.56 and Figure 13.57. The results show that some approaches are predicted to degrade to LOS B during the morning and afternoon/evening peak period.

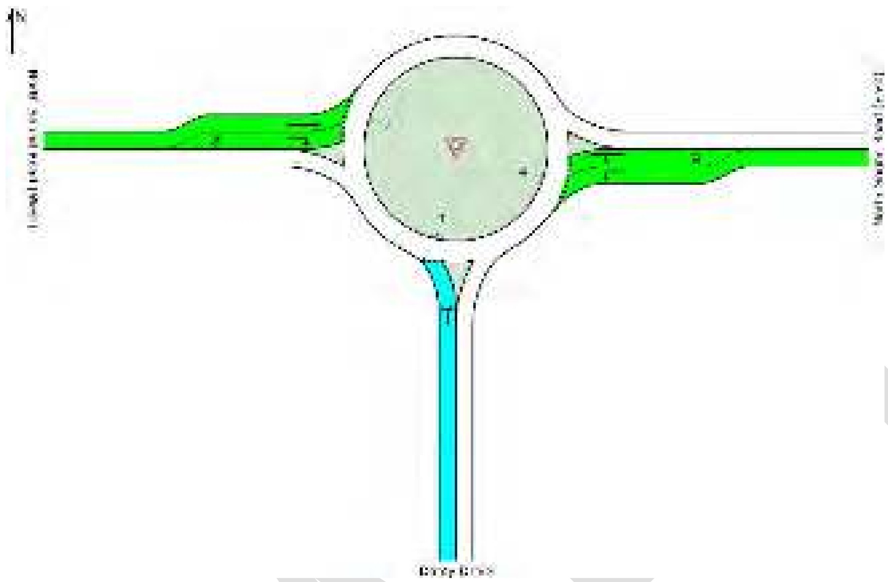


Figure 13.56 Sidra Model – Dorcy Drive roundabout – 2036 – AM Peak – Lane LOS

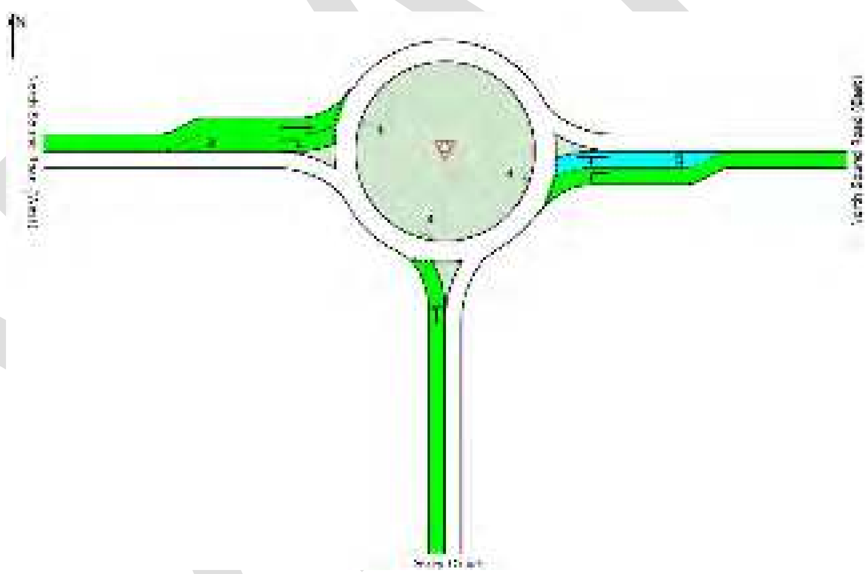


Figure 13.57 Sidra Model – Dorcy Drive roundabout – 2036 – PM Peak – Lane LOS

The analysis of the North Sound Road network as a whole, which includes the three intersections, shows that the network will continue to be affected by the capacity issues at BOB roundabout. Refer to Figure 13.58 for the morning peak hour analysis results and Figure 13.59 for the afternoon/evening peak hour results. Interrogation of the analysis results shows that the 95-percentile queue length on the North Sound Road (East) approach is predicted to increase to 416 vehicles during the morning peak hour, equating to an estimated distance of over 1.9 miles (3.1 km) and 639 vehicles during the morning peak hour, equating to an estimated distance of nearly 2.9 miles (4.67 km). This will significantly impact the operation of North Sound Road through the Study Area.

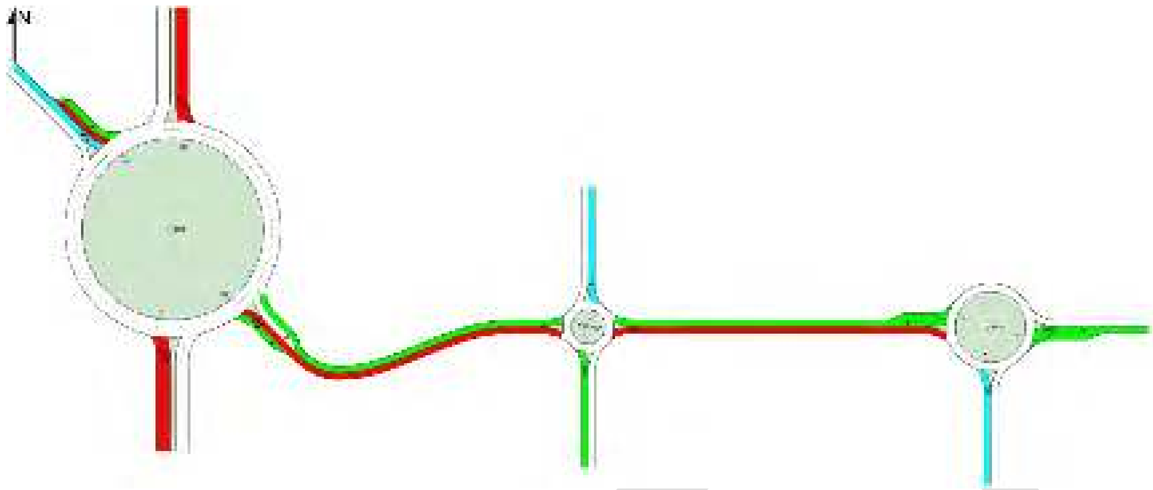


Figure 13.58 Sidra Model – North Sound Road Network – 2036 – AM Peak – Lane LOS

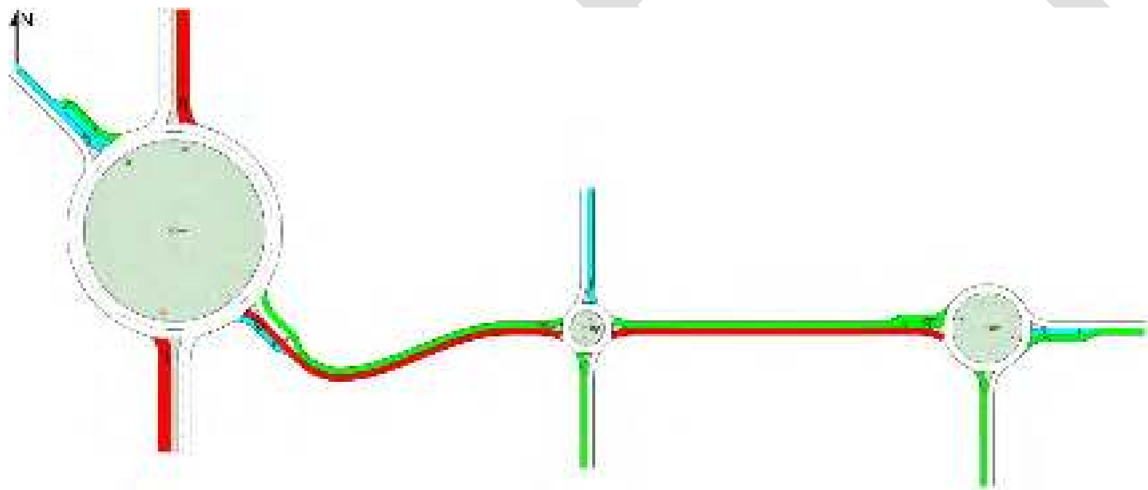


Figure 13.59 Sidra Model – North Sound Road Network – 2036 – PM Peak – Lane LOS

13.6.3 Construction impacts

The intention is that all ISWMS facilities will come online at approximately the same time. It is anticipated that design, engineering, procurement and construction, including site preparation and auxiliary works, for the ERF will take approximately two and a half years. It is anticipated that design, engineering, procurement and construction for the non-ERF facilities will take approximately one and a half years.

The construction works are likely to include:

– Site preparation, incorporating clearance works, site levelling, demolition and earthworks
– Piling and foundation works
– Erection of buildings
– Internal road construction
– Underground and overhead utility works

It is expected that at its peak activity period approximately 300 construction staff would be required to construct the ISWMS Site including the associated buildings. The construction phase is a temporary condition and the 300 personnel will only be on Site during the peak construction stage. Typical construction working hours in the

Cayman Islands are from 07:00 - 16:00. Based on this, the majority of the construction personnel will be travelling during the morning peak period and will partially straddle the afternoon/evening peak period.

It can be expected that construction personnel will travel to site using multiple models of transport – private vehicle, shared trips (multi-occupancy vehicles), bicycle and some public transport and on foot. For the purposes of analysis, we have assumed that of the 300 staff, 150 additional vehicles would be added to the traffic along North Sound Road & Seymour Road during the peak periods. This is consistent with transportation patterns on construction sites on Grand Cayman[12].

It can be anticipated that the construction personnel will travel to the site in distribution similar to those already travelling on North Sound Road.

Figure 13.60 and Figure 13.61 show the resulting LOS for Seymour Road roundabout for the base year (2022) with construction traffic during the morning and afternoon/evening peak periods, respectively. In order to undertake a robust analysis of the construction impacts, all construction traffic is modelled to utilize the network during the peak periods. The addition of the construction traffic reduces the LOS on the North Sound Road (East) approach from LOS "B" (reasonably free flow) to LOS "C" (stable flow) during the morning peak. During the afternoon/evening peak, the LOS on Seymour Road is reduced from LOS "B" (reasonably free flow) to LOS "C" (stable flow). It can be seen that the inclusion of additional traffic related to construction personnel travel to/from of the ISWMS Site has some minor impacts on the surrounding road network (approximately 13 to 15 percent increase on the existing traffic flow for the Seymour Road roundabout).

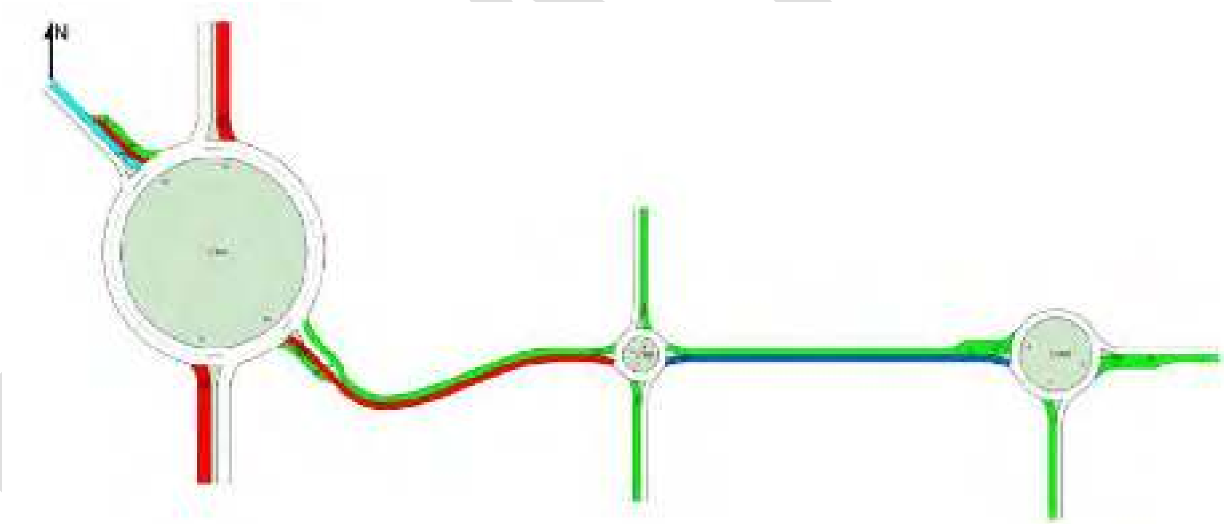


Figure 13.60 Sidra Model – North Sound Road Network – Base Year with Construction Traffic AM Peak – Lane LOS

12 Based on behaviour of construction staff at two current construction projects (Indigo and Hospital). Approximately 50 percent-60 percent of construction staff drive to work with the remaining majority car sharing and a smaller proportion utilizing public bus. Some existing sub-contractors do also have a company specific bus service for their staff.

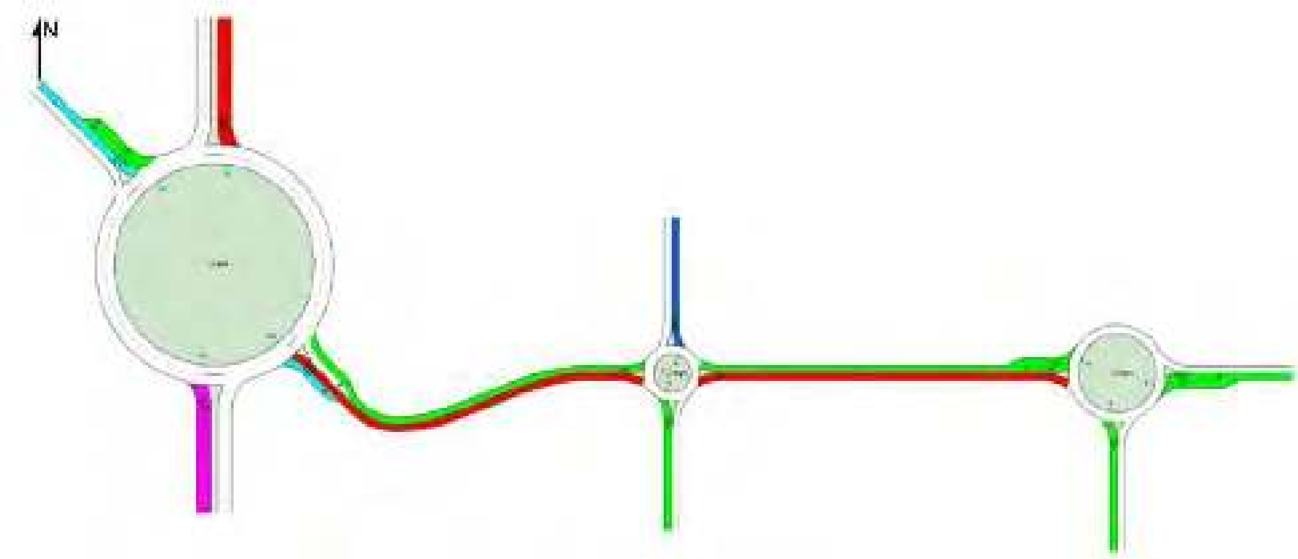


Figure 13.61 Sidra Model – North Sound Road Network – Base Year with Construction Traffic PM Peak – Lane LOS

The construction process will require machinery on site as well as vehicle and truck movements on the surrounding road network. Forecasts of the construction traffic prepared by the design team currently expect that approximately 37 HGVs per day will travel to / from the ISWMS site during the pile-construction stage of the project. It is expected that most construction delivery movements on the surrounding road network will occur outside the peak traffic flow periods. Based on this and the analysis above, it can be deduced that the construction delivery traffic will cause negligible impact on the surrounding road network. Movement of any large industrial equipment to the site during construction will be managed by specific plans that will consider Health & Safety and protection of any utilities along the path.

13.6.4 Mitigation

A Construction Traffic Management Plan (CTMP) will be prepared as part of the Environmental Management Plan (EMP) for the ISWMS Site prior to construction and will include consideration of the following:

– Consideration of any abnormal loads;
– Protocols for the movement of large industrial equipment to the ISWMS Site, considering Health & Safety and protection of utilities along the path;
– Signage warning other users of the construction;
– Information regarding road maintenance and cleaning;
– Specific timings to avoid peak traffic within the surrounding area;
– Wheel cleaning/dirt control arrangements at key stages of construction; and
– Provision of temporary signs and traffic control where necessary.

The ISWMS EMP will also include protocol(s) related to spills of hazardous and dangerous loads.

There are limited strategies available to improve traffic flow through the Study Area. As has been shown, the capacity issues on the surrounding road network are not as a result of the ISWMS Site and will progressively degrade over the coming years. One method of mitigating the impact of the ISWMS Site on the surrounding road network would be to encourage staff and other landfill associated traffic to access the site outside the peak periods of the network. We have determined from the traffic data available that this already occurs. The peak traffic flows associated with the GTLF occur mostly outside the peak traffic periods of the surrounding intersections/roads – any temporary fluctuations in traffic flow at the GTLF entrance will not impact peak hour operation of the rest of the road network within the Study Area.

The opening of the Airport Connector Road is likely to reduce traffic flow on the North Sound Road, however an assessment of that impact is outside the scope of the TS.

13.6.5 Impact analysis

This Section reports the likely effects of the Proposed Development in terms of Traffic and Transportation impacts within the defined Study Area, based on the findings from the TS, and whether these would be deemed to be significant.

Table 13.21 Significance of operation and construction traffic increases on local road network

Likely significant potential effect	Receptor	Mitigation	Residual effect	
			Magnitude & rationale	Significance
Operation				
Driver severance and delay at junctions or links subject to traffic flow increases which are either approaching capacity, or are over capacity (or delays resulting from traffic diversions)	Other vehicles using the local road network	No mitigation required/ proposed	The TS has demonstrated that while the intersections within the Study Area will experience a further deterioration in service in the future due to projected traffic growth for Grand Cayman, the change in total traffic and driver delay within the Study Area due to operation of the ISWMS Site is considered **very low**.	Seymour Road (from North Sound Road to the Site entrance) – **Negligible** North Sound Road (between Dorcy Drive and Esterly Tibbetts Highway) – **Slight/Negligible**
Pedestrian severance and delay at locations where physical obstructions or increases in traffic flows more than 30 percent are forecast to result in an increase in severance	Pedestrian using the local roads	No mitigation required/ proposed	The TS has demonstrated that the ISWMS Site will not result in increases in traffic flows more than 30 percent[13], therefore pedestrian severance and delay within the Study Area during operation is considered **very low**.	Seymour Road (from North Sound Road to the Site entrance) – **Negligible** North Sound Road (between Dorcy Drive and Esterly Tibbetts Highway) – **Slight/Negligible**
Pedestrian amenity and intimidation at junctions or links subject to substantial increases in traffic flow in conjunction with any changes in footway widths or crossing facilities.	Pedestrian using the local roads	No mitigation required/ proposed	No changes in footway widths or crossing facilities are proposed near the ISWMS site, therefore pedestrian amenity and intimidation within the Study Area during operation will remain similar to existing conditions/operations and the development to the ISWMS will not increase any existing pedestrian amenity and intimidation and is therefore considered to be **very low**.	Seymour Road (from North Sound Road to the Site entrance) – **Negligible** North Sound Road (between Dorcy Drive and Esterly Tibbetts Highway) – **Slight/Negligible**
Accidents and safety at links and junctions (for which data is available) with existing accident rates more than national averages which may be subject to an increase in traffic flows.	Local road users, adjacent land uses to the carriageway, pedestrian and cyclists	No mitigation required/ proposed	The TS has demonstrated that the intersections within the Study Area will experience a further deterioration in service in the future due to projected traffic growth for Grand Cayman and that the opening of the ISWMS is not expected to have a direct impact on the surrounding road network, as traffic associated with the Site will be in line with existing traffic flows associated with	Seymour Road (from North Sound Road to the Site entrance) – **Negligible** North Sound Road (between Dorcy Drive and Esterly Tibbetts Highway) – **Slight/Negligible** to **Slight/Moderate**

13 30 percent change is considered to double the delay experienced by pedestrian attempting to cross the road according to the IEMA guidelines.

Likely significant potential effect	Receptor	Mitigation	Residual effect	
			Magnitude & rationale	Significance
			the GTLF. As such, there is no predicted change in collision rates on the surrounding road network anticipated from the operation of the ISWMS. Study Area - There are no known existing safety issues with Study Area Seymour Road that would be exacerbated by the operation of the ISWMS and therefore, accidents and safety at links and junctions Study Area along Seymour Road is considered **very low**. Considering existing high MVA rates along North Sound Road (information on severity of collisions was not provided), known existing safety issues with North Sound Road have the potential to be exacerbated by the operation of the ISWMS and therefore, accidents and safety at links and junctions along North Sound Road is considered **very low** to **low medium**.	
Hazardous and dangerous loads (consideration of estimated number and composition of loads and assessment of accident risk if considered significant)[14]	Local road users, adjacent land uses to the carriageway, pedestrian and cyclists	ISWMS EMP to include spill protocol for hazardous/ dangerous loads	The TS has demonstrated that traffic associated with the ISWMS Site will be in line with existing traffic flows associated with the GTLF, including hazardous and dangerous loads. Further, there is no indication that if an accident did occur there would be a spillage. Therefore, the potential for effects on local road users, adjacent land uses to the carriageway, pedestrians and cyclists within the Study Area during operation due to hazardous and dangerous loads is considered **very low**.	Seymour Road (from North Sound Road to the Site entrance) – **Negligible** North Sound Road (between Dorcy Drive and Esterly Tibbetts Highway) – **Slight/Negligible**

[14] The IEMA guidelines note that the number of movements should be calculated and if it is considered to be significant then a risk analysis should be undertaken.

Likely significant potential effect	Receptor	Mitigation	Residual effect	
			Magnitude & rationale	Significance
Construction				
Driver severance and delay at junctions or links subject to traffic flow increases which are either approaching capacity, or are over capacity (or delays resulting from traffic diversions)	Other vehicles using the local road network	Construction delivery movements on the surrounding road network to occur outside the peak traffic flow periods.	The TS has demonstrated that the construction of the ISWMS Site will cause minor temporary impacts on the surrounding road network during the peak periods related to movement of construction staff to/from the site (approximately 13 to 15 percent increase on the existing traffic flow for the Seymour Road roundabout) and that construction delivery traffic will cause negligible impact on the surrounding road network. Therefore, driver severance and delay within the Study Area during construction is considered **very low**.	Seymour Road (from North Sound Road to the Site entrance) – **Negligible** North Sound Road (between Dorcy Drive and Esterly Tibbetts Highway) – **Slight/Negligible**
Pedestrian severance and delay at locations where physical obstructions or increases in traffic flows more than 30 percent are forecast to result in an increase in severance	Pedestrian using the local roads	Construction delivery movements on the surrounding road network to occur outside the peak traffic flow periods.	The TS has demonstrated that the construction of the ISWMS Site will cause some minor temporary impacts on the surrounding road network during the peak periods related to movement of construction staff to/from the site (approximately 13 to 15 percent increase on the existing traffic flow for the Seymour Road roundabout) and that construction delivery traffic will cause negligible impact on the surrounding road network. Therefore, pedestrian severance and delay within the Study Area during construction is considered **very low**.	Seymour Road (from North Sound Road to the Site entrance) – **Negligible** North Sound Road (between Dorcy Drive and Esterly Tibbetts Highway) – **Slight/Negligible**
Pedestrian amenity and intimidation at junctions or links subject to substantial increases in traffic flow in conjunction with any changes in footway widths or crossing facilities.	Pedestrian using the local roads	Movement of any large industrial equipment to the site during construction will be managed by specific plans that will consider Health & Safety and protection of any utilities along the	No changes in footway widths or crossing facilities are proposed for the construction of the ISWMS project, therefore pedestrian amenity and intimidation within the Study Area during construction is considered **very low**.	Seymour Road (from North Sound Road to the Site entrance) – **Negligible** North Sound Road (between Dorcy Drive and Esterly Tibbetts Highway) – **Slight/Negligible**

Likely significant potential effect	Receptor	Mitigation	Residual effect	
			Magnitude & rationale	Significance
		path. These will be included in the CTMP that will be prepared as part of the EMP.		
Accidents and safety at links and junctions (for which data is available) with existing accident rates more than national averages which may be subject to an increase in traffic flows	Local road users, adjacent land uses to the carriageway, pedestrian and cyclists	Movement of any large industrial equipment to the site during construction will be managed by specific plans that will consider Health & Safety and protection of any utilities along the path. These will be included in the CTMP that will be prepared as part of the EMP.	The TS has demonstrated that the construction of the ISWMS Site will cause some minor temporary impacts on the surrounding road network during the peak periods related to movement of construction staff to/from the site (approximately 13 to 15 percent increase on the existing traffic flow for the Seymour Road roundabout) and that construction delivery traffic will cause negligible impact on the surrounding road network. There are no known existing safety issues with Seymour Road that would be exacerbated by the construction of the ISWMS and therefore, accidents and safety at links and junctions along Seymour Road is considered **very low**. Considering existing high MVA rates along North Sound Road (information on severity of collisions was not provided), known existing safety issues with North Sound Road have the potential to be exacerbated by the construction of the ISWMS and therefore, accidents and safety at links and junctions along North Sound Road is considered **very low** to **low medium** Study Area.	Seymour Road (from North Sound Road to the Site entrance) – **Negligible** North Sound Road (between Dorcy Drive and Esterly Tibbetts Highway) – **Slight/Negligible** to **Slight/Moderate**
Hazardous and dangerous loads (consideration of estimated number and composition of loads and assessment of accident risk if considered significant)	Local road users, adjacent land uses to the carriageway, pedestrian and cyclists	Movement of any large industrial equipment to the site during construction will be managed by specific plans that will consider Health & Safety and	The TS has demonstrated that construction delivery traffic will cause negligible impact on the surrounding road network. Hazardous and dangerous loads are not anticipated as part of the construction of the ISWMS Site. Further, there is no indication that if an accident did occur there would be a spillage. Therefore, the potential for	Seymour Road (from North Sound Road to the Site entrance) – **Negligible** North Sound Road (between Dorcy Drive and Esterly Tibbetts Highway) – **Slight/Negligible**

Likely significant potential effect	Receptor	Mitigation	Residual effect	
			Magnitude & rationale	**Significance**
		protection of any utilities along the path. These will be included in the CTMP that will be prepared as part of the EMP. EMP to include spill protocol.	effects on local road users, adjacent land uses to the carriageway, pedestrians and cyclists within the Study Area during construction due to hazardous and dangerous loads is considered **very low**.	

13.7 Conclusions

The preceding sections provide information on the existing road network surrounding the proposed ISWMS Site and detail the current operation of the GTLF and proposed operation of the ISWMS. A detailed assessment of the traffic and road related aspects of the proposed development was undertaken, including a discussion on the expected trip generation of the ISWMS. A capacity assessment was provided for the three intersections within the Study Area that could be impacted by the proposed development and future traffic flows within the Study Area were calculated for the Opening Year (2026), Near-Term Year (2031) and the Medium-Term Year (2036). Impacts to the Study Area road network during the ISWMS Site construction phase are also reported as part of the TS.

The following points summarize the major assumptions underpinning the Traffic Statement:

- The ISWMS Site operations (operating times, waste collection practices, etc.) are expected to be similar to the existing GTLF operations with a marginal increase in staff numbers compared to existing
- Trip generation by the ISWMS Site is expected to be in line with the trips currently generated by the GTLF. There are no plans to modify the waste collection practices
- Trip distribution to and from the ISWMS Site is expected to be similar to existing trip distribution at the GTLF

The following points summarize the major findings of the TS:

- The peak traffic flows associated with the GTLF occur mostly outside the peak traffic periods of the surrounding intersections/roads – any temporary fluctuations in traffic flow at the GTLF/ISWMS entrance will not impact peak hour operation of the rest of the road network within the Study Area
- The North Sound Road network in the vicinity of the proposed ISWMS Site is currently operating beyond capacity, with much of North Sound Road and approaches to the Bank of Butterfield roundabout experiencing a Level of Service F
- The intersections within the Study Area will experience a further deterioration in service in the future due to projected traffic growth for Grand Cayman
- The opening of the ISWMS Site is not expected to have a direct impact on the surrounding road network, as traffic associated with the Site will be in line with existing traffic flows associated with the GTLF
- The construction of the ISWMS will cause some minor impacts on the surrounding road network during the peak periods
- Construction delivery traffic will cause negligible impact on the surrounding road network

The findings from the TS were relied upon to carry out the impact assessment for Traffic and Transportation for the ISWMS Site and evaluate the significance of effects. The impact assessment for Traffic and Transportation concludes the following:

- Residual effects related to driver severance and delay during construction and operation along Seymour Road (from North Sound Road to the Site entrance) are considered **Negligible**
- Residual effects related to driver severance and delay during construction and operation along North Sound Road (between Dorcy Drive and Esterly Tibbetts Highway) are considered **Slight/Negligible**
- Pedestrian severance and delay during construction and operation along Seymour Road (from North Sound Road to the Site entrance) are considered **Negligible**
- Pedestrian severance and delay during construction and operation along North Sound Road (between Dorcy Drive and Esterly Tibbetts Highway) are considered **Slight/Negligible**
- Pedestrian amenity and intimidation during construction and operation along Seymour Road (from North Sound Road to the Site entrance) are considered **Negligible**
- Pedestrian amenity and intimidation during construction and operation along North Sound Road (between Dorcy Drive and Esterly Tibbetts Highway) are considered **Slight/Negligible**

– Accidents and safety during construction and operation along Seymour Road (from North Sound Road to the Site entrance) are considered **Negligible**
– Accidents and safety during construction and operation along North Sound Road (between Dorcy Drive and Esterly Tibbetts Highway) are considered **Slight/Negligible** to **Slight/Moderate**
– The potential for effects on local road users, adjacent land uses to the carriageway, pedestrians and cyclists along Seymour Road (from North Sound Road to the Site entrance) during construction and operation due to hazardous and dangerous loads is considered **Negligible**
– The potential for effects on local road users, adjacent land uses to the carriageway, pedestrians and cyclists along North Sound Road (between Dorcy Drive and Esterly Tibbetts Highway) during construction and operation due to hazardous and dangerous loads is considered **Slight/Negligible**

14. Socio-Economics

14.1 Purpose

GHD Limited was retained by ReGen and the Cayman Islands Government (CIG) as approved by the Environmental Assessment Board (EAB) to undertake a socio-economic impact assessment (SEIA) as part of the Environmental Impact Assessment (EIA) for the proposed Integrated Solid Waste Management System (ISWMS, Project). The SEIA has been prepared to address the socio-economic requirements of the ISWMS for the Cayman Islands: Environmental Impact Assessment Terms of Reference (ToR) prepared by the proponent.

In line with ToR for the Project, the objectives for the SEIA are to 'consider the way in which the Proposed Development will affect people's way of life, their community, economic activity and culture'. Specifically, the SEIA:

– Describes the existing socio-economic conditions of the Study Area.
– Identifies potential socio-economic benefits and adverse impacts of the development, during construction and operation, and assesses their significance.
– Outlines measures that will be undertaken by the proponent to enhance socio-economic benefits and mitigate and/or manage negative socio-economic impacts of the Project.

The SEIA has been informed by the outcomes of stakeholder consultation conducted for the SEIA. It also includes consideration of the results of other technical studies prepared for the EIA, including Landscape and Visual (Chapter 10), Air Quality (Chapter 11), Noise and Vibration (Chapter 12), and Traffic and Transport (Chapter 13).

The SEIA has further been guided by the International Association for Impact Assessment's Guidance for Social Impact Assessment[1].

14.1.1 Overview of the proposed development

A complete description of each of the Project elements is provided in Chapter 4. Elements of particular importance to the socio-economic assessment include:

Workforce: a construction workforce of approximately 300 persons will be required to complete the ISWMS development, over the three-year construction period. The Project is anticipated to result in the creation of approximately 70 full-time positions (different job types than currently exist) during operation, which is comparable to the existing staffing level at the GTLF.

Timeframes: Construction for the proposed ISWMS development would commence in 2024, with completion planned in 2027.

14.1.2 Assumptions

The methodology includes the following limitations:

– There is no national guidance on the assessment of socio-economic impacts for the Cayman Islands, however, international best practice guidelines have been adopted as outlined in Section 14.2.
– The assessment is based on the information provided to GHD at the time of undertaking the SEIA.
– Economic data required to undertake the economic impact assessment was not available at the time of preparing this SEIA and therefore, economic impacts have been assessed qualitatively based on desktop information, the Project description and through findings from consultation.

[1] Vanclay, *Social Impact Assessment: Guidance for assessing and managing the social impacts of projects*, 2015

14.2 Applicable legislation, policies and guidelines

Table 14.1 summarises legislation, policies and guidelines relevant to this assessment.

Table 14.1 Applicable legislation, policies, and guidelines

Policy name	Relevance to project
Labour Law (2011 Revision)[2]	The Labour Law applies to any employee and/or employer in the Cayman Islands. The Labour Law provides a system of regulations including employment contract, types of leave, minimum wage, severance pay and termination. The Project is required to meet the obligations under the Labour Law, through the employment of the construction and operational workforce.
Workmen's Compensation Law (1996 Revision)[3]	The Workmen's Compensation Law provides workers' compensation which is payable to a worker who suffers an injury, disease or death arising from, or during, employment. The Project is required to meet the obligations under the Workmen's Compensation Law, through the employment of the construction and operational workforce.
Tourism Law (1995 Revision)[4]	The Tourism Law applies to the Department of Tourism and tourism-related boards and councils, operators licensing and more. This SEIA considers impacts of the Project, both beneficial and adverse to the tourism industry of the Cayman Islands.
Cayman Islands Climate Change Policy 2011[5]	The Cayman Islands' Climate Change Policy outlines consensus-based interventions to be implemented. Additionally, the Policy contains measures required to curb greenhouse gas emissions from activities that contribute to the problem of continued climate change. The Policy identifies policy goals and objectives. Under Critical Infrastructure one of the legislative actions to be implemented is to "Climate proof" existing and future waste management sites and designate temporary waste collection sites for storage of hurricane debris/waste. Another key policy goal is to Reduce Greenhouse Gas Emissions, in line with agreed national targets, through promoting energy conservation, reducing energy use and encouraging greater use of renewable energy. This Project is proposing to remediate and replace the existing landfill site with an integrated waste management facility as well as provide recycling opportunities for domestic and other waste. This is in line with the aforementioned goals and objectives. ***It should be noted that a revised Cayman Islands Climate Change Policy (2023-2040) is currently out for consultation.***
National Tourism Plan (NTP) 2019-2023[6]	The NTP provides a road map for enhancing the competitiveness of the Cayman Islands tourism industry and ensuring the sustainability of the islands' cultural and natural assets. The intent of the plan is to maximise and spread the benefits of tourism development throughout the country. The Plan identifies priority issues and challenges to be addressed. Solid Waste Disposal/Recycling was raised as an important and growing issue, revolving around landfills. Several studies have been conducted and alternative approaches proposed, including relocation of the existing landfill on Grand Cayman, development of a waste-to-energy facility, and recycling programmes. There appears to be a strong desire within the industry to improve and increase recycling programmes, but these issues have yet to be resolved. This Project is proposing to close the existing landfill in George Town, remediate, and replace with an integrated waste management facility. Therefore, is in line with the aforementioned aspirations.

2 Cayman Islands Government. *Labour Law (2011 Revision).* 2011
3 Cayman Islands Government. *Workmen's Compensation Law (1996 Revision) Cayman islands.* 1996
4 Cayman Islands Government. *Tourism Law (1995 Revision).* 1995
5 Cayman Islands Government. *Cayman Islands Climate Change Policy.* 2011
6 Cayman Islands. *National Tourism Plan 2019-2023.* 2020

Policy name	Relevance to project
National Energy Policy (NEP) 2017-2037[7]	The NEP seeks to establish a framework with which all stakeholders can identify, sets the stage for the achievement of the territory's energy goals and takes into account the imperative to reduce greenhouse gas emissions, thereby lowering the carbon footprint of the Cayman Islands. The Policy focuses on exploiting renewable energy, promotes energy efficiency and conservation measures and supports energy security by reducing the reliance on imported fossil-based fuels. Goal 1 aims to educate people on the impacts of energy demand on the environment. Strategy 3.1.2 - fuel products sector strategy: support jurisdiction-wide and industry developed public education programmes on handling, storage and disposal of waste, aims to support Goal 1. Goal 3 aims to ensure energy security for the Cayman Islands. Under this goal strategy 3.3.11.3 aims to support national waste management policies by facilitating interconnection of waste to energy generation to the grid. The ISWMS is proposed to include an ERF which is in line with the aforementioned goals and strategies.

14.3 Methodology

This Section presents the methodology adopted for the SEIA, based on the ToR, and includes the following best practice methodologies established by relevant standards, polices and guidelines and leading research:

– International Principles for Social Impact Assessment 2003[8]

– Social Impact Assessment: Guidance for Assessing and Managing the Social Impacts of Projects[9]

SEIA is broadly defined as the process for 'identifying and managing the socio-economic issues of project development'[10]. The goal of SEIA is ultimately to bring about better project outcomes that benefit both communities and proponent alike, not just the identification or amelioration of negative outcomes[11]

In line with this understanding, the assessment process is comprised of six phases as shown in Figure 14.1. These steps are explained in further detail below.

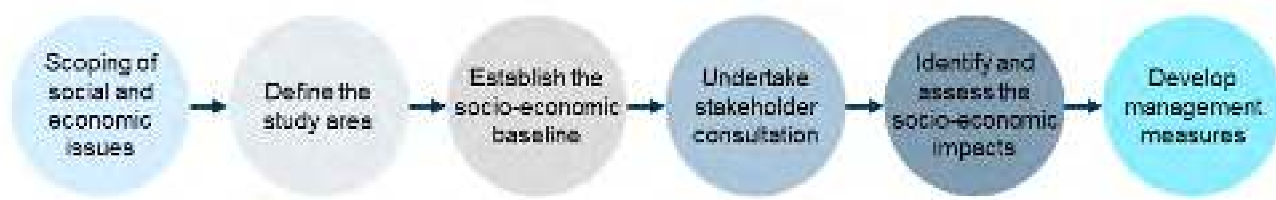


Figure 14.1 Overview of SEIA methodology

14.3.1 Scoping

The scoping phase involved preliminary planning of the SEIA. This included initial desktop research and consultation with the internal EIA Project team to understand the local context, discuss and agree on the SEIA scope, and identify Project-affected stakeholders.

A key outcome of this phase included agreement on the elements of the socio-economic environment for investigation that may be directly or indirectly changed by the Project. These indicators are outlined and defined in Table 14.2

7 Cayman Islands Government. *National Energy Policy 2017-2037*. 2017
8 Vanclay, *International Principles For Social Impact Assessment. Impact Assessment and Project Appraisal*, 2003
9 Vanclay, *Social Impact Assessment: Guidance for assessing and managing the social impacts of projects*, 2015
10 Vanclay, *Social Impact Assessment: Guidance for assessing and managing the social impacts of projects*, 2015
11 Vanclay, *International Principles For Social Impact Assessment. Impact Assessment and Project Appraisal*, 2003

below. These indicators have been adapted from a review of social changes commonly associated with major infrastructure development, in particular waste facilities[12]. The structure of the SEIA (i.e., the baseline and impact assessment) reflect these aspects in the Sections which follow.

Table 14.2 Elements of SEIA investigation

Element	Definition and scope
Population	The characteristics, mobility and rate of change of populations, including diversity, community composition and rates of influx.
Employment and economy	The availability and accessibility of employment and business development opportunities, and the existence and role of particular industries.
Health and community wellbeing	The ability of people to maintain their health and a lifestyle that is not detrimental to their wellbeing (e.g., nutrition and diet, physical and mental health). Also includes the overall wellbeing of a community, including its cohesion and safety, how it functions and people's sense of place.
Services and infrastructure	The quality, availability and accessibility of social services and infrastructure. This may include (but not limited to) health and emergency services, aged and childcare, utilities, roads network and infrastructure, public transport, housing and accommodation, recreational facilities.
Access and connectivity	The ability of people to maintain access to public spaces or private property and/or their ability to conveniently get from one place to another.

14.3.2 Study area

The study area is the geographical area of social influence of the proposal. For the purpose of this study, the study area includes the people and communities who are likely to experience changes to existing socio-economic conditions resulting from the Project.

Table 14.3 presents the study area for the SEIA.

Table 14.3 Description of the Study Area

Study area	Statistical area	Relevance to Project
Project footprint	N/A	This includes what is at the Site and landholdings in the Project's immediate surroundings.
Local study area	District of George Town	This includes the community of George Town, which is the municipal area containing the Project infrastructure and is likely to be the main source of workers, goods or services for the Project. People in the broader city of George Town are also expected to have a variety of interests and concerns with the Projects.
Regional study area	Cayman Islands	This includes the Cayman Islands as a whole, which is likely to be where economic changes will be most noticeable.

14.3.3 Establishing the socio-economic baseline

A baseline of the existing social and economic conditions was established for the local study area and regional study area. This context was used as the basis for considering potential impacts of the Project. Existing conditions were determined via a review of:

– Local population census data
– Government planning documents
– International financial institutions' statistics
– Non-governmental organisations (NGOs) and industry reports
– Other assessment reports prepared for projects in proximity to the Study Area

[12] Franks, *Social impact assessment of resource projects. International Mining for Development Centre*, 2012

– GIS mapping
– Information gathered through consultation with stakeholders (Section 14.4)

All data in Section 14.5 has been drawn from the Cayman Islands' 2021 Census of Population and Housing Report published in July 2022 and prepared by the Economic and Statistics Office (ESO), unless otherwise stated.

Where required information is not available in the 2021 Census, the baseline assessment has been supplemented by other available reports, including The Cayman Islands' Compendium of Statistics 2020[13] and The Cayman Islands' Labour Force Survey Report Fall 2022 prepared by the ESO[14].

The existing conditions describe the social values, economic characteristics and social infrastructure and services that are likely to be affected by the Project.

14.3.4 Consultation

14.3.4.1 SEIA consultation

Stakeholder consultation is a critical component of the SEIA process. Internal and external stakeholder consultation was undertaken to inform the SEIA. Prior to undertaking consultation, a Stakeholder Consultation Plan for approval by ReGen and the Environmental Assessment Board (EAB)was prepared to identify key stakeholders, detail the approach to consultation and identify themes to be discussed during consultation.

SEIA consultation was undertaken between May and June 2023 by the SEIA team via videoconference facilities. Section 14.4 presents a summary of the consultation activities and outcomes relevant to this assessment.

The overall purpose of the SEIA consultation was to validate and gather additional information to inform the development of the socio-economic baseline, identify potential social and economic benefits and impacts, and develop recommended mitigation and management measures. The stakeholders consulted for the SEIA (Table 14.4) were identified because they would have the potential to experience positive or negative social and economic impacts as a result of the proposal, or because they represent communities and stakeholders who would potentially experience impacts.

Table 14.4 Stakeholders

Stakeholder group	Stakeholders consulted
Government	– Department of Environment (DOE) – Ministry of Sustainability and Climate Resiliency – Ministry of Tourism and Ports – Ministry of health and Wellness
Business / industry organisations	– Cayman Islands Tourism Association (CITA) – Cayman Islands Chamber of Commerce – Island Waste Carriers
Community service providers	– George Town Police Station – Cayman Islands Fire Service
Non-government organisations	– Sustainable Cayman

[13] ESO. *The Cayman Islands' Compendium of Statistics 2020*. 2021
[14] ESO. *The Cayman Islands' Labour Force Survey Report Fall 2022*. 2023

14.3.5 Description and assessment of impacts

Following the scoping of socio-economic issues described in Section 14.3.1, impacts were confirmed using a data triangulation method, whereby multiple sources of information were used to confirm socio-economic impacts. These data sources are summarised below:

- The proposal description for the EIA to understand the proposed activities that would influence social aspects.
- Baseline conditions against which the social changes/impacts were measured.
- Outcomes of the stakeholder consultation undertaken for the SEIA and the proposal as a whole to understand the existing environment and stakeholder views on potential social changes brought about by the proposal.
- Relevant draft and final technical studies prepared for the EIS to gather technically sound evidence to identify and assess the social changes resulting from the proposal:
  - The Seascape and Landscape Visual Considerations Report (Chapter 10)
  - Air Quality Assessment (Chapter 11)
  - Noise and Vibration Assessment (Chapter 12)
  - Traffic Statement (Chapter 13)

The evaluation of the identified social impacts was undertaken using a sensitivity and magnitude significance rating, based on the significance criteria provided in the ToR and shown in Section 14.3.7.

14.3.6 Characterise the socio-economic impact

In order to place potential socio-economic impacts in context, the nature (beneficial or adverse), the temporal extent (short or long term) and their spatial context (local or national) were considered in accordance with Section 5.9.19 of the ToR.

The criteria used in considering the nature and type of impact are defined below:

14.3.6.1 Nature

- Beneficial: an impact is considered beneficial if a change represents an improvement from the socio-economic baseline, or if a new and desirable factor is introduced to the socio-economic environment.
- Adverse: an impact is considered adverse if there is a negative change to the socio-economic baseline, or if a new undesirable factor is introduced to the socio-economic environment.

14.3.6.2 Temporal extent

The temporal extent of an impact refers to the time in which the change will take place, and includes:

- Short term: an impact is considered short term if it involves a temporary socio-economic change (e.g., during construction or up to three years).
- Long term: an impact is considered long term if it involves a socio-economic change which is permanent or will be experienced over an extended period (e.g., over five years).

14.3.6.3 Spatial context

The spatial extent of an impact refers to the geographical rage in which a change extends, and includes:

- Local: an impact is considered to have local spatial context if it involves a socio-economic change which will have an adverse or beneficial impact on the immediate surrounds and George Town.
- National: an impact is considered to have national spatial context if it involves a socio-economic change which will have an adverse or beneficial impact on the Cayman Islands.

14.3.7 Assess the significance

Potential social impacts were organised according to the socio-economic elements described in Section 14.3.1. An assessment of the identified socio-economic impacts was then undertaken to determine their likely level of 'significance' in accordance with Section 4 of the ToR. Significance was determined by considering the sensitivity of socio-economic receptors (individuals or social or economic groups) (Table 14.5) and the anticipated (most likely) magnitude of the impact if it were to occur (Table 14.6). The overall level of significance was determined by combining the sensitivity and magnitude criteria as shown in Table 14.7, as presented in the ToR.

Table 14.5 Description of sensitivity

Sensitivity level	Description
Very low	Where the social area of influence is economically diverse and socio-economic indicators demonstrate an ability for the area to recover easily from the impact and natural, cultural and social functions are minimally affected.
Low	The socio-economic environment has minimal areas and levels of vulnerability and a high ability to absorb or adapt to change.
Medium	The socio-economic environment has some vulnerabilities but retains some ability to absorb or adapt to change.
High	The socio-economic environment exhibits a number of vulnerabilities and/or little capacity to absorb or adapt to change.
Very high	The socio-economic environment exhibits multiple vulnerabilities, will be irreversibly changed, and it will have a significant impact on natural, cultural and social functions of the community, leading to a compromise to the way of life.

Table 14.6 Description of magnitude level

Magnitude level	Description
Very low	No discernible positive or negative changes caused by the impact. Change from the baseline remains within the range commonly experienced by receptors.
Low	Minor changes to the social environment, which are easily reversible over time; localised impact among a small group of impacted stakeholders.
Medium	Noticeable deterioration/improvement to something that people value highly, either lasting for an extensive time, or affecting a group of people.
High	Substantial deterioration/improvement to something that people value highly, either lasting for an indefinite time, or affecting many people in a widespread area.
Very high	There is irreplaceable impact to a highly valued community, social, infrastructure area or item of international significance and would lead to loss of license to operate.

Table 14.7 Significance rating

		Magnitude of Change				
		Very High	**High**	**Medium**	**Low**	**Very Low**
Sensitivity	**Very High**	Major (Significant)	Major (Significant)	Major (Significant)	Major (Significant)	Moderate (Possibly significant)
	High	Major (Significant)	Major (Significant)	Major (Significant)	Moderate (Possibly significant)	Minor (Not significant)
	Medium	Major (Significant)	Major (Significant)	Moderate (Possibly significant)	Minor (Not significant)	Negligible (Not significant)
	Low	Major (Significant)	Moderate (Possibly significant)	Minor (Not significant)	Negligible (Not significant)	Negligible (Not significant)
	Very Low	Moderate (Possibly significant)	Minor (Not significant)	Negligible (Not significant)	Negligible (Not significant)	Negligible (Not significant)

The risk rating then determines if mitigation or management actions are required to address the socio-economic impact or enhance the socio-economic benefit.

The SEIA assessed the potential socio-economic impacts and benefits that may occur as a result of construction of the proposal (Section 14.6) and operation of the proposal (Section 14.7).

14.3.8 Development of management measures

Following the identification of impacts, measures were developed to enhance the positive impacts of the Project and to avoid, mitigate or manage negative impacts (collectively referred to as 'management measures'). Management measures were developed based on the findings of:

– Stakeholder consultation
– The assessment of potential social impacts
– The knowledge of the SEIA study team in developing and implementing management frameworks

Impact management measures are identified in Section 14.8 of this SEIA.

14.4 Stakeholder consultation

This section presents a summary of key themes and issues relevant to this SEIA raised by stakeholders and community members during SEIA consultation. Chapter 5 details the broader EIA engagement activities undertaken for the project.

14.4.1 SEIA consultation

Table 14.8 provides a summary of key themes and issues raised by stakeholders during SEIA consultation.

Table 14.8 Summary of key themes and issues

Topic	Description
Amenity impacts	– There are concerns about the potential amenity impacts including air quality and pollution, noise, and traffic and access from the new facility. – Some stakeholders raised concerns around the frequency of fires at the existing landfill and the associated decreased air quality particularly for those who live and work around the existing Site.

Topic	Description
	– Most stakeholders were supportive of the potential overall visual improvements of the Project at the existing landfill site especially with regards to improved visual amenity for tourism. – General comments about the poor road infrastructure near the existing landfill Site and impacts construction activities will have on the road quality. – Some stakeholders reported that odour is a current problem at the existing landfill Site.
Environmental impacts	– There was overall support for better environmental outcomes from the closure of the existing facility and the capacity of the new facility. – There was interest among stakeholders in the new facility potentially providing power to the existing grid and consequently overall lower energy costs for local Caymanians. – Some stakeholders raised concerns around potential run-off pollutants ending up in the nearby bay and ocean which could impact marine wildlife and overall health of the marine ecosystem. – Additional waste generated after hurricanes and other bad weather is a key issue facing the islands. Some stakeholders questioned if the new facility will have the ability to accommodate this additional waste.
Hazards and safety	– There was interest from stakeholders around the new facility's ability to deal with chemical, hazardous, and biological waste. – Some stakeholders raised safety concerns of the existing landfill and were interested in the safety measures, management and mitigation methods for the new facility. – Existing health and safety legislation is currently lacking and is not enforced on the Islands.
Health and wellbeing	– Most stakeholders were interested in the health and wellbeing benefits and overall improvements to local residents from reduced air pollution and visual impacts.
Economic and businesses	– The -nature-based tourism industry is an important part of the Cayman Islands which has increased in popularity over the last decade. – Some stakeholders raised queries as to who will operate the facilities once up and running.
Workforce and labour force	– There was keen interest in procurement and other business opportunities for local people, businesses and industries. – Rising cost of living expenses was a key barrier affecting the attraction and retention of new workers from overseas. – 'Green jobs' was raised as a potential employment opportunity to future-proof the workforce and skills availability in the Cayman Islands. – Across the Cayman Islands there is a strong dependency on the financial and insurance service industry and tourism industry which both contribute significantly to the economy. – Some stakeholders raised concerns about the lack of local labour force availability and increases in the foreign labour force which makes up a large portion of the tourism, financial services and construction industries. – There was interest among stakeholders about the potential long term employment opportunities during the operation of the new facility.
Skills and education development	– Some stakeholders indicated that there is a lack of local skills available particularly in the highly specialist/ technical fields or niche skills. – There was interest from stakeholders in potential skills development and local education and training opportunities for local Caymanians to either upskill or train in a new field to support the delivery of the new facility. – Some stakeholders mentioned opportunities to increase education and knowledge around litter and waste management practices across the Cayman Islands.
Housing and accommodation	– Housing availability and affordability is a key challenge across the Cayman Islands. Some stakeholders raised concerns around potential housing challenges and shortages from the arrival of overseas skilled migration.
Community	– There are a number of vulnerable people and people of lower socio-economic status who live around the existing landfill Site. – Rapid population increase and overcrowding has put a strain on the existing infrastructure on the Islands including the existing landfill services and capacity and overall waste management.

Topic	Description
	– Some stakeholders mentioned there exists scepticism from local community members around the existing recycling options available and where that recycled material gets used/ sent to after recycling. – The local community value, and take pride in, the natural environment.
Other	– There is a current shortfall in other waste management services available including haulage services, curb side pick up and recycling. – Some stakeholders raised questions about a resource recovery store available at the landfill for items that can be reused or resold. Also noting that it would be good to have more of these available in each community to support the reuse of items. – There is current work being undertaken by the Government to ban single use plastics on the Islands.

14.5 Baseline conditions

The section establishes the socio-economic context for the SEIA Study Areas, against which potential impacts of the proposed ISWMS development can be identified and measured.

14.5.1 Project footprint and immediate surrounds

The existing George Town Land Fill (GTFL) site, also known locally as 'Mount Trashmore', is currently one of the most pressing environmental issues for the Island. The GTLF can be seen by local and visitors from across the island as well as offshore. Part of the existing landfill is currently undergoing capping and remediation.

As described in Chapter 3, the proposed ISWMS development encompasses 11.9 acres (4.8 hectares [ha]) of the existing GTLF site for the development of a new Residual Waste Landfill and Landfill Gas Facility, together with a 16.8 acres (6.8 ha) parcel of undeveloped land immediately south-west of this for the remainder of the ISWMS facilities.

The undeveloped parcel of the ISWMS Site is zoned Heavy Industrial (HI). This designation includes all of the activities proposed at the ISWMS Site: power generation, solid waste disposal and recycling. The proposed ISWMS activities are consistent with existing zoning designations and activities on the lands surrounding the proposed ISWMS development. The Site is accessed via Seymour Drive.

The land usage surrounding the ISWMS Site is summarised in Table 14.9 below.

Table 14.9 Description of land uses surrounding the ISWMS site

Direction	Land use description
North	The existing GTLF lies immediately north and east of the proposed ISWMS Site. North of the GTLF is a tidal drainage channel managed by Mosquito Research & Control Unit (MRCU) for mosquito control that connects with North Sound about 0.7 miles (1.23 kilometres (km)) to the east. The area immediately north of the drainage channel is the alignment of the under-construction Airport Connector Road (ACR) and further north lies a swathe of disturbed mangrove area. The under-construction Health City Hospital, Cayman International School and Camana Bay development are located within 0.5 mile (0.8 km) to the north of GTLF. The Cayman International School (CIS) is a private, college preparatory, co-educational school for students from two years old through to Grade 12. It provides American/International educational services for the dependents of the multi-national professionals living in Cayman. In 2021, there were 955 students enrolled at CIS[15]. The Camana Bay development is a mixed-use master-planned community consisting of a town centre with retail and commercial office space, a marina village and a collection of residential neighbourhoods.
East	The land east of the GTLF is owned by Cayman Water Authority and comprises four large former wastewater treatment lagoons that are used for sludge storage. South of the lagoons is the current wastewater treatment plant including some buildings and four smaller basins.

15 Teacher Horizons, Cayman International School, 2023

Direction	Land use description
	Approximately 524 ft to 1049 ft (160 m to 320 m) east of the landfill site is land zoned for industrial use. This is mainly undeveloped or used for open storage. The Department of Environmental Health (DEH) collections depot (comprising several trailers for staff facilities and parking for staff and collection vehicles) is located on approximately one acre of land to the east of the wastewater treatment lagoons.
South	The southern boundary of the proposed ISWMS Site is currently an area covered by mangroves, beyond which is industrial and commercial development. This land is occupied by a variety of businesses, including a concrete batching plant and a concrete block and paver stone manufacturer.
West	The Esterly Tibbetts Highway (the main arterial road to West Bay) lies immediately adjacent to the fence line forming the western boundary of the proposed ISWMS Site. The Lakeside residential development is located west of this Highway. This development comprises 12 three-storey residential apartments with car parking and leisure/landscape areas (including a small lake). The North Mound of the GTLF is visible from the easternmost lakeside buildings

14.5.2 Local and regional study area

14.5.2.1 Overview of the study area

The Cayman Islands are a British Overseas Territory located in the Caribbean Sea, approximately 160 miles (257 km) south of Cuba and 167 miles (269 kilometres) north-west of Jamaica. The Cayman Islands is comprised of three islands: Grand Cayman, Cayman Brac and Little Cayman. In total, they encompass 101 square miles (263 km^2).

The Project Site is situated in the nation's capital of George Town, located on the western shore of Grand Cayman. The city covers approximately 11 square miles (29 km^2) and is one of six districts of the Cayman Islands.

Caymans natural resource base, including beaches, coral reefs and other marine resources is a main draw for the tourism industry, a second vital pillar of the nation's economy[16].

George Town is the economic, commercial, and governmental centre of the Islands. It is the site of several of Grand Cayman's main tourism attractions, including Seven Mile Beach and Stingray City, and hosts the majority of the Islands' hotels, resorts, and restaurants.

14.5.2.2 Demographic profile

14.5.2.2.1 Population

In 2021, George Town had a population of 34,921 persons, representing 49.1 percent of the Cayman Islands total population (Table 14.10). Between 2010 and 2020, the population of George Town increased by 24.3 percent at an average annual growth rate of 2.2 percent. This was slower than the annual growth rate recorded between the period between 1999 and 2010 (3.3 percent).

The overall population of the Cayman Islands was estimated at 71,105 persons in 2021. The population of the country increased by 29.2 percent between 2010 and 2021, however, decreasing from the 41.0 percent that was recorded between 1999 and 2010.

The population of the Cayman Islands was comprised of residents from 162 countries. The top countries of birth outside of the Cayman Islands were Jamacia (24.8 percent), Philippines (5.5 percent), UK (5.3 percent) and the USA (5.2 percent).

[16] Cayman Island Government (2019). Cayman Islands National Tourism Plan (2019-2023)

Table 14.10 Estimated population of local and regional study areas (1999, 2010, 2021)[17]

Study area	1999	2010	2021	Percentage (percent) change		Annual percent change	
				'99 – '10	'10 – '21	'99 – '10	'10 – '20
George Town	20,626	28,089	34,921	36.2 percent	24.3 percent	3.3 percent	2.2 percent
Cayman Islands	39,020	55,036	71,105	41.0 percent	29.2 percent	3.7 percent	2.7 percent

14.5.2.2.2 Age and sex profile

Previous census data indicated the median age of the Cayman Islands' population increased from 32.8 years in 1999 to 35 years in 2010[18]. The populations median age at the time of the 2021 census was 38 years for both males and females[19].

Data from for the 2021 census (Table 14.11) shows there are proportionally more men than women in George Town at 51.7 percent and 48.2 percent, respectively. This ratio is similar at the national level with men comprising 50.6 percent and women comprising 49.3 percent of the total population.

Table 14.11 Sex profile of local and regional study areas (2021)[20]

Area	Male	Female
Cayman Islands	50.6 percent	49.3 percent
George Town	51.7 percent	48.2 percent

The Cayman Islands is characterised by an aging population with an estimated 7.9 percent of the population aged 65 years and over at the 2021 census, compared to only 5.1 percent in 2010 (Table 14.12). This is consistent with the increasing age dependency ratio in the Cayman Islands, which was reported at 33.8 percent in 2020 compared to 30.8 percent in 2010[21].

In contrast, the proportion of youth (0 to 14 years) decreased slightly from 18.1 percent in 2010 to 15.9 percent in 2021. The majority of the Cayman Islands population are persons in working age groups (75.5 percent), between the ages of 15 and 64 years.

Table 14.12 Population by age group, Cayman Islands (2010 and 2020)[22]

Age group	2010		2021	
	Total	percent	Total	percent
0 -14 years	9,968	18.1 percent	11,315	15.9 percent
15 – 29 years	10,747	19.5 percent	12,251	17.2 percent
30 – 49 years	23,167	42.1 percent	27,291	38.4 percent
50 – 64 years	8,168	14.8 percent	14,130	19.9 percent
65+ years	2,832	5.1 percent	5,602	7.9 percent
Not stated	153	0.3 percent	515	0.7 percent

17 ESO. *Gross Domestic Product*. 2022
18 ESO. *The Cayman Islands' 2010 Census of Population and Housing Report*. 2011
19 ESO. *Gross Domestic Product*. 2022
20 ESO. *The Cayman Islands' Compendium of Statistics 2020*. 2021
21 ESO. *The Cayman Islands' Compendium of Statistics 2020*. 2021
22 ESO. *Gross Domestic Product*. 2022

14.5.2.2.3 Households

In 2021, there were a total of 29,699 households in the Cayman Islands. The 2021 census data shows that 6,939 households were added between 2010 and 2021, representing a 30.5 percent increase over that time[23].

The average household size declined marginally to 2.39 persons per household in 2021. Except for George Town, which remained constant over the census period, all districts recorded marginal reductions. George Town accounts for 51.6 percent of households in the Cayman Islands (15,331 households). The average household size in George Town is 2.3, which is slightly lower than the national average of 2.4 persons per household.

14.5.2.2.4 Cultural diversity

In 2021, 88.8 percent of the total population (Caymanians and non-Caymanians) spoke English as the main language at home (or 95.5 percent for Caymanian and 81.0 percent for non-Caymanian). For non-Caymanians, Filipino was the next most spoken language at home (8.0 percent) while for Caymanians, Spanish was the next most spoken language at home (3.2 percent)[24].

14.5.2.3 Employment and economy

14.5.2.3.1 Labour force and employment

In 2022, the Cayman Islands had a working age population of 69,383 people, with 57,582 of these within the labour force resulting in a labour force participation rate of 83.0 percent. Males (53.6 percent or 30,841 people) made up slightly more of the labour force compared to females (46.4 percent or 26,741 people). Of those employed, non-Caymanians made up 53.4 percent of the employed persons[25].

There is also a strong foreign labour force within the Cayman Islands. Foreign workers have sought to take advantage of the relatively easy access to Caymanian employment market afforded by temporary work permits[26]. As of January 2023, an estimated 34,067 people were recoded as having a work permit. Of these the top six nationalities on work permits included Jamaica (14,586 people or 42.8 percent), Philippines (5,284 people or 15.5 percent), UK (1,983 people or 5.8 percent), India (1,899 people or 5.5 percent), Honduras (1,234 people or 3.6 percent), and Canada (1,218 people or 3.6 percent)[27].

The *Review of Employment Policy and Strategy in the Cayman Islands*[28] highlighted that the Caymanian population is unable to meet the existing labour demand, and it is not expected to meet this demand in the foreseeable future due to anticipated growth of the local population in relation to the anticipated growth of the local economy. During consultation, stakeholders confirmed this trend, noting that there is often not enough local labour to meet the demand of certain industries, with foreign labour comprising a large proportion of the tourism, financial services and construction industries.

14.5.2.3.2 Unemployment and underemployment

Of the labour force, there were 1,227 people unemployed within the Cayman Islands in 2022, resulting in an unemployment rate of 2.1 percent. The unemployed labour force mainly consisted of persons aged 25 to 34 years (421 persons), accounting for 34.3 percent of the total unemployed.

'Underemployment' is defined as 'Involuntary part-time' work, where workers who could (and would like to) be working for a full work week can find only part-time work. The underemployed accounted for 5.1 percent (4.9 percent male and 5.3 percent female) of the employed in 2022. Caymanians and Permanent Residents had above-average underemployment rates of 6.4 percent and 6.6 percent respectively, while non-Caymanians had a lower rate of 4.0 percent.

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23 ESO. *The Cayman Islands' 2021 Census of Population and Housing Report*. 2022
24 ESO. *The Cayman Islands' 2021 Census of Population and Housing Report*. 2022
25 ESO. *The Cayman Islands' Labour Force Survey Report Fall 2022*. 2023
26 Amit. *A clash of vulnerabilities: citizenship, labor, and expatriacy in the Cayman Islands*. American Ethnologist 28(3), pp 574-594. 2001
27 Department of Workforce Opportunities & Residency Cayman. *Cayman Foreign Nationals – Summary by Nationality*. 2023
28 Cayman Island Government. *Review of Employment Policy and Strategy in the Cayman Islands*. 2015

The *Review of Employment Policy and Strategy in the Cayman Islands*[29] highlights a number of barriers to employment amongst the local Caymanian population, including a lack of training and development, a lack of internet and transportation and poor housing.

14.5.2.3.3 Key sectors of employment

Within the Cayman Islands the top six industries accounted for 59.4 percent of the employed labour force. The largest employing industries in 2022 were construction (15.7 percent); wholesale and retail trade (12.8 percent); professional, scientific, and technical activities (9.2 percent); administrative and support service activities (7.3 percent); activities of households as employers (7.3 percent) and financial and insurance activities (7.1 percent)[30].

Financial services

The financial services industry within the Cayman Islands employed 3,654 people during 2021, accounting for 8.2 percent of total employment within the country. In 2021, this industry was the fourth largest employer in the Cayman Islands. The financial services industry contributed $1,486 million worth of GDP to the Cayman Islands economy in 2019 (or 30.4 percent of GDP). The Cayman Islands had a total of 111,568 registered companies in 2020, with 92,550 of these being identified as exempt companies (whose proposed activities are to be carried out mainly outside the islands (offshore)), with an additional 11,731 new companies being registered between 2019 and 2020[31].

Tourism

The Cayman Islands recorded 659,900 visitors in 2020, down significantly compared to the 2,333,700 visitors in 2019 as a result of the global pandemic. Pre-2020, the Cayman Islands recorded in excess of 2.1 million visitors annually since 2015, with the majority of visitors (78.5 percent of visitors) arriving to the island on cruise ships in 2019. For visitors arriving to the Cayman Islands by air, 83.3 percent of these were from the USA, with Canada accounting for 6.0 percent of air arrivals and Europe accounting for 4.8 percent. Air arrival visitors to the Cayman Islands spent an average of 6.09 days within the country during 2019, travelling in a party of 2.39 people and spending on average CI$201.70 per night. In contrast, cruise ship visitors were estimated to spend on average CI$94.90 per day within the country[32]. Consultation indicated that tourism numbers were beginning to return to pre-2020 levels.

The tourism industry has grown rapidly within the Cayman Islands. While the tourism industry is one of the largest industries on the islands it is dependent on a foreign workforce with Caymanians reluctant to seek employment in the industry[33].

14.5.2.3.4 Occupation of employment

The top five occupations, which collectively accounted for 79.1 percent of total employment, were professionals (18.8 percent); service and sales workers (17.0 percent); craft and related trades workers (16.5 percent); elementary occupations (14.2 percent), and technicians and associate professionals (12.6 percent)[34].

14.5.2.3.5 Income

In 2021, 4,213 employed persons recorded annual earnings of between CI$14,400 - $19,199, which makes up 9.5 percent of employed persons. Within this income bracket women made up 59.5 percent and men made up 40.5 percent. The next highest annual earnings recorded was within the income bracket of CI$100,800 and over, which made up 8.8 percent of the total employed persons. Within this income bracket men made up 63.0 percent and women made up 37.1 percent.

Employed persons with annual earnings of between CI$19,200 - $23,999 were in the third highest bracket at 8.6 percent. Those with annual earnings between CI$24,000 - $28,799 were in the fourth highest income bracket at

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29 Cayman Islands Government. *Review of Employment Policy and Strategy in the Cayman Islands*. 2015
30 ESO. *The Cayman Islands' Labour Force Survey Report Fall 2022*. 2023
31 ESO. *The Cayman Islands' Compendium of Statistics 2020*. 2021
32 ESO. *The Cayman Islands' Compendium of Statistics 2020*. 2021
33 Amit. *A clash of vulnerabilities: citizenship, labor, and expatriacy in the Cayman Islands*. American Ethnologist 28(3), pp 574-594. 2001
34 ESO. *The Cayman Islands' Labour Force Survey Report Fall 2022*. 2023

8.1 percent of the total of employed persons. 1.0 percent of employed persons recorded annual earnings of CI$0 - $4,799. This income bracket represented the lowest percentage of employed persons.

14.5.2.3.6 Cost of living

The cost of living in the Cayman Islands is among the highest in the world. Recent estimates, estimate that the average monthly costs for a family of four is CI$,6,821 and CI$3,959 for a single person[35].

Increases in the Consumer Price Index (CPI) also indicate rising costs in consumer goods and services. Between 2020-21 CPI rose 3.3 percent[36].

Consultation indicated that increases in the cost of living across the Cayman Islands is a key barrier to people moving and staying on the Islands as well as finding affordable housing.

14.5.2.3.7 Regional output

As shown on Figure 14.2, the GDP of the Cayman Islands was CI$4.72 billion in 2021 (current prices). The financial and insurance services sector was the largest contributor in 2021 contributing CI$1.5 billion or 30.7 percent to GDP followed by the professional, scientific and technical activities industry which contributed CI$0.7 billion or 15.2 percent to GDP[37].

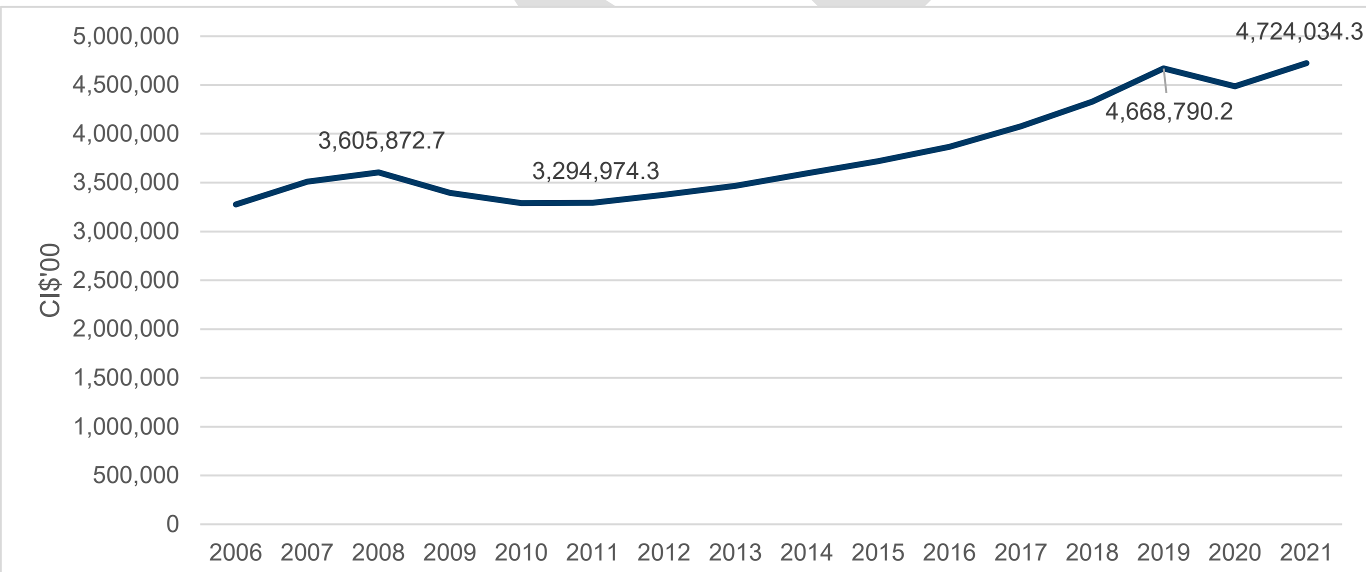

Figure 14.2 Cayman Islands GDP at current basic prices 2006-2021[38]

14.5.2.4 Education

There are six universities and technical colleges located within the Cayman Islands. The University College of the Cayman Islands offers a number of programs and course and is the only public university on the Islands.

In 2021, 13.3 percent of those 15 years and older (both Caymanians and non-Caymanians) had attained technical/ vocational training. 8.8 percent of those 15 years and older (both Caymanians and non-Caymanians) had attained associate or equivalent level education and 30.3 percent had attained a bachelor's degree of higher.

When this is split into Caymanian and non-Caymanian subset, non-Caymanians have a higher rate of attainment of technical/ vocational training at 15.7 percent, compared to 11.0 percent of Caymanians. Attainment of a Bachelor's

35 Expatistan. *Cost of living in Cayman Islands.* 2023
36 ESO. *Gross Domestic Product.* 2022
37 ESO. *Gross Domestic Product.* 2022
38 ESO. *Gross Domestic Product.* 2022

degree, Master's degree, Doctoral or equivalent education was higher for non-Caymanian's (36.2 percent) than Caymanian (24.3 percent). Attainment of associate level or equivalent education is higher for Caymanians at 10.5 percent than in non-Caymanians (7.0 percent).

Of the total school attendees in the Cayman Islands, the majority attend school in George Town.

14.5.2.5 Housing and accommodation

14.5.2.5.1 Tenure

Renting (furnished) is the most common type of tenure for dwellings among households in George Town (58.3 percent), followed by ownership with a mortgage (18.9 percent) (Table 14.13). These trends are similar for the national level. The high percentage of rentals points to the presence of a large immigrant population on contracts of employment, and who need to rent accommodation during their stay in the Cayman Islands[39].

Table 14.13 Housing tenure[40]

Housing tenure type	George Town		Cayman Islands	
	Number	percent	Number	percent
Owned with a mortgage	2,903	18.9 percent	6,787	22.9 percent
Owned without a mortgage	2,413	15.7 percent	6,052	20.4 percent
Rented - Furnished	8,943	58.3 percent	14,668	49.4 percent
Rented - Unfurnished	348	2.3 percent	568	1.9 percent
Subsidised Rent	48	0.3 percent	128	0.4 percent
Rent Free	278	1.8 percent	673	2.3 percent
Other	40	0.3 percent	113	0.4 percent
Not stated	356	2.3 percent	711	2.4 percent
Total	15,331	-	29,699	-

14.5.2.5.2 Median weekly rent

The rental market in the Cayman Islands has seen consistent growth over the last decade from 2010 to 2020. While COVID-19 has impacted rental rates in response to decrease in tourism and associated industry workers relocating, rental prices have returned to the decade long trend[41]. During consultation, stakeholders noted that the cost of living, and in particular, high housing costs is an issue in Cayman.

The average rental prices in Georgetown and across Grand Cayman are summarised in Table 14.14.

Table 14.14 Average rental price by location and accommodation type 2023 (in CI$)[42]

Area	1 Bedroom	2 Bedroom	3 Bedroom
West Bay	$900-1,500	$1,500-4,000	$2,500-3,200
Seven Mile Beach	$2,000-2,500	$3,500-5,500	$5,000+
Seven Mile Corridor	$2,000-2,500	$3,000-5,500	$5,000+
George Town	$1,100-2,100	$2,000-2,500	$4,000+
South Sound	$1,800-2,750	$2,000-3,000	$3,200+

39 Kairi Consultants Ltd. *The Cayman Islands National Assessment of Living Conditions (2006/2007). National Assessment of Living Conditions.* 2008
40 ESO. *The Cayman Islands' 2021 Census of Population and Housing Report.* 2022
41 IRG International. *Cayman Islands Property Market Report Winter & Spring 2020/2021.* 2021
42 Cayman Resident. *Renting Property in the Cayman Islands.* 2023

Area	1 Bedroom	2 Bedroom	3 Bedroom
Prospect/Savannah	$1,200-2,000	$1,750-2,500	$3,000+
Bodden Town	$950-1,500	$1,200-2,500	$2,500+

14.5.2.5.3 Median house price

There is a large disparity of house prices in the Cayman Islands and relatively small number of properties in the market. As such, reporting on house prices is often categorised by housing type, to attempt like-for-like market trend analysis. Sales data reported for villas in George Town shows that this area of the Cayman Islands has seen some of the greatest surges in property prices. The average price per unit for a villa in George Town in 2010 was CI$383,000, increasing to CI$655,464 in 2018 and CI$918,952 in 2020[43].

This trend is reflected at the national level, where an independent review of government data, found that open market property values steadily increased over the 2013 and 2019 period[44]. While COVID-19 related constraints brought challenges to this trend in early 2020, data from 2021 show property prices and transfer rates returning to pre-COVID-19 trends[45]. The average house price in 2020 was CI$700,000[46].

As mentioned in Section 14.5.2.3.6 the cost of living in the Cayman Islands is one of the highest in the world and increasing. Consultation supported this and indicated that an increase in cost of living across the Cayman Islands as a barrier to attracting and retaining skilled workforce.

14.5.2.5.4 Short term accommodation

Short-term rental accommodation has become increasingly popular on the Islands as it has become highly desirable for a tourist visiting the Islands. In May 2023, there were approximately 226 short-term rental accommodation listings available on Airbnb on Grand Cayman Island. The short-term rental accommodation available on the Islands plays an important role in supporting the tourism industry and wider economy. Under the Tourism Law[47], short-term rental accommodation must be operated by a licenced provider in the Cayman Islands. During consultation, stakeholders noted that there can be issues with the availability and affordability of available housing, particularly during peak tourism seasons.

14.5.2.6 Natural environment

The natural environment of the Cayman Islands is rich in biodiversity which attracts visitors from overseas and boost environmental and -nature-based tourism businesses as well as the overall economy on the Islands.

Currently, the National Trust protects approximately 6 percent of terrestrial areas. These protected reserves are designed to conserve wilderness representing areas of high biological diversity and significance. These areas of high importance include Salina Reserve, Collier's Wilderness Reserve, Governor Michael Gore's Bird Sanctuary, Mastic Reserve, and Malportas Pond Bird Sanctuary[48]. Aquatic and coastal areas around the Islands are also of importance with several important coral reefs, sea grasses and mangrove forests providing essential nutrients and habitat to fish colonies and other sea life[49].

There are also several terrestrial areas protected under the National Conservation Law in Grand Cayman, including the Western Mangrove Cays which is located approximately 1 mile (2 kilometres) north-east from the Project Site[50].

Consultation undertaken for this SEIA indicated residents and tourists value the natural environment of the Cayman Islands. As mentioned earlier -nature-based tourism is a significant draw for tourism on the islands.

43 Whittaker. *House prices have increased exponentially in last 5 years*. Cayman Compass. 2021
44 Charterland Ltd. *Cayman Property Review 2019*. 2019
45 Lands and Survey Department. *Lands and Survey Department Statistics*. 2021
46 Whittaker. *House prices have increased exponentially in last 5 years*. Cayman Compass. 2021
47 Cayman Islands Government. *Tourism Law (1995 Revision)*. 1995
48 National Trust. *Annual Report 2021-2022*. National Trust Cayman Islands. 2022
49 DOE. *Marine, Coral Reefs*. 2023
50 National Conservation Council of the Cayman Islands, 2022

14.5.2.7 Community health and wellbeing

14.5.2.7.1 Community identity and values

The local community have a strong sense of community and pride in local heritage. They also value and have a deep respect for the environment. The Cayman Islands have a rich and unique cultural heritage blending Caribbean and European style and influence[51].

Consultation with stakeholders noted that the local residents of the Cayman Islands highly value the natural environment including the terrestrial and marine environments where there are key unique flora and fauna. The local community also value the protection of these natural environments.

14.5.2.7.2 Health

The Cayman Islands enjoys a relatively high standard of living, as reflected in an annual per capita gross national income of US$61,880 in 2021 (12th in the world)[52]. The high standard of living, together with the high level of general and specialised medical care universally available in the Cayman Islands have contributed to the relatively good health of the population[53].

The ESO's 2020 Annual Compendium of Statistics recorded several improvements in health status and outcomes for the Cayman Islands population over recent years, including:

– Between 2005 and 2020 the general mortality rate fell from 3.8 deaths per 1,000 population to 3.3.
– Between 2002 and 2020 the infant mortality rate decreased from 13.7 deaths per 1,000 live births to 3.6.

Alongside these improvements, the Cayman Islands Government has recognised an important concern regarding the health status of the Cayman population relates to the gradual shift in disease patterns over the years, with chronic/lifestyle non-communicable diseases becoming more prevalent than communicable disease[54]. Mortality data for 2008 indicates that the leading causes of death in the Cayman Islanders were cardiovascular disease, heart disease, cancer, and respiratory diseases[55].

14.5.2.7.3 Crime and security

Data from the Royal Cayman Islands Police Service (RCIPS), which showed in 2021:

– There were 3,696 total recorded crimes, accounting for 11 percent of all incidents or calls for service. There have been 140 more crimes recorded in 2021 compared to 2020 equating to an increase of 3.9 percent.
– There were 56 crimes per 1,000 population in 2021, compared to 51 crimes in 2020.
– There was a total of 131 burglaries in 2021, a reduction of 26 compared to 2020, equating to a 16.6 percent year on year reduction.
– There was a slight decrease in the number of recorded offences involving domestic abuse, from 469 in 2020 to 406 in 2021. However, this reportedly decrease goes against the trend of year-on-year increases seen in previous years.

Consultation supported the finding that the Cayman Islands is a relatively safe place to live and visit. Car accidents and speeding were the most common type of incidents reported on the islands leading to the Cayman Islands having one of the highest road incidents in the world per capita. Other crimes include those involving drugs and alcohol.

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[51] Destination Cayman Islands. *Cayman's Cultural Identity*. 2021
[52] World Bank. *Gross national income per capita 2021, Atlas method and PPP*. 2023
[53] Kairi Consultants Ltd. *The Cayman Islands National Assessment of Living Conditions (2006/2007). National Assessment of Living Conditions*. 2008
[54] Ministry of Health. 2012
[55] Ministry of Health. 2012

14.5.2.8 Access and connectivity

The Islands can be accessed via plane or ship. Owen Roberts International Airport which is the main access point for international visitors is located in George Town on Grand Cayman Island. There are direct flights to 18 cities across the USA including New York City, Los Angles, Miami and Denver. There are also direct flights from Panama, Jamaica, Cuba, and Honduras. There are four cruise ship offshore anchor points located off Grand Cayman Island. Access to the Island from cruise ships is via two major port entries located at Grand Cayman and Cayman Brac.

When on the Islands, car travel is the most common and best way to get around. An existing bus service exists within the Study Area. According to the Public Transport Unit within the Cayman Islands Government, bus 5A travels along North South Road passing the south end of Seymour Road. Seymour Road is the main access road to the existing Landfill Site. Seymour Road connects with North Sound Road and to the main access roads of Esterly Tibbetts Highway and Godfrey Nixon Way, which connects various parts of the Island[56]. Other transport options include taxi's, walking, bicycle and rideshare options.

14.5.2.9 Access to services and infrastructure

14.5.2.9.1 Health infrastructure

Cayman Islands is serviced by a number of hospitals and health care services with three fully equipped hospitals in Grand Cayman, including, Cayman Islands Hospital, Doctors Hospital, and Health City Cayman Islands.

The local study area is serviced by a mix of public and private health care services, notably:

– The 127-beds Cayman Islands Hospital is the principal health care facility of the country, providing 24-hour full service medical services[57]. It is located on Smith Road, George Town approximately 2.5 miles (4 kilometres) from the project site and is operated by the Health Services Authority (HSA) of the Cayman Islands.
– The George Town District Health Centre, also operated by the HSA, also provides health services including physicians, including general physicians and mental health support services[58]. The Clinic is located at the Cayman Islands Hospital.
– Doctors Express is located in George Town and offers urgent care, family medicine, a pharmacy and other wellness services[59].
– Health City Cayman Islands is a tertiary care medical centre and hospital in Grand Cayman which opened in 2021 and offers a number of medical, surgical and diagnostic services[60].
– The independently owned and operated Doctor's Hospital is located on Walkers Road in George Town, approximately 2.8 miles (4.5 kilometres) from the Project Site. It is an eighteen-bed, medical/surgical hospital[61].

George Town is also serviced by a number of smaller, private health care clinics, general practitioners and pharmacies.

With respect to the capacity of these facilities, there are 4.7 doctors per 1,000 population in the country, representing a decrease from 5.5 in 2015[62].

14.5.2.9.2 Police service

The Cayman Islands is serviced by the RCIPS. RCIPS has seven police stations and approximately 400 officers and support staff and 50 coast guards[63]. The George Town Police Station, the main headquarters, is located on Elgin Street approximately 2.5 miles (4 kilometres) from the Project Site.

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56 APEC. *Grand Cayman Proposed Integrated Solid Waste Management System: Traffic Statement*. 2023
57 HAS. *Cayman Islands Health Services Authority*. 2023
58 HAS. *Cayman Islands Health Services Authority*. 2023
59 Cayman Islands Urgent Care, 2021
60 Health City Cayman Islands, 2023
61 Cayman Health. *New Cayman Islands hospitals planned*. 2021
62 ESO. *The Cayman Islands' Compendium of Statistics 2020*. 2021
63 RCIPC. *RCIPS Annual Crime And Traffic Statistical Report*. 2021

Consultation identified that the Police service do support the fire department in incident response and management as needed.

14.5.2.9.3 Fire service

The Cayman Islands Fire Service (CIFS) provides firefighting and rescue services nation-wide and is operational 24 hours a day 7 days a week. CIFS has approximately 153 staff members who work rotating shifts. The George Town Fire Station is located on Owen Roberts Drive, approximately 2.5 miles (4 kilometres) from the Project Site.

Consultation indicated that the Fire service currently attend to all fire related matters including aviation, education, residential, commercial, hazardous, and search and rescue. The Fire service also attend to fires at the existing Landfill Site on a regular basis. They also conduct annual inspections of the existing landfill including fire breaks around the Landfill Site.

14.5.3 Key findings

The key findings of the socio-economic baseline are summarised below:

– The population of George Town and the Cayman Islands has grown considerably over the last decade.
– There is a high migrant population in the Cayman Islands with a high proportion of people arriving from Jamacia, the Philippines, the UK, and USA. This is also reflected in the high foreign labour market and temporary workers permits.
– Along with the high foreign labour force there was high labour force participation. Males made up slightly more of the labour force compared to females.
– Unemployment across the Cayman Island was low at an estimate 2.2 percent in 2022. The majority of the unemployed labour force consisted of persons aged 25-34 years.
– The construction industry was the largest employing industry in the Cayman Islands by total labour force making up over 15 percent of the total labour force.
– The financial services industry was the fourth largest industry by people employment and the largest industry by economic value contributing $1.5 billion to the GDP of the country.
– Tourism is a key industry on the Islands with over 2.1 million people visiting the Islands each year. The tourism industry also employs a significant proportion of the foreign labour market.
– Renting is the most common type of tenure across the Cayman Islands. Over the last decade the rental market has seen consistent growth with the average rental price for a 2-bedroom apartment between CI$2,000 and CI$2,500 per month. High rental prices and overall cost of living is seen as a barrier to housing affordability and attracting and retaining people.
– The natural environment of the Cayman Islands is highly valued and protected by the local community. The natural environment is also a key tourist attraction to the islands with a number of businesses in the -nature-based tourism industry.

14.6 Impact assessment – construction

This section assesses the socio-economic impacts associated with the construction of the Project. The sensitivity and magnitude have been determined in accordance with the methodology outlined in Section 14.3.5. The significance rating shown in Section 14.3.7 has been applied to each social impact based on the outcome of this assessment.

Table 14.15 Socio-economic impact assessment – construction

Impact summary	Description	Nature/ extent/ context	Magnitude	Sensitivity	Significance rating
Population					
Population and demographic change from construction workforce	During construction, the workforce is estimated to be 300 employees over the duration of the three-year construction timeframe. As detailed in Chapter 4, there is aspiration for up to 100 personnel to be local Caymanian residents as employees or subcontractors. The Project will prioritise the sourcing of construction personnel from the Cayman Islands, however, for the remaining workforce, and where workers are unable to be sourced from within the country, personnel may be engaged from elsewhere, including from other surrounding Caribbean islands and overseas. On this basis, Project construction would contribute to a temporary population increase in Cayman. Given that the existing high tourism and non-resident worker populations is part of community composition in Cayman, a temporary increase in the non-resident population may not be highly noticed. Given the typical nature of construction workforce, it is also anticipated that the additional temporary population would be a predominantly single male population.	**Beneficial / Adverse** **Short term** **National**	**Low**	**Medium**	**Minor (neutral)**
Employment and economy					
Increase in direct local employment during construction.	The Project's construction phase will create direct employment for approximately 300 full-time equivalent (FTE) workers over the three-year construction period (on average 100 FTE per year), and for 15 months the number will exceed 250 people. This would provide employment opportunities for residents in Cayman, in particular those skilled in construction, engineering, project management and administration, potentially increasing the level of employment in the region. Stakeholders consultation indicated the potential of the project to have positive impact on the regional economy through direct employment opportunities was a key benefit. As detailed in Chapter 4, up to 100 individuals are proposed to be local Caymanian residents engaged as employees or subcontractors (and for 16 months the percentage of local Caymanians will exceed 30 percent)	**Beneficial** **Short term** **National**	**Low**	**Medium**	**Minor (beneficial)**

Impact summary	Description	Nature/ extent/ context	Magnitude	Sensitivity	Significance rating
	during the construction period. Based on the number of people employed within the construction industry, this would amount to 1.5 percent of the total construction workforce currently within the Cayman Islands. Notwithstanding this, during consultation, stakeholders noted that there is often not enough local labour to meet the demand of certain industries, with foreign labour comprising a large portion of the construction industry.				
Increased training opportunities	The Project's construction phase will provide opportunities to enhance skills and capacity of employees in the local and regional study areas through the proposed apprenticeships, traineeships and work experience opportunities throughout the works period, as identified in Chapter 4. Through the SEIA consultation it was understood that there is a strong interest in the potential for the Project to create employment and skills development opportunities for the local population, however understanding these training requirements ahead of time is critical in allowing time for trade colleges and vocational education providers to upskill the existing workforce. Project training and development opportunities would provide particular benefit for young people and new entrants to the workforce who experience high levels of disadvantage and employment inequity in the regional study area.	**Beneficial** **Long term** **National**	**Medium**	**Medium**	**Moderate (beneficial)**
Increased competition for workers in local and regional labour market	During consultation, stakeholders noted that there are often labour challenges amongst local workforces for specialist roles, with many industries being supplemented by a foreign workforce. Consequently, there is potential for the Project to draw local workers from existing jobs, potentially creating competition for labour for particular skills, particularly in the construction industry. This may result in increased skilled labour shortages for periods of the construction phase. The attraction of a construction workforce from existing businesses and industries in the region may contribute to competition for labour in the regional study area. This may lead to temporary labour shortfalls and increased cost of labour for other construction work, particularly if other projects are constructed during the same period.	**Adverse** **Short term** **National**	**Medium**	**Medium**	**Moderate (adverse)**

Impact summary	Description	Nature/ extent/ context	Magnitude	Sensitivity	Significance rating
Procurement opportunities for local businesses and the purchase of goods and services during construction	As noted in Chapter 4, the project will provide procurement opportunities for eligible regional businesses to provide construction materials and services (including civil works, construction and transportation), which would lead to increased revenue and business growth for those engaged and contribute to the regional economy. Consultation for the SEIA noted that there is capacity amongst local businesses to support the construction of the Project.	**Beneficial** **Short term** **National**	**Low**	**Medium**	**Minor (beneficial)**
	During the construction period, the Project will provide local spend at Cayman businesses through the provision of goods and services to support construction activities, including, but not limited to construction materials, uniforms, catering and accommodation. An increase in local spend opportunities would lead to increased revenue and business growth for those businesses.	**Beneficial** **Short term** **National**	**Low**	**Medium**	**Minor (beneficial)**
Indirect employment through procurement opportunities	The procurement of local and regional goods and services to support construction and operation of the Project would indirectly generate employment opportunities for residents of the region.	**Beneficial** **Short term** **National**	**Low**	**Low**	**Negligible (beneficial)**
Increased in local trade associated with expenditure of wages	Local food and retail businesses in George Town would benefit economically from increased food and beverage trade as a result of patronage by the construction personnel working on the Project Site. Local businesses, including accommodation providers, and food and beverage providers may also benefit from short term foreign workers during the construction phase, as they would need to be accommodated nearby.	**Beneficial** **Short term** **National**	**Low**	**Medium**	**Minor (beneficial)**
Services and infrastructure					
Increased demand for housing and accommodation access	During construction, an influx non-resident workers may result in an increased demand on short term housing and accommodation in Cayman. During consultation, stakeholders noted that there existing pressures relating to the availability and affordability of housing and accommodation in Cayman, particularly during peak tourism seasons. Housing requirements during construction may result in reduced availability of rentals and short-term accommodation facilities.	**Adverse** **Short term** **National**	**Low**	**Low**	**Negligible (adverse)**
	Tourism is a major industry contributing to the Cayman Island economy. Increased pressure on short term accommodation, over the construction period, may have some impact on short-term accommodation availability for the tourism industry.	**Adverse** **Short term** **National**	**Very low**	**Low**	**Negligible (adverse)**

Impact summary	Description	Nature/ extent/ context	Magnitude	Sensitivity	Significance rating
Increased demand for community facilities and services.	The non-resident construction workforce may increase demand on local and regional community facilities and services, such health services. As identified in Section 14.5.2.9.1, there are a number of health services in Cayman, including the Cayman Islands Hospital and George Town District Health Centre. On this basis, it is anticipated that available services can absorb an increase in demand and therefore unlikely to impede of local community' s access to health services.	**Adverse** **Short term** **National**	**Very low**	**Low**	**Negligible (adverse)**
Increased demand on emergency services	There may also be demand for assistance from fire services in relation to fire planning / prevention to protect Project infrastructure. During consultation, it was noted that emergency services are frequently required at the existing landfill site to respond to fires occurring at the Site. Increased construction activity in addition to an increase in population associated with the construction activity may result in increased demand for emergency services, particularly for the Cayman Island Fire Service.	**Adverse** **Short term** **National**	**Medium**	**Low**	**Minor (adverse)**
Perceived impacts to community safety and community cohesion	Research indicates a common concern raised by communities during the planning for major infrastructure projects relates to the 'influx' of non-local workers ('outsiders') and the perceived potential for an increase in anti-social behaviour, crime and overall reduction in community cohesion, particularly in small communities with limited exposure to development[64]. The construction workforce (approximately 300 FTE workers over the three-year construction period) would include a proportion of non-resident workers. In the event that the majority of construction workers are from outside of the regional study area, there is potential that the occurrence of or any perceived anti-social behaviour could be attributed to the presence of construction workers and result in feelings of anxiety and distrust towards project workers by members of the local community.	**Adverse** **Short term** **National**	**Medium**	**Low**	**Minor (adverse)**
Changes in perception of personal safety	Presence of male dominated workforce during construction in George Town may contribute to concerns about community safety within Cayman particularly as the workforce would be non-local to Cayman. The presence of a non-local construction workforce may also concern some residents regarding reduction in feelings of community cohesion. However, given the high proportion of foreign workers currently in Cayman (Section 14.5.2.3.1), it is anticipated that residents are likely to adapt to an increase to the existing non-residential workforce.	**Adverse** **Short term** **National**	**Medium**	**Low**	**Minor (adverse)**

64 Scott, John, Kerry Carrington, and Alison McIntosh. *'Established-Outsider Relations and Fear of Crime in Mining Towns.' Sociologica Ruralis, 52(2), 147–69*. 2011

Impact summary	Description	Nature/ extent/ context	Magnitude	Sensitivity	Significance rating
Mental health of non-resident workers	Non-resident construction workforce may be at greater risk of mental health and wellbeing impacts. Isolation and loneliness has been found to contribute to feelings of decreased mental health for non-resident construction workforce.	**Adverse** **Short term** **National**	**Very low**	**Low**	**Negligible (adverse)**
Environmental quality and natural resources					
Increased noise, vibration and dust levels due to construction activities	Construction activities would generate noise, vibration and dust during standard work hours. This would involve the use of noise generating equipment, operation and movement of heavy machinery (such as dozers, graders, front end loaders, excavators, trucks and scrapers) and construction traffic. Most noise would be intermittent or sporadic throughout the construction period. Increased construction noise during the daytime may disturb day-to-day activities for affected residents, and impact their quality of life. This could include the need to close windows whilst indoors, or spending less time outdoors engaging in recreational activities or relaxation. Increased noise could disturb activities such as conversations, watching television, or listening to music or the radio. *Noise and Vibration* (Chapter 12) found that the Project has the potential to produce noise emissions in the vicinity of the Project above the documented baseline limits. These changes would be experienced for nearby sensitive receptors including nearby residential areas, residents along haulage routes, the nearby school and nearby hospital. *Noise and Vibration* (Chapter 12) has deemed that construction vibration impacts are 'insignificant' for all receptors with magnitude of change of "very low".	**Adverse** **Short term** **Local**	**Medium**	**Low**	**Minor (adverse)**
	Air Quality and Greenhouse Gases (Chapter 11) reports that some construction activities would have the potential to generate dust which would be experienced by residences and businesses close to the construction area, and at some residences along haulage routes. Increases in dust may lead some residents and businesses to alter their way of life, such as closing windows whilst indoors, spending less time outside, or spending additional time cleaning indoor and outdoor surfaces. *Air Quality and Greenhouse Gases* (Chapter 11) has deemed that there are negligible dust effects likely to occur due to the construction activities and will be managed through the implementation of appropriate mitigation plans.	**Adverse** **Short term** **Local**	**Low**	**Low**	**Low (adverse)**

Impact summary	Description	Nature/ extent/ context	Magnitude	Sensitivity	Significance rating
Changes to visual amenity and sense of place	During consultation, stakeholders noted that the visual amenity and the natural environment is highly valued by residents and tourists of the Cayman Islands (Section 14.5.2.6). Additionally, stakeholders noted that the current landfill operations considerably reduce the visual amenity, particularly for surrounding residents, residents in high-rise apartment buildings, tourists using main roads, incoming cruise ships off Seven Mile Beach. *Landscape and Visual* (Chapter 10) found that there may be direct and indirect landscape effects upon the surrounding landscape/townscape/seascape character of areas during construction of the Project (for those visual receivers/viewpoints with views to the Project Site). This would include the presence of construction machinery and infrastructure, construction workers, and views of construction vehicles along haulage routes. Changes to visual surroundings may impact residents' sense of pride in their local area, and reduce enjoyment of outdoor areas, or views from some windows and yards. Views of construction activities would have the potential to impact properties close to the project site in surrounding residential settlements and properties in high-rise residential properties on Seven Mile Beach. These residents are likely to be sensitive to these changes due to the value that is placed on the character of the area (Section 14.5.2.6), and the existing visual amenity impacts of the current landfill operation (Section 14.5.1). Visual impacts would be limited to the duration of the construction period, and most residents are expected to adapt to these changes.	**Adverse** **Short term** **National**	**Medium**	**Low**	**Minor (adverse)**
	Landscape and Visual (Chapter 10) identified that construction activities may be visual from high-rise residential properties on Seven Mile Beach, the National Gallery of the Caymans Island and Cruise Liners anchored off Seven Mile Beach, which are key areas for tourists. This would include the presence of construction machinery and infrastructure, construction workers, and views of construction vehicles along haulage routes. Tourists may be sensitive to these changes due to the value that is placed on the character of the area (Section 14.5.2.6). Visual impacts would be limited to the duration of the construction period, and most tourists are expected to adapt to these changes, as construction sites are a commonly occurring urban views.	**Adverse** **Short term** **National**	**Medium**	**Low**	**Minor (adverse)**

Impact summary	Description	Nature/ extent/ context	Magnitude	Sensitivity	Significance rating
Combined amenity impacts	Residents and businesses located adjacent to the Project Site and along construction haulage routes would have the potential to experience combined impacts during construction due to noise, dust and visual changes. Residents in the area would be sensitive to these changes, however as the Site is located on the Site of the existing landfill, it is not expected that residents will be able to adapt to these changes. Some residents may be more vulnerable, and there is potential for impacts to overall wellbeing for some.	**Adverse** **Short term** **National**	**Medium**	**Low**	**Minor (adverse)**
Access and connectivity					
Reduced traffic safety / increased risk of traffic accidents due to construction traffic	During construction, *Traffic and Transport* (Chapter 13) reports that of the 300 staff, 150 additional vehicles would be added to the traffic along North Sound Road & Seymour Road during the peak periods, across the three- year construction period. In addition to this, it is expected that there will be approximately 37 heavy vehicles will travel to and from the ISWMS Site during the construction stage of the Project. During consultation, stakeholders noted that along these roads there are existing traffic issues associated with long travel time during peak hours as well as a high number of traffic accidents. An increase in light and heavy vehicles on major roads may result in actual or perceived reductions in road safety for road users.	**Adverse** **Short term** **Local**	**Medium**	**Low**	**Minor (adverse)**
Increased travel times and inconvenience for local road users	Increased time spent travelling may cause delays in getting home, to work, or other commitments. This may be inconvenient for some road users and cause frustration.	**Adverse** **Short term** **Local**	**Low**	**Low**	**Low (adverse)**
Damage to roads as a result of construction traffic	The presence of construction traffic on local roads in Cayman, and in particular, in George Town, may result in damage to roads and potentially lead to increased travel time for commuters, increase the chances of damages to commuter vehicles and reduced road safety.	**Adverse** **Short term** **Local**	**Low**	**Low**	**Low (adverse)**

14.7 Impact assessment – operation

This Section assesses the socio-economic impacts associated with the operation of the proposal. The sensitivity and magnitude have been determined in accordance with the methodology outlined in Section 14.3.5. The significance rating shown in Section 14.3.7 has been applied to each social impact based on the outcome of this assessment.

Table 14.16 Socio-economic impacts – operation

Impact category	Description	Nature/ extent/ context	Magnitude	Sensitivity	Significance rating
Population					
Population and demographic change from operational workforce	As detailed in Chapter 4, the project is expected to require an operational workforce of 70 FTE workers per year, (which is comparable to the existing staffing level at the GTLF), however a number of these would be new roles and be predominantly skilled positions associated with the operation of the ERF and resource recovery facilities. The Project will prioritise the sourcing of operational personnel from the Cayman Islands, however, where workers are unable to be sourced from within the country, personnel may be engaged from elsewhere, including from other surrounding Caribbean islands and overseas. There are currently low levels of unemployment (Section 14.5.2.3.2) and a high proportion of foreign workers in Cayman, with stakeholders (during SEIA consultation) noting a number of industries are supplemented by non-resident workers, particularly specialist roles (Section 14.5.2.3.1). On this basis, it is likely that a proportion of the operational workforce may be sourced from overseas, requiring relocation to Cayman Islands, which is likely to result in a direct increase in the permanent resident population of Cayman.	**Beneficial/ Adverse** **Long term** **National**	**Low**	**Medium**	**Minor (neutral)**
Employment and economy					
Increase in local employment during operation.	As detailed within Chapter 4, the Project is expected to require an operational workforce of 70 FTE workers per year (which is comparable to the existing staffing level at the GTLF). These would be new roles and be predominantly skilled positions associated with the operation of the ERF and resource recovery facilities. This would provide employment opportunities for residents in the local and regional area, potentially increasing the level of employment in the region. However, there are low unemployment rates in Cayman (Section 14.5.2.3.2) with stakeholders (during SEIA consultation) noting that there is often not enough local labour to meet the demand of certain industries, with foreign labour supplementing a number of industries, and in particular, skilled roles (Section 14.5.2.3.1).	**Beneficial** **Long term** **National**	**Low**	**Low**	**Negligible (beneficial)**

Impact category	Description	Nature/ extent/ context	Magnitude	Sensitivity	Significance rating
	On this basis, operational-related local employment opportunities are likely to be limited to a small number of people, however, would be long-term in nature and sustain local employment opportunities.				
Contribution to the regional economy through procurement of goods and services, employment, and supporting growth of the renewable energy industry.	During operation, there would be opportunities for businesses in Cayman to supply goods and services to the ERF. This includes opportunities to service operations such as transport and logistics (e.g., waste haulage companies). The Project also has the potential to generate new businesses to support its operations in Cayman as ERF technology is a new industry for the region.	**Beneficial** **Long term** **National**	**Medium**	**Medium**	**Moderate (beneficial)**
	During operation, the Project will contribute to the regional economy through: The sale of electricity from the ERF to the Caribbean Utility Company (CUC) The Green Waste Processing Facility which will receive and process yard waste and will store the resulting compost and mulch products for onward resale into the Cayman marketplace The Construction and Demolition Waste Processing Facility which will allow for the recycling, recovery and diversion of construction and demolition wastes which can be repurposed will be re-sold into the market These components of the Project will contribute to the growth of the region's renewable energy and waste management industries.	**Beneficial** **Long term** **National**	**Medium**	**Medium**	**Moderate (beneficial)**
Opportunity to support local businesses through improvements in waste management	During operation, the waste management facilities, including the Construction and Demolition Waste Processing Facility and Green Waste Processing Facility will receive materials which includes yard materials, construction waste and demolition waste. Businesses such as construction and landscaping companies may benefit from appropriate facilities to manage their waste, assisting in their waste management process. This may improve processes and efficiency of waste management, which is likely to be positively received by local businesses.	**Beneficial** **Long term** **National**	**Low**	**Low**	**Negligible (beneficial)**
Opportunity for economic diversification	Operation of the Project would contribute to economic diversification of the Cayman Island economy through the production of green electricity, the operation of new waste management technology and through the recovery and repurposing of resources. Diversification of the economy was noted as a key benefit of the Project by stakeholders.	**Beneficial** **Long term** **National**	**Medium**	**Medium**	**Moderate (beneficial)**

Impact category	Description	Nature/ extent/ context	Magnitude	Sensitivity	Significance rating
Opportunity for the Project to support the growth of the tourism industry	Stakeholders consulted for the SEIA noted that within the tourism industry, there is an aspiration for more sustainable waste management practices. Improvements in waste management practices, including the transition from the existing landfill Site, may improve Cayman's tourism offering by allowing expansion the -nature-based tourism market and to promote sustainable tourism practices. The tourism industry, including operators and business owners, are likely to be welcoming of improvements to waste management.	**Beneficial** **Long term** **National**	**Low**	**Low**	**Negligible (beneficial)**
Increased competition for workers in local and regional labour market	As discussed in Section 14.5.2.3.2, there are low unemployment rates in Cayman. Consequently, due to operational workforce requirements there may be potential for the Project to draw workers from existing jobs, potentially creating competition for labour for particular skillsets. However, during consultation, stakeholders noted that there is often not enough local labour to meet the demand of certain industries and operational roles are likely to require specialist skills which may not be available in the local workforce. This may require outsourcing employment to non-resident workers which would reduce pressure on the local labour market.	**Adverse** **Long term** **National**	**Low**	**Low**	**Negligible (adverse)**
Increased capacity of the local workforce	During consultation, stakeholders identified that education and training associated with upskilling the workforce is a potential key benefit that could arise during operation of the Project. Training opportunities would benefit residents of Cayman by building capacity and skills of the workforce, with stakeholders citing potential opportunities as including apprenticeships, traineeships, upskilling and linkages with existing training providers in the region.	**Positive** **Long term** **National**	**Medium**	**Medium**	**Moderate (beneficial)**
Services and infrastructure					
Increased demand for housing and accommodation	During operation, there may be non-residential workers being employed and subsequently permanently relocating to Cayman. An increase in non-resident operational workers may result in an increased demand on housing in Cayman. During consultation, stakeholders noted that there is existing demand on affordability and availability of housing and accommodation in Cayman, particularly during peak tourism seasons. Housing requirements during operation may result in reduced availability of long-term rentals.	**Adverse** **Long term** **National**	**Low**	**Low**	**Negligible (adverse)**
Increased demand for community facilities and services.	An increase in the permanent population of Cayman during operation may increase demand on local services and facilities, such as health services.	**Adverse** **Long term** **National**	**Low**	**Low**	**Negligible (adverse)**

Impact category	Description	Nature/ extent/ context	Magnitude	Sensitivity	Significance rating
	As identified in Section 14.5.2.9.1, there are a number of health services in Cayman, including the Cayman Islands Hospital and George Town District Health Centre. The number of non-resident workers required for operation of the Project is likely to be small, generating limited additional demand for community infrastructure. Community infrastructure is likely to cope with this additional demand.				
Increased demand on emergency services	There may also be demand for assistance from fire services in relation to fire planning / prevention to protect Project infrastructure. During consultation, it was noted that emergency services are frequently required at the existing landfill Site to respond to fires occur at the Site. Operational activities in addition to an increase in population associated with the operation activity may result in increase demand for emergency services to respond to incidents. Consultation with emergency services suggested that with current operations requiring frequent incident response, there would be capacity for the service to respond to demand created by the new facility if appropriate emergency management planning is undertaken.	**Adverse** **Long term** **National**	**Low**	**Low**	**Negligible (adverse)**
Health and community wellbeing					
Community pride associated with the contribution to the circular economy.	During operation of the Project, the recycling center will be used to receive end-of-life goods together with unwanted but serviceable or repairable products that can be re-used or repurposed. These will then be made available free of charge to other members of the public or third sector organisations for beneficial re-use. Additionally, the Green Waste Processing Facility and Construction and Demolition Waste Processing Facility will receive and process reusable materials for onward resale into the Cayman marketplace. The establishment of the household waste recycling centre, Green Waste Processing Facility and Construction and Demolition Waste Processing Facility may create a sense of civic pride and satisfaction through participation in recycling and contribution to a circular economy.	**Beneficial** **Long term** **National**	**Medium**	**Medium**	**Moderate (beneficial)**
	During operation, the process of diverting solid waste from a conventional landfill to an energy recovery process, would emit considerably less GHG and will offset emissions with every ton of avoided waste to a landfill. Residents of Cayman place a high value on the natural environment and environmental preservation. This is also a key driver of tourism on the Island. A reduction in GHG emissions from the operation of the Project may create a sense of civic pride and satisfaction through the participation in environmental sustainability efforts.	**Beneficial** **Long term** **National**	**Medium**	**Medium**	**Moderate (beneficial)**

Impact category	Description	Nature/ extent/ context	Magnitude	Sensitivity	Significance rating
Perception of health risk associated with the operation of the project	Residents in the local study area may be concerned that the Project may increase the potential for the ingestion of contaminated produce or water or inhaling air-borne pollutants. The perception of potential impacts to health may lead to stress and worry for some community members, which could impact health and wellbeing for some individuals, and may have broader community wellbeing effects.	**Adverse** **Long term** **National**	**Medium**	**Medium**	**Moderate (adverse)**
Changes (actual and perceived) to personal safety and hazard exposure	Energy from waste is an emerging technology in Cayman, although it is a common method of processing waste in a range of countries around the world. Stakeholders indicates that the potential impacts and benefits of energy from waste technology and these types of facilities are not well understood by the community. The perception of negative health impacts from the operation of the Project, and uncertainty about the processing technology, may lead to stress and worry for some residents in the area. This could affect overall mental health and wellbeing	**Adverse** **Long term** **National**	**Medium**	**Medium**	**Moderate (adverse)**
Perceived impacts to community safety and community cohesion	The operational workforce (averaging 70 FTE per year) would include a proportion of non-resident workers. In the event that the majority of operational workers are from outside of the regional study area, there is potential that the occurrence of or any perceived anti-social behaviour could be attributed to the presence of operational workers and result in feelings of anxiety and distrust towards Project workers by members of the local community. However, given the high proportion of foreign workers currently in Cayman (Section 14.5.2.3.1), it is anticipated that residents are likely to adapt to an increase to the existing non-residential workforce.	**Adverse** **Long term** **National**	**Low**	**Low**	**Negligible (adverse)**
Changes in perception of personal safety during operation	During operation of the Medical Waste Facility, there may be actual or perceived impacts to community safety as a result of possible theft of contraband drugs destined for incineration. This may concern some residents regarding reduction in safety.	**Adverse** **Long term** **National**	**Low**	**Low**	**Negligible (adverse)**
	The Project operation will involve the processing and storing of some combustible materials, particularly in the Construction and Demolition of existing waste facility. This may elevate the fire risk at the Project Site. Given the current issues associated with fire occurrences at the existing landfill Site, residents may be sensitive to safety concerns associated potential fire risk during operation of the Project.	**Adverse** **Long term** **National**	**Low**	**Low**	**Negligible (adverse)**

Impact category	Description	Nature/ extent/ context	Magnitude	Sensitivity	Significance rating
Environmental quality and natural resources					
Improvements to safety and amenity during operation of the ISWMS	During consultation, the majority of stakeholders noted considerable issues with the existing landfill operations. These concerns include safety impacts associated with persistent fire risk, the unpleasant visual amenity as the existing Site is visible from major roads and from tourist destinations, and the odour associated with an open landfill Site. The Project aims to alleviate the current waste management issues associated with the landfill Site by providing an ERF and Household Waste Recycling Centre which aims to reduce the amount of physical waste present on-Site. The operation of the Project will subsequently minimise current amenity and safety impacts being experienced, with stakeholders noting that the Project will be beneficial to improve current conditions. Residents in Cayman are likely to be receptive to improvements in current waste management operations which may result in improved amenity.	**Positive** **Long term** **National**	**Medium**	**Medium**	**Moderate (beneficial)**
Noise impacts associated with the operation of the Project	During operation of the Project, there will be a number of noise and vibration generating activities associated with waste processing and storage. These activities will involve exhaust systems, shredders, grinders, generators and combustion stacks which have the potential to cause an adverse noise impacts at receptors. Sensitive receptors associated with noise impacts are surrounding residential properties, schools, and commercial sites. Some of the activities with highest noise and vibration potential, such as combustion and power generation would occur 24 hours a day, 7 days a week. However, a number of design features have been built into the concept design for the Facility to reduce potential noise impacts and ensure compliance with noise criteria at residences. During operation of the ERF, steam purging is a critical hot commissioning activity that occurs once in the lifetime of the plant and is a high noise generating activity. This process involves a silencer designed to reduce noise from this event and will only occur one time prior to the commencement of operation of the Facility. *Noise and Vibration* (Chapter 12) indicates that the overall noise impact is considered to be low during the daytime and medium moderate during the quiet parts of the evening and night-time. *Noise and Vibration* (Chapter 12) recommends measures to manage and minimise the potential impacts identified. With appropriate design responses, it is expected that operation of the Facility is unlikely to generate significant noise impacts.	**Adverse** **Long term** **National**	**Low**	**Low**	**Negligible (adverse)**
	During operation, *Noise and Vibration* (Chapter 12) indicated that additional heavy vehicles associated with the transport of waste materials will result in a negligible to minor short-term increase and a negligible	**Adverse** **Long term**	**Low**	**Low**	**Negligible (adverse)**

Impact category	Description	Nature/ extent/ context	Magnitude	Sensitivity	Significance rating
	long-term increase to road traffic noise levels at existing sensitive receptors. Residents along haulage routes are likely to be sensitive to operational traffic	**National**			
Changes to air quality due to operation of the Project	During operation of the Project, there would be increased contaminant concentrations and odour due to the additional emissions. Emissions and odour would be associated with the ERF, incinerators, waste storage and from the transportation of waste. Operation associated with the Green Waste Operations and Construction and Demolition processing may produce dust during processing of materials. Increases in odour and air-borne pollutants may be noticeable in areas around the Project Site and along haulage routes and could lead some residents and business owners changing their behaviour. This could include spending more time indoors, and closing windows and doors of houses or vehicles. This may impact residents' overall enjoyment of outdoor spaces, and reduce feelings of pride in their local area. However, *Air Quality and Greenhouse Gases* (Chapter 11) states that all cumulative impacts are shown to be 'not significant', when mitigation measures are applied.	**Adverse** **Long term** **National**	**Low**	**Low**	**Negligible (adverse)**
Changes to visual amenity and sense of place	During consultation, stakeholders noted that the visual amenity is highly valued by residents and tourists of the Cayman Islands. Additionally, stakeholders noted that the current landfill operations considerably reduce the visual amenity, particularly for surrounding residents, residents in high-rise apartment buildings, tourists using main roads, incoming cruise ships off Seven Mile Beach. The *Landscape and Visual* (Chapter 10) found that there may be direct and indirect landscape effects upon the surrounding landscape/townscape/seascape character of areas during operation of the Project due to the presence of the ERF and associated resource recovery facilities (for those visual receivers/viewpoints with views to the Project Site). The operation would be visible from properties close to the Project Site in surrounding residential settlements and properties in high-rise residential properties on Seven Mile Beach. These properties would currently have views of the existing landfill Site. Due to existing amenity impacts associated with the current landfill operation, it is anticipated that residents would be able to adapt to these changes, with stakeholders noting that the Project is welcome to provide improvements to overall visual amenity.	**Adverse / beneficial** **Long term** **National**	**Low**	**Low**	**Negligible (neutral)**

Impact category	Description	Nature/ extent/ context	Magnitude	Sensitivity	Significance rating
Combined amenity impacts	Residents and businesses located adjacent to the Project Site and along waste haulage routes would potentially experience combined impacts during operation due to noise, dust and visual changes. Residents in the area would be sensitive to these changes, however as the Site is located on the existing landfill, it is expected that residents will be able to adapt to these changes. Some residents may be more vulnerable, and there is potential for impacts to overall wellbeing for some.	**Adverse** **Long term** **National**	**Low**	**Low**	**Negligible (adverse)**
Access and connectivity					
Increased traffic during the operation of the Project	An increase in light and heavy vehicles on major roads during operation may result in actual or perceived reductions in road safety for road users. However, as noted in *Traffic and Transport* (Chapter 13), the operation of the Project (operating times, waste collection practices, etc.) are expected to be similar to the existing GTLF operations with a marginal increase in staff numbers compared to existing. Trip generation by the ReGen Facilities is expected to be in line with the trips currently generated by the GTLF. There are no plans to modify the waste collection practices. During consultation, stakeholders noted that along these roads there are existing traffic issues associated with long travel time during peak hours as well as a high number of traffic accidents. While the operation of the Project does not involve any changes to the existing waste collection processes, there may be an increase in private vehicles transporting waste to the resource recovery facilities at the ISWMS, however this is not expected to increase the existing safety issues on the road network.	**Adverse** **Long term** **National**	**Low**	**Low**	**Negligible (adverse)**

14.8 Mitigation measures

The socio-economic opportunities and impacts identified and assessed in this report would be managed and mitigated and opportunities enhanced through a range of measures recommended in this report, and by other relevant mitigation measures recommended in other EIS specialist studies (such as the noise and vibration assessment, landscape and visual assessment, and traffic and transport assessment) and Chapter 4. Measures for the mitigation and management of socio-economic impacts are detailed in Table 14.17.

Table 14.17 Overview of mitigation and enhancement measures

Plan	Description
Employment and skills plan	As detailed in Chapter 4, the construction contractor will develop an Employment and skills plan which will be submitted to the Government two months prior to the Works Commencement Date for comment and review. The Employment and skills plan will aim to: – Promote the availability of both skilled and unskilled employment opportunities within the Project – Encourage the workless and new entrants into the workforce – Ensure compliance with the relevant labour Legislation in the Cayman Islands by setting out the particular requirements – Improve the skills of the local workforce, both new and existing by encouraging transition from expats to local employment over the course of time – Provide apprenticeships, traineeships and work experience opportunities throughout the Works Period The Employment and skills plan will include, at a minimum: – Staffing capacity – Staff training and performance assessment procedures – Details of induction training for staff and visitors – Working hours and shift patterns for each Facility – Number of supervisors and use of sub-contractors – Details of experience and qualifications required of key Project personnel – Staff welfare policy – Job descriptions – Backup arrangements in case of shortages, seasonal and exceptional staffing requirements The Contractor will undertake annual reviews of the Employment and Skills Plan to ensure relevance and appropriateness and to monitor performance. As part of the Employment and Skills Plan, the Contractor will develop an "Employees Handbook" that sets out the rights and responsibilities of all members of staff during the Services period.
Consultation framework	As detailed in Chapter 5, a formal consultation framework for the ISWMS has been developed in collaboration with ReGen and CIG to satisfy the public consultation requirements of the EIA as well as engage and educate the public and key stakeholders about the ISWMS Project. The main goals of the consultation framework include: – Satisfy public consultation requirements per the EIA Directive – Improve efficiency of communication with the public and stakeholders – Maintain and improve relationships with stakeholders, including neighbors, and the broader community – Demonstrate willingness to listen and consider input from stakeholders – Enhance the reputation of ReGen as a responsible entity for managing waste The consultation framework is expected to assist in managing potential concerns about the Project once the EIA is on public exhibition, as well as strengthen relationships with key stakeholders (e.g., emergency services, government agencies and residents).

Plan	Description
Community Liaison Plan	ReGen has been undertaking engagement with the local community and key stakeholders for the ISWMS prior to this Project. There is therefore an established relationship between ReGen, and some local communities and stakeholders. SEIA consultation indicated that ongoing, regular and transparent communication with key stakeholders and residents in Cayman would be important to managing community perceptions of the Project in the community. In line with Good Industry Practice, the Contractor will develop and agree with the Government a Community Liaison Plan (CLP), which will cover both the construction and operational phases of the Contract. The CLP will include: – The scope, purpose and timetable for all consultations with relevant stakeholders – Full details of all promotional activities to promote each of the Facilities (including but not limited to the provision of a web site containing community and facility performance information). For the construction period this will be provided through a link to the Contractor's Project website – Measures to proactively encourage community attendance at organised liaison meetings – Details of the general procedures for handling questions, complaints and protests A Community and Stakeholder Engagement Strategy is expected to assist with managing potential concerns about the Project, as well as strengthen relationships with key stakeholders (e.g., emergency services, government agencies and residents).
Enquires and complaints plan	A Project-specific enquiries and complaints plan for the Project will be developed to establish the protocol by which standards for dealing with enquiries, complaints, compliments and suggestions from members of the public and other interested parties. The Contractor will allow for enquiries, complaints, compliments and suggestions to be made directly to a member of staff either by telephone, e-mail, via the designated Project website or social media interface or in writing. This will involve a dedicated e-mail address to enable the receipt of complaints, which will facilitate an acknowledgement by return via an automated response. Details of the dedicated web address for enquiries and complaints will be published in newsletters, on site entrance signs, on informational or promotional literature associated with the Project, and on the Contractor's website with an appropriate link. This would be developed and implemented to ensure that residents and stakeholders are notified in a timely manner about construction activities and potential for impacts, accurate information is accessible, and enquiries and complaints are managed in a timely manner.
Procurement plan	As detailed in Chapter 4, the proponent ReGen is committed to supporting the Cayman Islands through the procurement with local businesses. ReGen will develop a procurement plan, to support procurement activities required for the construction and operation of the project, and to leverage local contractors, where feasible. Procurement for the Project will, at a minimum, involve: – Bid packages: which will be developed to make best use of local contractors and their capabilities – A procurement plan will be developed to include target dates for scope development Procurement planning will be developed to assist local contractors and businesses in understanding the opportunity and scope of the Project procurement requirements and allow for involvement in the tendering process for bid packages.

Table 14.18 summarises the mitigation and enhancement measures applicable to the socio-economic impact identified in Sections 14.6 and 14.7 of this chapter, and from other environmental topic chapters.

Table 14.18 Summary of mitigation and enhancement measures for socio-economic impacts

Impact category	Mitigation or enhancement	Relevant EIA specialist study
Population and demographic change from construction workforce	Employment and skills plan	SEIA
Increase in direct local employment during construction.	Employment and skills plan	SEIA
Increased training opportunities	Employment and skills plan	SEIA
Increased competition for workers in local and regional labour market	Employment and skills plan	SEIA

Impact category	Mitigation or enhancement	Relevant EIA specialist study
Procurement opportunities for local businesses and the purchase of goods and services during construction	Procurement plan	SEIA
Indirect employment through procurement opportunities	Procurement plan	SEIA
Increased in local trade associated with expenditure of wages	Procurement plan	SEIA
Increased demand for housing and accommodation access	Employment and skills plan Consultation framework Community Liaison Plan	SEIA
Increased demand for community facilities and services.	Consultation framework Community Liaison Plan	SEIA
Increased demand on emergency services	Consultation framework Community Liaison Plan	SEIA
Perceived impacts to community safety and community cohesion	Consultation framework Community Liaison Plan Enquires and complaints plan	SEIA
Changes in perception of personal safety	Consultation framework Community Liaison Plan Enquires and complaints plan	SEIA
Mental health of non-resident workers	Employment and skills plan	SEIA
Increased noise, vibration and dust levels due to construction activities	Environmental Management Plan Mitigation measures will be incorporated into the site design to reduce noise emissions where feasible and Best Available Technology (BAT) will be adopted, which will further reduce noise from the ISWMS at receptors Consultation framework Community Liaison Plan Enquires and complaints plan	Noise and Vibration (Chapter 12) Air Quality and Greenhouse Gases (Chapter 11)
Changes to visual amenity and sense of place	Consultation framework Community Liaison Plan Enquires and complaints plan	Landscape and Visual (Chapter 10)
Reduced traffic safety / increased risk of traffic accidents due to construction traffic	Environmental Management Plan	Traffic and Transport (Chapter 13)
Increased travel times and inconvenience for local road users	Environmental Management Plan	Traffic and Transport (Chapter 13)
Damage to roads as a result of construction traffic	Environmental Management Plan	Traffic and Transport (Chapter 13)
Increase in local employment during operation.	Employment and skills plan	SEIA
Contribution to the regional economy through procurement of goods and services, employment, and supporting growth of the renewable energy industry.	Procurement plan	SEIA

Impact category	Mitigation or enhancement	Relevant EIA specialist study
Opportunity to support local businesses through improvements in waste management	Procurement plan	SEIA
Opportunity for economic diversification	Procurement plan	SEIA
Opportunity for the Project to support the growth of the tourism industry	Consultation framework Community Liaison Plan	SEIA
Increased competition for workers in local and regional labour market	Employment and skills plan	SEIA
Increased capacity of the local workforce	Employment and skills plan	SEIA
Increased demand for housing and accommodation	Consultation framework Community Liaison Plan	SEIA
Increased demand for community facilities and services.	Consultation framework Community Liaison Plan	SEIA
Increased demand on emergency services	Consultation framework Community Liaison Plan	SEIA
Community pride associated with the contribution to the circular economy.	Consultation framework Community Liaison Plan	SEIA
Perception of health risk associated with the operation of the Project	Consultation framework Community Liaison Plan Enquires and complaints plan	SEIA
Changes (actual and perceived) to personal safety and hazard exposure	Consultation framework Community Liaison Plan Enquires and complaints plan	SEIA
Perceived impacts to community safety and community cohesion	Consultation framework Community Liaison Plan Enquires and complaints plan	SEIA
Changes in perception of personal safety during operation	Consultation framework Community Liaison Plan Enquires and complaints plan	SEIA
Improvements to safety and amenity during operation of the ISWMS	Consultation framework Community Liaison Plan	Landscape and Visual (Chapter 10)
Noise impacts associated with the operation of the Project	Environmental Management Plan Mitigation measures will be incorporated into the site design to reduce noise emissions where feasible and BAT will be adopted, which will further reduce noise from the ISWMS at receptors Consultation framework Community Liaison Plan Enquires and complaints plan	Noise and Vibration (Chapter 12) Air Quality and Greenhouse Gases (Chapter 11)
Changes to air quality due to operation of the Project	Environmental Management Plan Enquires and complaints plan	Air Quality and Greenhouse Gases (Chapter 11)

Impact category	Mitigation or enhancement	Relevant EIA specialist study
Changes to visual amenity and sense of place	Consultation framework Community Liaison Plan Enquires and complaints plan	Landscape and Visual (Chapter 10)
Increased traffic during the operation of the Project	Environmental Management Plan	Traffic and Transport (Chapter 13)

14.9 Conclusion

This SEIA has identified and addressed the key socio-economic impacts associated with the Project and provides a set of recommended mitigation measures.

The key positive socio-economic impacts with the potential to occur during construction are primarily related to an increase in employment opportunities for Cayman residents, procurement opportunities for businesses to supply goods and services, and minor increase in revenue for local businesses due to construction workers purchasing meals and other services.

The potential temporary negative socio-economic impacts that may occur during construction are summarised below:

– Reduced amenity for some residents, businesses and community facilities in close proximity to construction activities.
– Minor disruptions to traffic conditions, resulting in delays and potential for increased travel times for people travelling in the local and regional area, including local community members and regional road users.

The key socio-economic benefits of the Project are primarily related to the regional economic benefits associated with the development of a new, technologically advanced method of dealing with solid waste, industry and the diversification of the economy. In particular, the Project has the potential for capacity building and upskilling of the existing workforce, and provides opportunities for new business generation to support its operations in Cayman as ERF technology is a new industry for the region.

Additionally, due to the nature of the facility, involving the production of green energy, the recovery and reusing of materials and the overall improvements to current waste management practices in Cayman, residents may experience a sense of community pride associated with the contribution to the circular economy. This may in turn support the tourism industry to achieve its aspirations for sustainable and -nature-based tourism practices as a large waste contributor on the island.

The key negative socio-economic impacts during operation are related to the perception of health and safety risk associated with the operation of the Project and potential changes to local amenity for some residents and businesses in close proximity to the Project Site due to changes in air quality, noise and visual amenity.

The positive and negative social impacts identified and assessed in this report would be managed and mitigated through a range of measures, including those recommended in other Chapters of the ES.

The SEIA has identified the following recommended mitigation measures from Chapter 4 to minimise potential social impacts, and to enhance social benefits:

– Employment and skills plan
– Consultation framework
– Community Liaison Plan
– Enquires and complaints plan
– Procurement plan

15. Cumulative Effects and Summary of Mitigation Measures

15.1 Overview

This chapter provides an assessment of cumulative effects for the Proposed Development and tabulates the mitigation and monitoring commitments identified in the environmental topic assessments to be carried forward into the Environmental Management Plan (EMP).

15.2 Cumulative effects

This section addresses cumulative effects for the Proposed Development. Paragraph 5 of Schedule 2 of the EIA Directive[1] refers to the need to consider cumulative effects. There are two types of cumulative effects assessment (CEA) which should be considered in an EIA as set out below:

Inter-project – an inter-project assessment indicates how the environmental effects resulting from the proposed ISWMS development identified for each environmental topic could combine with similar topic-related effects generated by other committed[2] or proposed developments that affect the same receptor and are proximate to the proposed ISWMS.

Inter-related – involves assessing whether any of the individual environmental topic effects resulting from the Proposed Development could combine to create effects that are greater than the sum of the individual effects on a given receptor.

15.2.1 Inter-project

As noted above, the inter-project CEA considers how the environmental effects resulting from the proposed ISWMS development identified for each environmental topic could combine with similar topic-related effects generated by other committed[3] or proposed developments that affect the same receptor and are proximate to the proposed ISWMS. To do this, it is important to first identify the furthest extent within which potential effects from the ISWMS development may be experienced, which will determine the cumulative effects study area or Zone of Influence (ZoI). Potential effects from the landscape and visual environmental topic are anticipated to be the furthest reaching and therefore define the extent of the Cumulative Effects ZoI (see Figure 15.1).

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[1] Cayman Islands Government. *Directive for Environmental Impact Assessments, Section 43, National Conservation Act (Extraordinary Gazette No. 50/2016*. June 29, 2016.

[2] Developments which have planning consent, but which have yet to be constructed

[3] Developments which have planning consent, but which have yet to be constructed

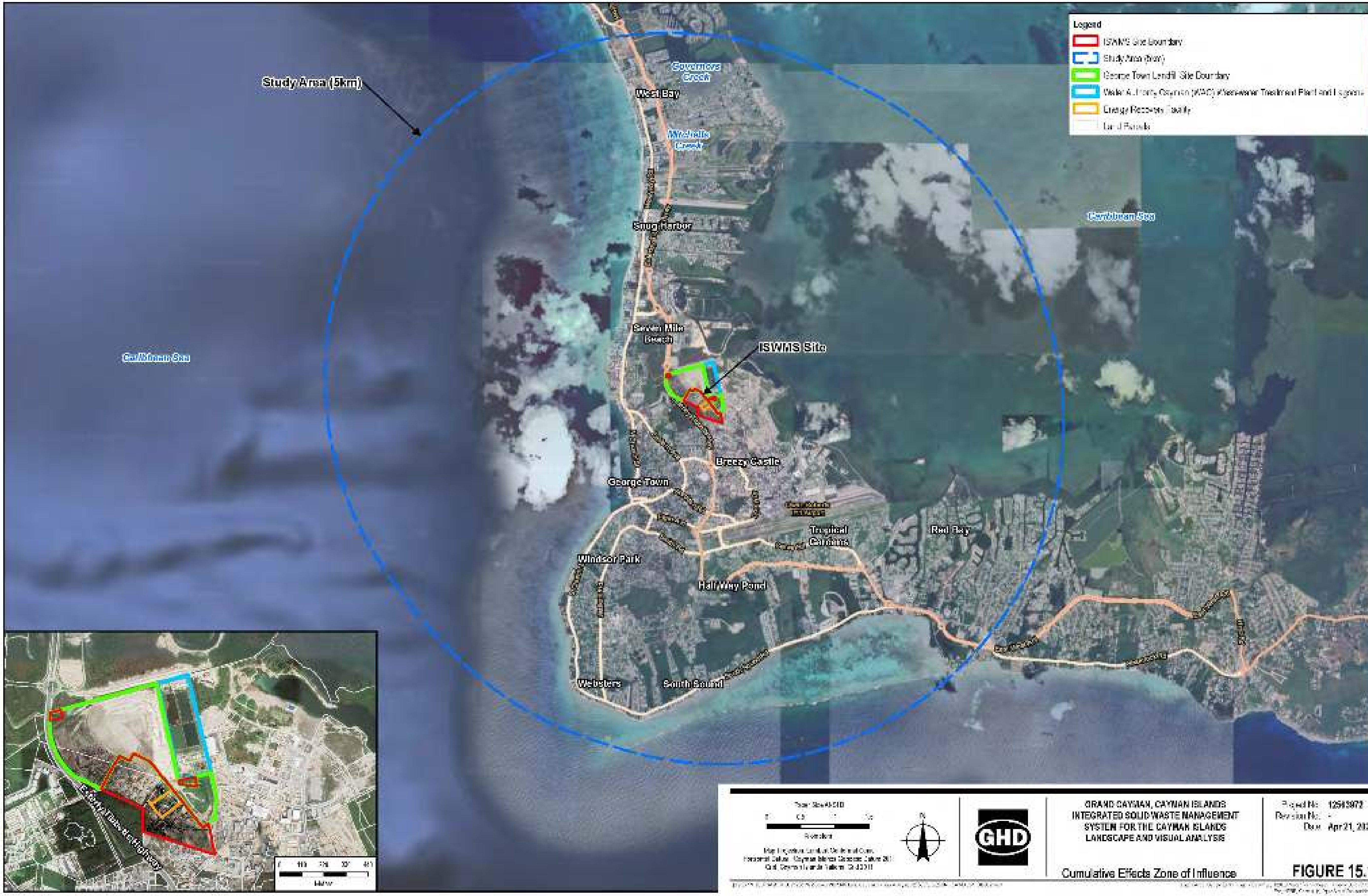

Figure 15.1 Cumulative effects zone of influence

Next, other committed[4] or proposed developments located within the established ZoI and of a scale which will require an assessment of cumulative effects must be identified. Schemes considered to be proximate to the proposed ISWMS and of a relevant scale identified during the ToR included:

- The Planned Area Development for Camana Bay; and
- The proposed Cruise Berthing Facility.

Schemes that have been identified since the preparation of the ToR and which are considered to be proximate to the proposed ISWMS and of a scale which will require an assessment of cumulative effects include:

- Airport Connector Road
- Health City Camana Bay
- Hyatt conversion / Palm Sunrise development

The schemes considered in the assessment of inter-project related cumulative effects are described below and the cumulative effects assessment is presented in subsequent sections of this Chapter.

The Planned Area Development for Camana Bay[5]

The Camana Bay Planned Area Development, spread over about 675 acres (273 hecatres (ha)) is located approximately 0.5 miles (1 kilometres (km)) north of the proposed ISWMS site. Camana Bay is a mixed use development comprising of condominiums, house lots, hotels and retail spaces and a marina. The PAD includes lands both east and west of Esterly Tibbetts Highway and stretches from the North Sound to the Caribbean sea. A significant portion of the Camana Bay PAD has already been completed. Given the current status of the development the potential inter-project effects, such as increased Traffic and Transport, Air Quality, and visual impacts were included in the assessment of cumulative effects.

Cruise Berthing Terminal for Cayman Islands[6]

The proposed Cruise Berthing Terminal for the Cayman Islands proposes to provide two cruise ship piers at George Town Harbour to provide cruise ship passengers with direct access to the shore. The proposed Terminal is intended to form an extension to the existing terminal and is located approximately 1 mile (1.5 km) from the ISWMS Site. The proposed project has been halted since 2019 due in part to public opposition[7]. As such, this scheme has not been considered in relation to inter-project cumulative effects.

Airport Connector Road[8]

The Airport Road Connector (ACR) is proposed to assist commuters to the North Sound Area and help to alleviate congestion at the Butterfield roundabout. The project is currently comprised of two sections as follows:

- Section 1: extends between the Esterly Tibbetts Highway and Allie B Drive, directly north of the GTLF site boundary and within approximately 820 feet (250 metres (m)) of the ISWMS Site boundary.
- Section 2: extends between Allie B. Drive and Sparky Drive to the northwest and east of the GTLF site boundary, approximately 1,640 feet (500 m) at the closest extent to the ISWMS Site boundary.

The project website indicates that Section 1 was expected to be completed by the end of 2022 and Section 2 construction was expected to start in early 2023. Given these proposed project timelines, it is considered that construction of Section 1 will not overlap with the ISWMS construction and that there is a possibility that construction of Section 2 may overlap with the initial site preparation and construction phases of the ISWMS development. This will overlap with the operation of the ISWMS.

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4 Developments which have planning consent, but which have yet to be constructed
5 https://www.visitcaymanislands.com/en-gb/plan-your-trip/our-local-business/camana-bay
6 Ministry of District Administration Tourism & Transport and The Port Authority of the Cayman Islands, prepared by Baird. Proposed Cruise Berthing Facility, Grand Cayman, Environmental Statement. 2015.
7 https://caymannewsservice.com/2023/03/ppm-continues-to-push-for-cruise-dock-in-port-plans/
8 https://www.caymanroads.com/projects/airport-road-connector

Health City Camana Bay[9]

Health City Camana Bay is a new 70,000 square foot (6,503 m^2) state-of-the-art hospital located on three acres of land immediately north of the western extent of Section 1 of the ARC and within 1,640 feet (500 m) of the ISWMS Site boundary. Construction of Health City Camana Bay commenced in January 2022 with an anticipated construction schedule of 18 months, resulting in an expected completion date of mid-2023. Given these proposed timelines, it is considered that Health City Camana Bay will be fully constructed and operational prior to the construction of the ISWMS Site.

Hyatt conversion / Palm Sunrise development[10]

This 83,725 square foot (7,778 m^2) development is proposed to consist of a hotel, retail offices, a pool, and a restaurant and will be located between Esterly Tibbetts Highway and Brittania Drive north of the roundabout, approximately 1.1 miles (1.8 km) from the ISWMS Site. The redevelopment has been broken into two phases, a north and south, and it is the south part of the former Hyatt property, which is approximately 7.3 acres (3 ha) that is presently moving forward with development. As there are no construction timelines currently proposed for this proposed development, it is considered that its construction has the potential to overlap with the construction of the ISWMS.

Table 15.1 Inter-project cumulative effects

Environmental Topic	Inter-Project Source	Potential cumulative effect
Marine Ecology	All identified developments	There are no anticipated residual effects from the proposed ISWMS development on the marine environment, therefore, there is no potential for cumulative effects to occur between the ISWMS project or any of the identified developments with respect to the marine environment.
Terrestrial Ecology	All identified developments	There are no anticipated residual effects from the proposed ISWMS development on the terrestrial environment, therefore, there is no potential for cumulative effects to occur between the ISWMS project or any of the identified developments with respect to the terrestrial environment.
Hydrology and Hydrogeology	All identified developments	Due to the limited radius of influence of the hydrology and hydrogeology effects, cumulative effects in relation to the identified schemes are considered to be unlikely.
Land Quality	All identified developments	Due to the nature of geotechnical and geoenvironmental risks, which are unlikely to extend beyond the Site boundary, cumulative effects in relation to the identified schemes are considered to be unlikely.
Landscape and Visual	All identified developments	Should construction of any of the identified developments overlap with the ISWMS construction, there is potential for temporary compounding impacts from a visual perspective at Viewpoint 6 (Tall residential properties on Seven Mile Beach) and Viewpoint 7 (Cruise Liner anchored off Seven Mile Beach) due to the combined visibility of construction operations from these vantage points. Given the temporary nature of the impacts and the proposed construction timelines for the identified developments it is considered that the potential cumulative impact would be low. While the visual landscape will change based on the development of the ISWMS and other developments within the ZoI, including the Health City Camana Bay development the residual effects from a landscape and visual is considered low.
Air Quality and Greenhouse Gases	ACR	No significant residual impacts for air quality and greenhouse gases on nearby sensitive receptors are anticipated with implementation of proposed mitigation measures. The potential for increased emissions and therefore increased concentrations of pollutants that could affect human health at nearby sensitive receptors during construction of the ISWMS is considered very low given the temporary nature of the construction activities and distance to the nearest sensitive receptor more than 1,148 feet (350 m) away. Given the substantial completion of the Camana Bay PAD, and the types of uses within this PAD, no overlapping impacts from an Air Quality perspective are anticipated. Should construction

9 https://caymannewsservice.com/2022/01/health-city-breaks-ground-on-new-100m-hospital/comment-page-1/
10 https://www.planning.ky/wp-content/uploads/meetings/Mcpa1423.pdf

Environmental Topic	Inter-Project Source	Potential cumulative effect
		of the ACR Section 2 overlap with the ISWMS construction for any period of time, there may be potential for a temporary compounding impact; however, given the distance between the two construction areas at their closest locations (approximately 1,640 feet (500 m) to the east of the ISWMS), the industrial nature of this area, and the key sensitive receptor locations being located to the north, west, and south of the ISWMS Site, it is considered that the potential cumulative impact at key sensitive receptors would be low.
Noise and Vibration	ACR	No significant residual impacts from noise and vibration on nearby existing sensitive receptors are anticipated with implementation of proposed mitigation measures. As noise from construction phase activities is anticipated to have a minor or negligible impact at sensitive receptors, there may be potential for a temporary compounding impact should construction of the ACR Section 2 overlap with the ISWMS construction for any period of time. Given the distance between the two construction areas at their closest locations (approximately 1,640 feet (500 m) to the east of the ISWMS), the industrial nature of this area, and the nearby sensitive receptor locations being located to the north, west, and south of the ISWMS Site, it is considered that the potential cumulative impact at sensitive receptors would be minor. There are no anticipated residual effects during the operation of the ISWMS.
Traffic and Transport	All identified developments	The traffic and transport analysis considered current traffic volumes (i.e. with current developments in place at the ISWMS and surrounding area) as well as future traffic levels based on anticipated growth. With this in mind, the traffic and transport has to a degree considered the cumulative effect of future interactions of the ISWMS and future developments in the surrounding area/ ZoI. The construction of the ISWMS will cause some minor impacts on the surrounding road network during peak periods. Should construction of the ACR Section 2 overlap with the ISWMS construction no compounding impacts to traffic and transportation are anticipated as the ACR construction area would likely be accessed from the completed Section 1, north of the ISWMS Site, via Esterly Tibbetts Highway. There are no anticipated residual effects during the operation of the ISWMS.
Socio-Economics	All identified developments	There could be minor disruptions to traffic conditions resulting in delays and potential for increased travel times for people travelling in the local and regional area should construction of any of the identified developments overlap with the ISWMS construction. Additional future developments may increase the reduced amenity for some residents, businesses and community facilities that are in close proximity to construction activities, resulting in a cumulative effect to residents and businesses. However, these cumulative effects will be temporary in nature. However, the resulting cumulative socio-economic impacts would be enhanced due to the positive impacts related to an increase in employment opportunities for Cayman residents, procurement opportunities for businesses to supply goods and services, and minor increase in revenue for local businesses due to construction workers purchasing meals and other services.

With the above in mind, the assessment of inter-project effects has concluded that the majority of cumulative effects will be temporary in nature, and therefore are not significant. It is acknowledged that the visual landscape will change within the ZoI due to the development of the ISWMS and multiple other identified developments, including the under-construction Health City Camana Bay building.

15.2.2 Inter-related

As noted above, an inter-related CEA considers whether any of the individual environmental topic effects resulting from the Proposed Development could combine to create effects that are greater than the sum of the individual effects on a given receptor. An example of an intra-project effect would be where a local resident is affected by dust, noise and traffic disruption during the construction of the ISWMS, with the result being a greater nuisance than each individual effect alone.

The first step is to identify the environmental topics that have ‘common receptors’, and then to consider whether the topic effects on any common receptors are likely to combine. The most likely types of receptors that could fall into this category are those pertaining to the amenity of the relevant human population. For example, the occupants of a residential property in close proximity to the proposed development might be subject to adverse effects in terms of noise, air quality, traffic, as well as with regard to visual amenity, or any combination thereof, each of which, when assessed individually, is not significant in EIA terms, but when assessed in combination the combined effects are judged to be significant.

Because this combined assessment involves different environmental topic assessments that cannot robustly be combined, the outcome of this CEA is reliant on the application of professional judgement from, several different technical specialists.

For the purpose of this sub-section, consideration will be given to the additive or amplified effects resulting from environmental effects on ‘common receptors’ and also where sources of effect from different components of the Project may combine to be of greater significance than when considered alone. It should be noted that each of the environmental component Chapters (6-14) has addressed inter-related cumulative effects from that specific individual topic including the mitigation required. Based on a review of the various environmental components and summary of effects, it was determined that the ‘common receptors’ are likely to be limited to nearby residential dwellings (i.e. NSR1 (Lakeside Residential Development) and NSR5 (Woodside Drive/Glenwood Drive Residence). Potential effects at these ‘common receptors’ may comprise the following:

– Noise effects
– Traffic effects
– Air Quality (limited to dust)
– Views from residential dwellings

Due to the application of specific mitigation measures (i.e. avoidance of certain habitats, erosion and sediment control) which ensure that likely significant effects on shared receptors are unlikely, or the absence of any effects on shared receptors, the following topics are scoped out from the intra-cumulative assessment:

– Marine Ecology
– Terrestrial Ecology
– Hydrology and Hydrogeology
– Land Quality
– Socio-Economics

Table 15.2 Intra-project cumulative effects

Commons Receptor with potential for multiple effects	Potential Intra-Project Effects	Summary
Residential dwellings/ residents	Dust, Noise, Traffic, Landscape/Visual	Construction and operation of the ISWMS will result in activities (mainly related to construction) not previously present. This creates a marginal (and temporary during construction) increase in traffic flows, disruption of views and potential production of noise and dust (largely only during the construction period and therefore temporary) from the Project as a whole. This may have an effect on nearby residential dwellings and the residents who inhabit the dwellings. As appropriate mitigation is proposed within the individual topic chapters to reduce the effects to be not significant and given that a number of the above identified combined inter-related project effects on receptors will be temporary in nature, this will result in a Minor adverse in-combination effect, which is not significant.

With the above in mind, the assessment of inter-related project effects on common receptors has concluded that the effects are Minor adverse, and therefore are not significant.

15.3 Summary of mitigation measures

Table 15.3 describes the mitigation and monitoring that have been committed to within this ES for both the construction and operational phases of the Proposed Development. These measures are organised by environmental topic and include details of responsibility for implementation and the compliance mechanism, and are presented as a table that would form a base component of an Environmental Management Plan (EMP) to be employed to ensure that mitigation measures set out in this ES are implemented.

Table 15.3 Summary of mitigation measures and monitoring commitments

ES Chapter / Section	Potential effect	Phase	Mitigation measure / monitoring commitment	Responsibility	Compliance mechanism
Chapter 4 Proposed Project, Section 4.1.1	Physical change to the existing site	Operation	The landscaping strategy will incorporate the planting of native species to create an attractive setting, with visual interest as well as softening the appearance of the development and enhancing biodiversity across the ISWMS Site.	Contractor	EMP
Chapter 4 Proposed Project, Section 4.1.2	Waste generated due to construction of the ISWMS	Construction	A Site Waste Management Plan (SWMP) will be prepared prior to commencing works at the ISWMS Site. The SWMP will include measures to identify the volume and type of material likely to arise from site clearance operations, opportunities for the reuse and recovery of materials and demonstrate how volumes of waste will be minimised and managed. The SWMP will set standards and strategies for effective waste minimisation that will be followed by all of the Construction Sub-Contractors.	Contractor	Construction Environmental Management Plan (CEMP)
	General site construction	Construction	Sustainable construction practices that will be adopted include: – Buildings will be designed as 'flexible' where practicable and sustainable to enable them to be reused and reconfigured to meet future needs (e.g., Legio type blocks for internal pushwalls). – The use of locally available material in construction will be maximized (including C&D waste). – Prefabrication of structural / mechanical elements will be used where practicable	Contractor	CEMP
Chapter 6 Marine Ecology, Section 6.6.3	Vegetation clearing (including isolated mangroves within the ISWMS Site)	Construction	Potential effects controlled through: – Clearly demarcate work limits at outset of construction and minimize unnecessary vegetation clearing – Appropriate vegetation clearing techniques will be used – Planning permissions are required to be granted if removal of mangroves is required by the Central Planning Authority or Development Control Board. Conditions may be attached to restore the mangroves removed[11]. – Any removal of mangroves on the Site should be outside the bat breeding window and bird nesting season. The bat breeding window is from June 1 to November 15. The bird nesting season is from April 1 to June 30. Therefore, with these restrictions any clearing is recommended to occur after November 15 and before April 1 of any given year Proposed monitoring: – Monitoring for marine wildlife is to occur for the duration of each journey when barges are travelling between islands.	Contractor	CEMP, EMP
	Soil erosion from land preparation (e.g., earthworks, excavation) and sedimentation into adjacent areas (including isolated mangroves within and surrounding the ISWMS Site)	Construction	Potential effects controlled through: – Limit vegetation clearing only to areas where construction works are being completed to prevent sediment being exposed – During construction and operation: – Establish and maintain erosion and sediment control fencing in good working order to capture any erosion whilst construction works are being completed – Maintain erosion and sediment control fencing in place until final site development, or stabilize soils with vegetation (e.g., annual seed mix and/or plantings) – Routinely inspect erosion and sediment control measures, including following storms, and repair as required – All machinery should be inspected for fluid leaks or other potential pollutants. The Contractor should evaluate each piece of equipment to ensure all risk of spills or sediment release due to its use is mitigated prior to putting it into service – Trucks and equipment shall be cleaned prior to leaving the site to prevent mud/dirt from tracking onto roads	Contractor	CEMP, EMP

[11] National Conservation Council. *Species Conservation Plan for Mangroves*. 2013. URL: https://conservation.ky/wp-content/uploads/2021/01/Species-Conservation-Plan-for-Mangroves-FINAL.pdf

ES Chapter / Section	Potential effect	Phase	Mitigation measure / monitoring commitment	Responsibility	Compliance mechanism
	Dust from land preparation (e.g., earthworks, excavation) affecting isolated mangroves within and surrounding the ISWMS Site	Construction and Operation	Potential effects controlled through: – Manage dust emissions through the use of water or dust suppressants on non-paved roads and cleaning of paved roads, where applicable, reflecting regulatory direction and approval – In dust sensitive areas (e.g., near mangroves, etc.), control dust using water and not chemical suppressants – Establish Site speed limits for Project vehicles traveling within the Site to minimize dust emissions – Ensure that equipment maintenance and checks occur on a regular basis – Proper stockpiling of dust producing building materials such as sand or cement in low enclosures and covered, away from drainage areas where they could easily be dispersed by wind or washed away during heavy rains – All loads entering or leaving the Site must be covered	Contractor and Operator	CEMP, EMP
	Flooding / change in water quality affecting the North Sound habitats and species including fringing mangroves and seagrass beds	Construction and Operation	Potential effects controlled through: – Implement engineering controls to isolate any flood-prone areas from construction soil/sand/cement stockpiles, and operations materials stockpiles	Contractor and Operator	CEMP, EMP
	Flooding / change in water quality affecting isolated mangroves within and surrounding the ISWMS Site	Construction and Operation	Potential effects controlled through: – Implement a stormwater management plan to maintain pre-construction drainage patterns and flows during all project phases – Implement appropriate erosion and sediment controls to mitigate Site runoff of water or mud	Contractor and Operator	CEMP, EMP
	Spills of oil, gasoline, and other fluids into natural communities affecting the North Sound habitats and species including fringing mangroves and seagrass beds	Construction and Operation	Potential effects controlled through: – Implement a stormwater management plan to maintain pre-construction drainage patterns and flows during all project phases – Implement appropriate erosion and sediment controls to mitigate Site runoff of water or mud – All machinery should be inspected for fluid leaks or other potential pollutants. The Contractor should evaluate each piece of equipment to ensure risks of spills or sediment release due to its use is mitigated prior to putting it into service – Proper machinery inspections and maintenance, as well as establishing areas away from natural features that are dedicated to re-fuelling and storing machinery – Proper vessel inspections to reduce likelihood of a spill occurring – Implement an emergency and response management plan to address the potential for spills – Include a landfill cap within construction design to reduce the levels of contaminants within stormwater runoff and groundwater – Preparation and implementation of a detailed wastewater and sewerage plan, including suitable treatment options for wastewater prior to discharge	Contractor and Operator	CEMP, EMP
	Spills of oil, gasoline, and other fluids into natural communities affecting isolated mangroves within and surrounding the ISWMS Site	Construction and Operation	Potential effects controlled through: – All machinery should be inspected for fluid leaks or other potential pollutants. The Contractor should evaluate each piece of equipment to ensure risks of spills or sediment release due to its use is mitigated prior to putting it into service – Proper machinery inspections and maintenance, as well as establishing areas away from natural features that are dedicated to re-fuelling and storing machinery – Implement an emergency and response management plan to address the potential for spills – Include a landfill cap within construction design to reduce the levels of contaminants within stormwater runoff and ground water	Contractor and Operator	CEMP, EMP
	Site degradation affecting isolated mangroves within and surrounding the ISWMS Site	Construction and Operation	Potential effects controlled through: – Enlist an experienced environmental professional onsite to provide guidance to mitigate potential negative environmental effects – All construction materials, excess materials and debris should be removed and appropriately disposed of following construction. Implement environmental inspection by an experienced environmental professional during construction to ensure that all mitigation measures are implemented properly, maintained, and repaired and remedial measures are initiated in a timely manner where warranted – Train Site staff in the identification of site-specific protected species and invasive species. Post their identification and management information in construction and operation offices	Contractor and Operator	CEMP, EMP

ES Chapter / Section	Potential effect	Phase	Mitigation measure / monitoring commitment	Responsibility	Compliance mechanism
	Increased water pollution affecting the marine environment, including habitats, vegetation, and wildlife	Operation	Potential effects controlled through: – Maintain records of waste at collection, transfer and tipping locations – Implement securing mechanisms to prevent waste falling off vessel	Operator	EMP
	Increased vessel strikes on marine wildlife (e.g., hawksbill, green and loggerhead turtle, groupers, marine mammals, and sharks)	Operation	Potential effects controlled through: – Travel at slow and safe speeds, in accordance with the Cayman Islands Port Regulations (2022 Revision), to avoid collisions with marine wildlife – Work with coast guards to utilize recommended routes to avoid species during known migration time periods – Ensure vessel operators are knowledgeable of marine wildlife seasonality and speed limits	Operator	EMP
	Increased turbidity affecting the marine environment, including habitats, vegetation, and wildlife	Operation	Potential effects controlled through: – Berthing management plans to reduce the number of vessels in the port at the same time	Operator	EMP
	Invasives transported with ballast water affecting the marine environment, including habitats, vegetation, and wildlife	Operation	Potential effects controlled through: – Adhere to a ballast water management plan and maintain records of ballast water exchange – Ballast water to take place mid sea in ballast water exchange areas – Flush otherwise-empty ballast tanks with open ocean water in order to reduce the risk posed by any residual ballast water and sediments	Operator	EMP
	Increased sound and vibration in the marine environment affecting migratory and highly mobile marine wildlife (e.g., hawksbill, green and loggerhead turtle, groupers, marine mammals, and sharks)	Operation	Potential effects controlled through: – Work with coast guard and DoE to identify and utilize recommended routes which avoid densely populated areas and high migration times	Operator	EMP
	Grounding of barges	Operation	Potential effects controlled through: – Work with coast guard and DoE to identify and utilize recommended routes which avoids shallow areas – Adequate towing equipment to ensure control of the barge – Ensure vessel operators are checking and maintaining equipment	Operator	EMP
Chapter 7 Terrestrial Ecology, Section 7.6.3	Loss of habitat that provides foraging and sheltering habitat for protected and notable species within the ISWMS Site	Construction	Potential effects controlled through: – Clearly demarcating work limits at outset of construction and minimizing unnecessary vegetation clearing – Vegetation clearing techniques shall include felling trees away from retained natural areas and watercourses and removing all debris – Removing of any mangroves on the Site should be outside the bat breeding window and bird nesting season. The bat breeding window is from June 1 to November 15. The bird nesting season is from April 1 to June 30. Therefore, with these restrictions any clearing is recommended to occur after November 15 and before April 1 of any given year – Restabilizing and revegetating exposed surfaces as soon as possible following disturbance	Contractor	CEMP, EMP
	Introduction or spread of invasive species within the ISWMS Site	Construction and operation	Potential effects controlled through: – Machinery, equipment, and materials shall arrive at Site cleaned – Cleaning shall occur a minimum of 98 feet (30 m) from waterbodies – Equipment to be used in or near water shall be cleaned before and after use. Cleaning shall remove any visible attached material (mud, vegetation, fauna).	Contractor, Operator	CEMP, EMP

ES Chapter / Section	Potential effect	Phase	Mitigation measure / monitoring commitment	Responsibility	Compliance mechanism
	Killing or injury of protected and notable species within the ISWMS Site	Construction	Potential effects controlled through: – Avoiding bird nesting season window, where possible, for tree and vegetation removal activities (bird nesting season for the Site has been identified as April to June). If vegetation clearing within the bird nesting season is required, a nest survey will be required, to be completed by a qualified professional to identify any active nests of birds, and breeding activity of birds that may indicate nesting – Avoiding removal of large trees (i.e., greater than 10 cm diameter at breast height) during bat roosting season to protect bats (the active bat roosting season for the Site has been identified as June 1 to November 15). – Following the posted speed limit for all vehicles and equipment, to reduce the potential for wildlife collisions – Training all Site personnel in general protected species awareness and identification of protected species with the potential to occur on Site – Completing visual inspections daily before works commence. If fauna is found on Site during the work measures will be taken to allow fauna to leave the work area passively. Active relocation should be a last resort; if it is required, it will be completed in a manner that prevents harm to fauna – Should the animal be resident within the Site (remaining on-Site longer than 24 hours), injured, or eggs/nests are observed, additional measures to avoid impacts may be required before work can restart – Posting information in construction offices of protected species and siting management plan – Having an experienced environmental professional on Site to confirm species presence and identification Proposed monitoring: – Additional cameras to be set up to monitor for species occurrences (blue iguana)	Contractor	CEMP, EMP
	Dust from land preparation affecting protected and notable habitats around the ISWMS Site	Construction	Potential effects controlled through: – Managing dust emissions through the use of water or dust suppressants on non-paved roads and cleaning of paved roads, where applicable, reflecting regulatory direction and approval – In dust sensitive areas (e.g., near wetlands, etc.), control dust using water and not chemical suppressants – Establishing Site speed limits for vehicles traveling within the Site to minimize dust emissions – Ensuring that equipment maintenance and checks occur on a regular basis – Proper stockpiling of dust producing building materials such as sand or cement in low enclosures and covered, away from drainage areas where they could easily be dispersed by wind or washed away during heavy rains – All loads entering or leaving the Site must be covered – Restabilizing and revegetating exposed surfaces as soon as possible following construction to limit dust generation	Contractor	CEMP, EMP
	Noise / light / visual disturbance including from movement of construction workers disturbing wetland/ migratory birds potentially on habitat linked to proposed Ramsar sites and protected and notable species around the ISWMS Site	Construction	Potential effects controlled through: – Limiting construction activities to daylight hours – Ensuring equipment meets industry standards with respect to noise level thresholds – Undertaking regular maintenance of the equipment as part of the preventative maintenance plans implemented for all mobile and stationary equipment – Training Site personnel to ensure equipment is used in ways that minimize noise – Controlling noise by maintaining separation distance between source and receptor and equipment design, where feasible – Establishing an exclusion barrier within the Site boundary to restrict fauna access to the Site; maintain throughout construction – Ensuring engines are turned off when possible; vehicles will not be left to idle – Choosing broadband reversing alarms instead of tonal alarms	Contractor	CEMP, EMP

ES Chapter / Section	Potential effect	Phase	Mitigation measure / monitoring commitment	Responsibility	Compliance mechanism
	Spills of oil, gasoline, and other fluids into natural communities around the ISWMS Site	Construction and operation	Potential effects controlled through: – Inspecting all machinery for fluid leaks or other potential pollutants. The Contractor/Operator should evaluate each piece of equipment to ensure all risk of spills or sediment release due to its use is mitigated prior to putting it into service – Proper machinery inspections and maintenance – Conducting equipment maintenance and refuelling at the designated and properly contained maintenance areas located well away from watercourses and wetlands and outside retained vegetation areas – Implementing an emergency and response management plan to address the potential for spills	Contractor, Operator	CEMP, EMP
	Soil erosion and sedimentation into adjacent areas to the ISWMS Site	Construction and operation	Potential effects controlled through: – Limiting vegetation clearing only to areas where construction works are being completed to prevent sediment being exposed – Establishing and maintain erosion and sediment control fencing in good working order to capture any sediment migration whilst construction works are being completed – Maintaining erosion and sediment control fencing in place until final Site development, or stabilize soils with permanent vegetation (e.g., annual seed mix and/or plantings) – Routinely inspecting erosion and sediment control measures, including following storms, and repair as required All machinery should be inspected for fluid leaks or other potential pollutants. The Contractor should evaluate each piece of equipment to ensure all risk of spills or sediment release due to its use is mitigated prior to putting it in to service – Cleaning trucks and equipment prior to leaving the Site to prevent mud/dirt from tracking onto roads	Contractor, Operator	CEMP, EMP
	Deposition of contaminants on sensitive habitats or species within the range of emissions from the ISWMS Site	Operation	Potential effects controlled through: – Implementation of the Air Pollution Control (APC) System to capture emission contaminants. A system of humidification of the APC Residues will be provided for the flue gas residue discharge process. – Appropriate disposal of APC materials into designated engineered RWL – Regular inspection of facility and implementing good housekeeping action when required. – The Construction and Demolition processing operations will be undertaken in the open air and crushing and screening equipment will be fitted with water misters to reduce dust emissions. – Detail design shall consider including dedusting (suction to filter) in order to avoid dust emissions during the residues discharge from silo the truck.	Consultant, Operator	Detailed Design, EMP
	Vehicle strikes on protected and notable species causing injury or death on the ISWMS Site	Operation	Potential effects controlled through: – Training all Site personnel in general protected species awareness and identification of protected species with the potential to occur on Site – Completing visual inspections daily before works commence. If fauna is found on Site during the work measures will be taken to allow fauna to leave the work area passively. Active relocation should be a last resort; if it is required, it will be completed in a manner that prevents harm to fauna – Should the animal be resident within the Site (remaining on-Site longer than 24 hours), injured, or eggs/nests are observed, additional measures to avoid impacts may be required before work can restart – Following the posted speed limit for all vehicles and equipment, to reduce the potential for wildlife collisions – Post information in construction and operation offices of protected species and siting management plan – Have an ecologist or experienced environmental professional on site to confirm species presence and identification	Operator	EMP
	Lighting from operation causing disturbance to protected and notable species around the ISWMS Site	Operation	Potential effects controlled through: – Limiting operation activities to daylight hours – Reducing the intensity of lighting fixtures – Ensuring white lighting on building where lights are required overnight	Operator	EMP

ES Chapter / Section	Potential effect	Phase	Mitigation measure / monitoring commitment	Responsibility	Compliance mechanism
	Noise from operation causing disturbance to protected and notable species around the ISWMS Site	Operation	Potential effects controlled through: – Ensuring equipment meets industry standards with respect to noise level thresholds – Undertaking regular maintenance of the equipment as part of the preventative maintenance plans implemented for all mobile and stationary equipment to ensure all equipment is well-maintained to minimise noise emissions. – Training Site personnel to ensure equipment is used in ways that minimize noise – Controlling noise by maintaining separation distance between source and receptor and equipment design, where feasible – Establishing an exclusion barrier within the Site boundary to restrict fauna access to the Site; maintain throughout operation – Ensuring engines are turned off when possible; vehicles will not be left to idle – Utilizing Legio-type blocks for internal pushwalls providing additional noise absorption. – Construction and demolition process operations that have a high noise level (shredder and crusher) will only be activated intermittently which will reduce noise emission duration. – Bottom Ash process operations that have a high noise level (trommel) will only be activated intermittently which will minimise noise emissions duration. – High noise emitting equipment (baler and shear in particular) will only be used intermittently to minimise noise exposure time.	Operator	EMP
	None specified	Pre-construction	Proposed monitoring: – Fauna monitoring: field surveys to be completed in advance of construction to support the habitat characterizations present herein and add confidence in iguana species which may be using the Site. If a blue iguana (or suspected blue iguana) is observed on Site, the Site Supervisor is to be notified immediately. – Fauna monitoring: exclusion fencing will be established around the ISWMS Site to mitigate fauna from entering areas where clearing or construction works are to be undertaken. Fencing is to be installed prior to construction works commencing. However, even with this fencing there is a potential for fauna to enter the Site. If fauna is found on Site measures will be taken to allow fauna to leave the work area passively. Active relocation should be a last resort; if it is required, it will be completed in a manner that avoids injury to the identified fauna. If a blue iguana (or suspected blue iguana) is observed on Site, the Site Supervisor is to be notified immediately. – Erosion and sediment control monitoring: silt fencing will be established around the ISWMS Site to limit sediment run-off into the surrounding environment. Regular inspections (i.e., weekly, before and following 0.98 inches (25 millimetres (mm)) or more rainfall) should be conducted to identify any damage to the fencing and ensure a prompt repair.		
	None specified	Construction and operation	Proposed monitoring: – Fauna monitoring: If fauna is found on Site measures will be taken to allow fauna to leave the work area passively. Active relocation should be a last resort; if it is required, it will be completed in a manner that avoids injury to the identified fauna. If a blue iguana (or suspected blue iguana) is observed on Site, the Site Supervisor is to be notified immediately. – Erosion and sediment control monitoring: Regular inspections (i.e., weekly, before and following 0.98 inches (25 mm) or more rainfall) should be conducted to identify any damage to the fencing and ensure a prompt repair. – Additional monitoring may be required based on approvals from the Central Planning Authority, Development Control Board, or if the vegetation clearing avoidance windows cannot be adhered to		
Chapter 8 Hydrology and Hydrogeology, Section 8.6.4	Disturbance of existing contamination (surface waters (North Sound & Mosquito control canals)	Construction, Operation	Potential effects controlled through: – Implementation of a strategy to prevent or appropriately manage the disturbance of existing known areas of contamination on the Site (as detailed in Chapter 9 (Land Quality)).	Contractor, Operator	CEMP, EMP
	Disturbance of existing contamination (subsurface infrastructure)	Construction, Operation	Potential effects controlled through: – Implementation of a strategy to prevent or appropriately manage the disturbance of existing known areas of contamination on the Site (as detailed in Chapter 9 (Land Quality)). – Construct using an appropriate grade of concrete to prevent sulphate attack in the event of groundwater contamination.	Contractor, Operator	CEMP, EMP

ES Chapter / Section	Potential effect	Phase	Mitigation measure / monitoring commitment	Responsibility	Compliance mechanism
	Potentially contaminative activities on-Site (surface waters (North Sound & Mosquito control canals))	Construction, Operation	Potential effects controlled through: – Include protocols for all potentially-contaminative on-Site activities in the Site EMP. – Prepare a detailed wastewater and sewerage plan to minimise the risk of leaks and spills within the system and incorporate suitable treatment options for wastewater prior to discharge. – Detailed design to consider the feasibility of the option to connect to local wastewater network for disposal of sewerage to the local wastewater treatment works.	Consultant, Contractor, Operator	Detailed Design, CEMP, EMP
	Potentially contaminative activities on-Site (subsurface infrastructure)	Construction, Operation	Potential effects controlled through: – Include protocols for all potentially-contaminative on-Site activities in the Site EMP. – Prepare a detailed wastewater and sewerage plan to minimise the risk of leaks and spills within the system and incorporate suitable treatment options for wastewater prior to discharge. – Detailed design to consider the feasibility of the option to connect to local wastewater network for disposal of sewerage to the local wastewater treatment works. – Construct using an appropriate grade of concrete to prevent Sulphate attack in the event of groundwater contamination.	Consultant, Contractor, Operator	Detailed Design, CEMP, EMP
	Tidal flooding, surface water flooding and extreme weather and climate change-induced flood events (Surface waters (North Sound & Mosquito control canals))	Construction, Operation	Potential effects controlled through: – Include protocols for all potentially-contaminative on-Site activities in the Site EMP. – Prepare a waste management plan inclusive of appropriate waste management for emergency situations, factoring in emergency response and flooding.	Contractor, Operator	CEMP, EMP
	Tidal flooding, surface water flooding and extreme weather and climate change-induced flood events (Site infrastructure, staff, and visitors)	Construction, Operation	Potential effects controlled through: – The design should include consideration of the layout of the site (in terms of vulnerability/sensitivity to flooding), establishing finished floor levels or raising equipment above anticipated flood water levels, topographic gradients of surfaces to direct floodwater away from sensitive infrastructure and evacuation routes or refuges. A hazard management plan for the site will document evacuation procedures in response to government issued warnings.	Consultant, Contractor, Operator	Detailed Design, CEMP, EMP
Chapter 9 Land Quality, Section 9.10.2 Geoenvironmental, Area 1	Disturbance, exposure and spread of existing contamination (including buried wastes) within the Old Scrap and Tyre Stockpile Area (site staff, construction workers and visitors)	Construction	Undertake appropriate site investigation activities across Area 1, which could be combined with any required geotechnical investigation/remediation, to: – Identify if any waste materials are present and, if so, to determine their characteristics and extent (both lateral and depth); – Identify any additional sources of contamination; and – Confirm the concentration of relevant contaminants, particularly in Made Ground, and their extents.	Consultant, Contractor	Detailed Design, CEMP
	Disturbance of existing contamination within the Equipment Storage Area, particularly the Oil and Hazardous Waste Storage Area (site staff, construction workers and visitors) (NB oil contamination has been observed in this area)	Construction	Undertake appropriate site investigation activities across Area 1, which could be combined with any required geotechnical investigation/remediation, to: – Identify if any waste materials are present and, if so, to determine their characteristics and extent (both lateral and depth); – Identify any additional sources of contamination; and – Confirm the concentration of relevant contaminants, particularly in Made Ground, and their extents. Once this data is available an appropriate generic quantitative risk assessment should be undertaken to reassess the significance of the effects identified and confirm that no other significant effects are indicated. To ensure that any unacceptable risks are adequately managed, including within the Oil and Hazardous Waste Storage Area, where contaminant concentrations exceed the relevant Contaminant Cleanup Target Levels (CCTLs) the affected materials will be excavated for stockpiling and subsequent removal to the RWL once the RWL is constructed. Materials below the CCTLs do not pose an unacceptable risk and so no mitigation or remediation of such materials is required.	Consultant, Contractor	Detailed Design, CEMP

ES Chapter / Section	Potential effect	Phase	Mitigation measure / monitoring commitment	Responsibility	Compliance mechanism
	Failure of landfill cap (e.g. due to flawed engineering, extreme weather events or sea level rise) (surrounding land users)	Operation	Undertake appropriate site investigation activities across Area 1, which could be combined with any required geotechnical investigation/remediation, to: – Identify if any waste materials are present and, if so, to determine their characteristics and extent (both lateral and depth); – Identify any additional sources of contamination; and – Confirm the concentration of relevant contaminants, particularly in Made Ground, and their extents. Once this data is available an appropriate generic quantitative risk assessment should be undertaken to reassess the significance of the effects identified and confirm that no other significant effects are indicated. It is essential that the cap used to seal completed sections of the RWL remains intact into the future; this needs to include consideration of foreseeable changes to the local climate and sea level due to climate change. The RWL is intended to be constructed in a phased manner and capping of the first phase is not anticipated until parts of the landfill have reached final tipping levels. Prior to any capping, checks should be made to ensure that the current design is adequate in light of the latest climate data and modelling and procedures put in place to ensure that the ultimate construction is in line with the agreed design.	Consultant, Operator	Detailed Design, EMP
Chapter 9 Land Quality, Section 9.10.2 Geoenvironmental, Area 2	Exposure (and potential spread) of contaminated soils at the site surface and release of runoff, dusts, gases and vapours (site staff, construction workers and visitors)	Construction	Undertake appropriate site investigation activities across Area 2, which could be combined with any required geotechnical investigation/remediation, to: – Identify if any waste materials are present and, if so, to determine their characteristics and extent (both lateral and depth); – Identify any additional sources of contamination; and – Confirm the concentration of relevant contaminants, particularly in Made Ground, and their extents. To ensure that any unacceptable risks are adequately managed, where contaminant concentrations exceed the relevant CCTLs the affected materials will be excavated for stockpiling and subsequent removal to the RWL once the RWL is constructed. Materials below the CCTLs do not pose an unacceptable risk and so no mitigation or remediation of such materials is required. If not already available, a detailed surface runoff management plan should be prepared, which details all areas from which runoff can arise and all locations where surface water contamination may arise. The plan should then propose appropriate and adequate runoff collection and treatment options for the identified runoff. It is recommended that, wherever possible, the principles of Sustainable Urban Drainage Systems should be applied.	Consultant, Operator	Detailed Design, EMP
	Accumulation of asbestos fibres in underlying soils and potentially released and spread during treatment and onward during reuse as aggregate (site staff, construction workers and visitors).	Operation		Consultant, Operator	Detailed Design, EMP
	Spread of wastes and contamination in floodwater/runoff leading to affects on soils beneath Area 2 and surrounding land (surrounding land users)	Operation		Consultant, Operator	Detailed Design, EMP
Chapter 9 Land Quality, Section 9.10.2 Geoenvironmental, Area 4	Exposure (and potential spread) of contaminated soils at the site surface and release of runoff, dusts, gases and vapours	Construction	Undertake appropriate site investigation activities across Area 4, which could be combined with any required geotechnical investigation/remediation, to: – Identify if any waste materials are present and, if so, to determine their characteristics and extent (both lateral and depth); – Identify any additional sources of contamination; and – Confirm the concentration of relevant contaminants, particularly in Made Ground, and their extents. To ensure that any unacceptable risks are adequately managed, where contaminant concentrations exceed the relevant CCTLs the affected materials will be excavated for stockpiling and subsequent removal to the RWL once the RWL is constructed. Materials below the CCTLs do not pose an unacceptable risk and so no mitigation or remediation of such materials is required.	Contractor	Detailed Design, CEMP
Chapter 9 Land Quality, Section 9.11.1.4	Development of ISWMS infrastructure	Construction	Transfer development loads down to Ironshore or bedrock of the Bluff Formation.	Consultant, Contractor	Design, CEMP
	Construction on shallow foundations on Ironshore Formation	Construction	Install geotextile and geogrids, if needed	Consultant, Contractor	Design, CEMP
	Construction of piled foundations in bedrock of the Bluff Formation	Construction	Map cavity locations via supplemental geophysical investigations to better define the limits of proposed structures.	Consultant, Contractor	Design, CEMP
	Operation of facility	Operation	ISWMS facilities and foundation systems will be designed to resist seismic forces in accordance with applicable building codes. Application of the measures above will also contribute to mitigation of structural seismic response.	Consultant, Contractor Operator	Design, CEMP, EMP
Chapter 10 Landscape and Visual, Section 10.6.1	Impacts to landscape and seascape character zones	Construction and operation	The following mitigation measures are to be considered to reduce the effects of the project: – Colour gradations to reflect the surrounding sky, landscape and seascape; – Materials of low reflectivity; and – Façade treatment or alternative use to create visual variation (such as artistic mural, outdoor cinema, rock climbing etc.).	Consultant, Contractor Operator	Design, CEMP, EMP

ES Chapter / Section	Potential effect	Phase	Mitigation measure / monitoring commitment	Responsibility	Compliance mechanism
Chapter 10 Landscape and Visual, Section 10.7.1	Impacts to sensitive visual receivers	Construction and operation	The following mitigation measures are to be considered to reduce the effects of the project: – Colour gradations to reflect the surrounding sky, landscape and seascape; – Materials of low reflectivity; and – Façade treatment or alternative use to create visual variation (such as artistic mural, outdoor cinema, rock climbing etc.).	Consultant, Contractor Operator	Design, CEMP, EMP
Chapter 11 Air Quality and GHGs, Section 11.9	Emission of dust causing loss of amenity at sensitive receptors that occur near to work sites and haul road	Construction	Implement site-specific dust mitigation plans (road dust mitigation)	Contractor	CEMP
	Emissions from construction vehicles and plant through fuel combustion that could increase concentrations of pollutants that could affect human health (NO_2 and particulate matter)	Construction	Implement best practices to limit fuel combustion	Contractor	CEMP
	Emission of air pollutants causing effects on human health and ecological receptors	Operation	Implement site-specific dust mitigation plans (road dust mitigation) and Best Available Technology	Operator	EMP
	Odour emissions causing effects on quality of life	Operation	Odour emissions will be controlled through: – Operating the ERF under negative pressure – Capturing and flaring landfill gas – Operating the Medical Waste Incinerator using best available control technology systems for pollution control	Operator	EMP
	Bioaerosol causing effects on human health	Operation	Conform to a Code of Good Practice to adopt operations and mitigation measures to control activities that may generate and affect the release of bioaerosols.	Operator	EMP
	GHG emissions causing effects on climate	Operation	Quantify GHG emissions annually in accordance with internationally recognised methodologies and reporting procedures and make all reasonable attempts to maximise energy efficiency and design facilities to minimise energy use.	Operator	EMP
	Dust arising from the ash storage area causing effects on human health and quality of life	Operation	During maturation at the Bottom Ash Storage Area, storm water collected through the leachate collection system will be recirculated (sprayed) over the bottom ash to assist with the weathering process and reduce dust emissions by keeping the bottom ash moist/quenched.	Operator	EMP
	Dust arising from the production of the aggregate causing effects on human health and quality of life	Operation	Bottom Ash Processing Facility will be fully enclosed	Operator	EMP
	Emissions arising from the RWL development activities	Operation	Implement site-specific dust mitigation plans (road dust mitigation) and Best Available Technology	Operator	EMP
Chapter 12 Noise and Vibration, Section 12.6	Green Waste Facility – Noise from grinding, screening and shredding systems generating low-level broad-spectrum noise levels	Design	GHD recommends re-orienting the GWF operations pad to use the proposed storage area concrete push walls (16 ft (4.9 m) above grade) to block line of sight and noise emissions.	Contractor, Operator	Detailed design
	Materials Recycling Facility building – Noise from inside the MRF building will be generating low-level broad-spectrum noise levels which will be tonal or impulsive (broadband only).	Design	A noise barrier is required to protect noise emissions toward the south by erecting a 16 ft (4.9 m) tall, 19 ft (6 m) long noise barrier to provide reduced line of sight and noise towards the southeast	Contractor, Operator	Detailed design
	Construction noise	Construction	Implement best working practice, where possible, to minimize potential levels of noise generated by the construction works, following guidelines in BS5228-1 and the guidance in BRE Controlling Particles, Vapour and Noise Pollution from Construction Sites, Parts 1 to 5, 2003.	Contractor	CEMP

ES Chapter / Section	Potential effect	Phase	Mitigation measure / monitoring commitment	Responsibility	Compliance mechanism
	Construction noise	Construction	Implement the following measures to minimise noise emissions: – All plant and machinery will be regularly maintained to control noise emissions, with particular emphasis on lubrication of bearings and the integrity of silencers. – Broadband reversing alarms will be chosen instead of tonal alarms. – Site staff will be made aware that they are working adjacent to a residential area and avoid all unnecessary noise due to misuse of tools and equipment, unnecessary shouting and radios. – A further measure to reduce noise levels at the sensitive receptors will include, as far as possible, the avoidance of two noisy operations occurring simultaneously in close proximity to the same sensitive receptor. – Adherence to the restriction of operating hours. – Ensure engines are turned off when possible. – Should construction activities need to be carried out during night-time hours, this will be discussed with the Cayman Islands Government, which may include a requirement for advance notice and details of any night working to provided. The majority of lorry movements will be carried out in forward gear in order to minimize noise associated with vehicle maneuvering.	Contractor	CEMP
	Construction noise	Construction	Implement construction management procedures to minimize noise associated with construction activity including the application of techniques in accordance with BS 5228: 2009. Such measures will, where necessary, include: – Use of mufflers or silencers on tools and plant. – Where practicable and economic, electrically powered equipment will be used in preference to diesel or gasoline, as it is quieter. – Low noise emissions and white noise reversing alarms on vehicles that are procured for the Works Period. – Shut down (or throttle down) of machines in intermittent use in periods between work. – Use of acoustic fencing or stockpiles for screening sound. – Particularly noisy activities will be limited to certain periods of the day where appropriate. – ReGen will keep neighbours informed regarding the work that is to be undertaken on site and the associated duration. – Prior to commencement of particularly noisy operations, an environmental procedure detailing the method of works, program of work, predicted noise levels and manufacturers specifications for equipment and machinery will be submitted to the Contractor by the Construction Sub-Contractors for acceptance. – Where practicable noisy equipment will be located away from sensitive noise boundaries. – Loading and unloading of vehicles, dismantling of site equipment such as scaffolding or moving equipment or materials around site will be conducted in such a manner as to reduce noise generation and where practicable will be conducted away from noise sensitive areas. – If elevated noise / vibration levels are encountered, the source of noise or vibration is to be identified and alternative methods or additional control measures are to be implemented. A maximum speed limit of 5 mph (8 kph) will apply on the site for the safety of the workforce and to minimize disturbance from noise and vibration in dusty areas. During regular operations on paved roads a maximum speed limit of 13 mph (20 kph) will apply.	Contractor	CEMP
	Operational noise	Operation	Implement Best Available Technology to ensure that the noise levels within the vicinity of the operational plant buildings associated with the ISWMS will be 80 dBA or less.	Operator	EMP

ES Chapter / Section	Potential effect	Phase	Mitigation measure / monitoring commitment	Responsibility	Compliance mechanism
	Operational noise	Operation	Implement the following best working practices: – All plant and machinery will be regularly maintained to control noise emissions, with particular emphasis on lubrication of bearings and the integrity of silencers. – Broadband reversing alarms will be chosen instead of tonal alarms. – Site staff will be aware that they are working in the vicinity of residential properties and avoid all unnecessary noise due to misuse of tools and equipment, unnecessary shouting and radios. Noisy external activities such as cleaning and maintenance will be scheduled to avoid night-time working in the vicinity of sensitive receptors where possible. – All works and ancillary operations that are audible at sensitive receptors outside the Site boundary shall be carried out only during hours of 8am till 6pm. – All equipment and machinery in use shall be properly silenced where practicable and economic and maintained in accordance with the manufacturer's instructions. – Any emergency deviation from these conditions shall be reported to the Contractor without delay. – All vehicles to switch off engines upon arrival at site. The Site is to be a no-idling site. – The majority of lorry movements will be carried out in forward gear in order to minimise noise associated with vehicle manoeuvring.	Operator	EMP
	Operational noise	Operation	Establish noise management objectives as follows: – 65 dBA at a distance of one meter from existing building facades. – 75 dBA at the site boundaries neighbouring roads and car parks. – 80 dBA at all other site boundaries.	Operator	EMP
Chapter 13 Traffic and Transport, Section 13.6	Pedestrian severance and delay at locations where physical obstructions or increases in traffic flows more than 30% are forecast to result in an increase in severance	Construction	Construction delivery movements on the surrounding road network to occur outside the peak traffic flow periods.	Contractor	Construction Transportation Management Plan (CTMP) to be included in CEMP and EMP
	Pedestrian amenity and intimidation at junctions or links subject to substantial increases in traffic flow in conjunction with any changes in footway widths or crossing facilities.	Construction	Movement of any large industrial equipment to the site during construction will be managed by specific plans that will consider Health & Safety and protection of any utilities along the path.	Contractor	CTMP to be included in CEMP and EMP
	Accidents and safety at links and junctions (for which data is available) with existing accident rates more than national averages which may be subject to an increase in traffic flows.	Construction	Movement of any large industrial equipment to the site during construction will be managed by specific plans that will consider Health & Safety and protection of any utilities along the path.	Contractor	CTMP to be included in CEMP and EMP
	Hazardous and dangerous loads (consideration of estimated number and composition of loads and assessment of accident risk if considered significant)	Construction	Movement of any large industrial equipment to the site during construction will be managed by specific plans that will consider Health & Safety and protection of any utilities along the path. Prepare a spill protocol for hazardous/ dangerous loads	Contractor	CTMP to be included in CEMP and EMP
	Hazardous and dangerous loads (consideration of estimated number and composition of loads and assessment of accident risk if considered significant)	Operation	Prepare a spill protocol for hazardous/ dangerous loads	Operator	EMP
Chapter 14 Socio-Economic, Section 14.8	Increased training opportunities	Construction	Potential effects controlled through: – Employment and skills plan	Contractor	CEMP
	Increased competition for workers in local and regional labour market	Construction	Potential effects controlled through: – Employment and skills plan	Contractor	CEMP
	Contribution to the regional economy through procurement of goods and services, employment, and supporting growth of the renewable energy industry.	Construction or operation (or both)	Potential effects controlled through: – Procurement plan	Contractor, Operator	CEMP, EMP

ES Chapter / Section	Potential effect	Phase	Mitigation measure / monitoring commitment	Responsibility	Compliance mechanism
	Opportunity for economic diversification	Operation	Potential effects controlled through: – Procurement plan	Operator	EMP
	Increased capacity of the local workforce	Construction or operation (or both)	Potential effects controlled through: – Employment and skills plan	Contractor/Operator	CEMP, EMP
	Community pride associated with the contribution to the circular economy.	Operation	Potential effects controlled through: – Consultation framework – Community Liaison Plan	Operator	EMP
	Perception of health risk associated with the operation of the project	Operation	Potential effects controlled through: – Consultation framework – Community Liaison Plan – Enquires and Complaints Plan	Operator	EMP
	Changes (actual and perceived) to personal safety and hazard exposure	Operation	Potential effects controlled through: – Consultation framework – Community Liaison Plan – Enquires and Complaints Plan	Operator	EMP
	Improvements to safety and amenity during operation of the ISWMS	Operation	Potential effects controlled through: – Community Liaison Plan	Operator	EMP

Appendices

Appendix 1.A

Terms of Reference Concordance Table

Terms of Reference Concordance Table

Table 1 Terms of Reference Concordance Table

No.	ToR Section	ToR Commitment	How the Commitment was Addressed in the ES	ES Stage Addressed	ES Report Section
1.	2.1.6	The EIA will consider the cumulative effects of **all** aspects of the ISWMS. The various components of the new ISWMS are as follows: - Energy Recovery Facility (subject to EIA) - Non-Energy Recovery Facilities: • Site weighbridges (excluded from EIA) • Green Waste Processing Facility (subject to EIA) • Construction and Demolition Waste Processing Facility (subject to EIA) • Bottom Ash Processing Facility (subject to EIA) • Abandoned and End-of-Life / Scrap Metal Processing Facility (subject to EIA) • Medical Waste Facility (subject to EIA) • Materials Recycling Facility (excluded from EIA) • Household Waste Recycling Centre (excluded from EIA) • Landfill Gas Facility (subject to EIA) • Residual Waste Landfill (subject to EIA) - Ancillary Facilities: • Admin Building (excluded from EIA) • Maintenance Building (excluded from EIA)	The ES describes all ISWMS components as listed in the ToR The cumulative effects are addressed in the Proposed Project and Overview of Concerns Constraints as well as the Summary of Impact Assessment.	Project Description, all Environmental Topics, Cumulative Effects	4.1, 6-14, 15.2
2.	2.1.62	The EIA for the ISWMS excludes an assessment of the proposed facilities in Little Cayman and Cayman Brac.	The proposed site for the ISWMS is defined as a consolidation of parcels that are either a part of or located in the vicinity of GTLF totaling 30 acres (12.4 ha) including: Block 13D Parcel 431, Parts of Block 13D Parcel 1 and Block 13C Parcel 1, North east portion of Block 13D Parcel 287 and	Site Description Project Description	3.1.1, 4.1

No.	ToR Section	ToR Commitment	How the Commitment was Addressed in the ES	ES Stage Addressed	ES Report Section
			North portion of Block 13C Parcel 1.		
3.	2.1.63	Transport of material from the Sister Islands to the Port will be reviewed and described in the EIA.	The Sister Island facilities are described in the EIA. This is addressed in the Proposed Project and Overview of Concerns Constraints	Project Description Marine Ecology – Impact Assessment and Mitigation	4.1, 6.6
4.	2.2.4	The EIA will not readdress the need for the undertaking nor will it assess alternatives to or alternative methods of carrying out the undertaking.	Neither the need for the undertaking nor alternatives were readdressed in the EIA.	Project Need, Policy Context	2.1.2., 2.2.1
5.	2.2.4	Since the original ISWMS strategy dates back to 2014 the EIA will review the basis for the strategy to ascertain if there have been fundamental changes over time, such as new applicable technologies, that may impact on strategy development.	The basis for the ISWMS strategy was reviewed as part of the EIA to confirm its validity over time with respect to available technologies.	Project Need, Policy Context	2.1.2.1, 2.2.1
6.	3.3.1 & 2	The ES will consider planning policy which is relevant to the proposed development as summarised in the Development Plan 1997 (being the plan for zoning and physical development of the Cayman Islands). Extant policy in the Development Plan 1997 is also presently under review. In November 2018, the CPA published, for consultation, a new draft National Planning Framework. As this new policy emerges, the ES will, as appropriate, take cognisance of this evolving, new policy.	The ES considers relevant planning policy as presented in the Development Plan 1997 and takes note of any new policy that emerges from the National Plan review.	Policy Context, Planning Policy	2.2, 2.2.2
7.	3.3.4	The ES will be prepared in the context of the policy set out in [the National Solid Waste Management Policy (NSWMP) for the Cayman Islands (August 2015) & National Solid Waste Management Strategy (NSWMS) for Cayman Islands (2016) and the associated Integrated Solid Waste Management System for the Cayman Islands – Outline Business Case (2016)].	The ES is prepared in the context of the policy set out in the NSWMP and NSWMS.	Policy Context	2.2, 2.2.1
8.	3.3.5	The ES will also be prepared in accordance with the Institute of Environmental Management and Assessment EIA Quality Mark scheme and resources, (particularly commitments 4, 5 and 6 as relevant).	The ES is in accordance with the Institute of Environmental Management and Assessment EIA Quality Mark scheme and	Policy Context, Other Policy	2.2, 2.2.4

No.	ToR Section	ToR Commitment	How the Commitment was Addressed in the ES	ES Stage Addressed	ES Report Section
			resources, (particularly commitments 4, 5 and 6 as relevant).		
9.	4.1.7 & 8	The spatial scope [(the area over which changes to the environment are predicted to occur as a consequence of the proposed development)] will vary between environmental topics and will therefore be described in each of the topic chapters in the ES. The temporal scope of likely significant effects will typically be described in the ES as either: - Temporary - temporary effects are typically related to a particular activity and will cease when that activity finishes. These activities can nevertheless be either 'short-term' or 'long-term; an - Permanent - these are effects that will remain once the proposed development is completed and will not change	The spatial scope for each environmental topic is described within the corresponding chapters in the ES. The temporal scope of likely significant effects for each environmental topic is described within the corresponding chapters in the ES and include Temporary and Permanent effects, among others.	Marine Ecology Study Areas, Impact Assessment and Mitigation Terrestrial Ecology Study Area, Impact Assessment and Mitigation Hydrology and Hydrogeology Study Area, Impact Assessment Land Quality Spatial Scope, Impact Assessment Geotechnical, Impact Assessment Geoenvironmental Landscape and Visual Study Area, Impact Assessment Air Quality and GHGs Study Area, Impact Assessment and Mitigation Noise and Vibration Spatial Boundaries, Noise Impact Assessment and Mitigation Traffic and Transport Study Area and Background Information, Impact Assessment and Mitigation Socio-Economic Scoping, Study Area,	6.2, 6.6, 7.2, 7.6, 8.2, 8.5, 9.2.1, 9.9, 9.10, 10.2.2, 10.2.4, 11.2, 11.9, 12.2.1, 12.6, 13.2, 13.6, 14.3.1, 14.3.2, 14.6, 14.7

No.	ToR Section	ToR Commitment	How the Commitment was Addressed in the ES	ES Stage Addressed	ES Report Section
				Impact Assessment Construction, Impact Assessment Operation	
10.	4.1.9	Effects during the following key stages of a proposed development will generally be considered: - Construction – the effects may arise from the construction activities themselves, or from the temporary occupation of land. Effects are often of limited duration although there is potential for permanent effects. Where construction activities create permanent change, the effects will continue into the operational period. At present, it is anticipated that the construction period will be over a ~24-33 month period from 2021 to 2024; and - Operation – effects may be permanent, or they may be temporary, intermittent, or limited to the life of a proposed development until decommissioning (as in the case of wind power developments which gain planning permission for a defined and finite number of years). An assessment of operational effects will be carried out on a reasonable 'worst case' basis. This has been defined as when all components of the ISWMS are operational i.e. commencing mid 2024. As all elements of the proposed ISWMS will not be operating at full capacity in 2024, it is proposed that the assessment will take a conservative approach and assume that all elements will be operating concurrently at peak capacity from the outset for modelling and comparison purposes.	The key stages of the proposed development are described in Chapter 4. Effects during key stages of the proposed development are considered for each environmental topic and described within the corresponding chapters in the ES. Key stages include Construction and Operation, among others.	Project Description Marine Ecology Impact Assessment & Mitigation Terrestrial Ecology Impact Assessment & Mitigation Hydrology and Hydrogeology Impact Assessment Land Quality Impact Assessment Geotechnical, Geoenvironmental Landscape and Visual Impact Assessment Air Quality and GHG Impact Assessment and Mitigation Noise Impact Assessment and Mitigation Traffic and Transport Impact Assessment and Mitigation Socio-Economic Impact Assessment Construction, Impact Assessment Operation	4.1, 6.6, 7.6, 8.5, 9.9, 9.10, 10.2.4, 11.9, 12.6, 13.6, 14.6, 14.7
11.	4.1.10	The EIA will identify mitigation measures for the project, which will include monitoring during construction and operation.	Mitigation measures and monitoring for each environmental topic is described within the	Marine Ecology Impact Assessment & Mitigation, Monitoring	6.6, 7.6, 7.7, 8.6, 9.11, 10.2.5, 10.8, 11.9, 12.6, 13.6.4, 14.8

No.	ToR Section	ToR Commitment	How the Commitment was Addressed in the ES	ES Stage Addressed	ES Report Section
			corresponding chapters in the ES.	Terrestrial Ecology Impact Assessment & Mitigation, Monitoring Hydrology and Hydrogeology Mitigation measures Land Quality Mitigation measures Landscape and Visual Mitigation measures Air Quality and GHGs Impact Assessment and Mitigation Noise Impact Assessment and Mitigation Traffic and Transport Mitigation Socio-Economic Mitigation measures	
12.	4.1.10	An Environmental Management Plan(s) (EMP) will be developed subject to the monitoring requirements and will be documented in the ES. The EMP will serve as a guidance document during the construction and operation to measure and achieve compliance with the environmental protection and mitigation measures identified during the EIA.	The mitigation and monitoring that have been committed to within this ES for both the construction and operational phases of the Proposed Development are summarised in Table 15.3. These measures are organised by environmental topic and include details of responsibility for implementation and the compliance mechanism, and are presented as a table that would form a base component of an EMP to be employed to ensure that mitigation measures set out in the ES are implemented.	Summary of mitigation measures	15.3

No.	ToR Section	ToR Commitment	How the Commitment was Addressed in the ES	ES Stage Addressed	ES Report Section
13.	4.2.8	The assessment of the significance of effects for each technical topic will take into account any inherent mitigation to the proposed ISWMS (i.e. features which form an integral part of the proposed ISWMS, e.g. appropriate lining in the RWL, etc.). Additional mitigation measures which are required to avoid, reduce or remedy significant adverse effects will be listed and detailed (e.g. a Stormwater Management Plan). The residual effects which remain significant after the implementation of additional mitigation measures will be identified.	The assessment of the significance of effects for each environmental topic considers any inherent mitigation to the proposed ISWMS. Additional mitigation measures required to avoid, reduce or remedy significant adverse effects and resulting residual effects are detailed within each environmental topic chapter.	Marine Ecology Impact Assessment & Mitigation Terrestrial Ecology Impact Assessment & Mitigation Hydrology and Hydrogeology Impact Assessment, Mitigation Measures Land Quality Impact Assessment Geotechnical, Geoenvironmental, Mitigation Measures Landscape and Visual Impact Assessment, Likely Significant Effects Air Quality and GHG Impact Assessment and Mitigation Noise Impact Assessment and Mitigation Traffic and Transport Impact Assessment and Mitigation Socio-Economic Impact Assessment construction, operation, Mitigation measures	6.6, 7.6, 8.5, 8.6, 9.9, 9.10, 9.11, 10.6, 10.7, 10.8, 11.9, 12.6, 13.6, 14.6, 14.7, 14.8
14.	4.2.17	The magnitude of change affecting a receptor that would result from the development proposals will be identified on a scale from minor alterations or change, up to major changes or the total or substantial loss of the receptor.	The magnitude of change affecting a receptor that would result from the development proposal are identified on a scale from minor alterations or change, up to major changes or the	Marine Ecology Impact Assessment & Mitigation, Terrestrial Ecology Impact Assessment & Mitigation	6.6., 7.6, 8.6, 9.9, 9.10 10.6, 10.7, 11.9, 12.6, 13.6, 14.6,14.7

No.	ToR Section	ToR Commitment	How the Commitment was Addressed in the ES	ES Stage Addressed	ES Report Section
			total or substantial loss of the receptor.	Hydrology and Hydrogeology Impact Assessment Land Quality Impact Assessment Geotechnical, Geoenvironmental Landscape and Visual Impact Assessment Air Quality and GHGs Impact Assessment and Mitigation Noise Impact Assessment and Mitigation Traffic and Transport Impact Assessment and Mitigation Socio-Economic Impact Assessment construction, operation	
15.	4.3.4 & 4.3.5	At this stage, schemes which are considered to be proximate to the proposed ISWMS and of a scale which will require an assessment of [inter-project] cumulative effects are: - The Planned Area Development for Camana Bay; and - The proposed Cruise Berthing Facility. However, the traffic and transport assessment of cumulative effects should not include these schemes in the baseline conditions.	Inter-project cumulative effects have been considered.	Summary of Impact Assessment cumulative effects	15.2
16.	4.3.8	Because this combined assessment involves different environmental topic assessments that cannot robustly be combined, the outcome of this CEA [for inter-related effects] will be reliant on the application of professional judgement from, potentially, several different technical specialists.	The CEA for inter-related effects relied upon the application of professional judgement.	Summary of Impact Assessment cumulative effects	15.2
17.	4.4.1	A Non-Technical Summary (NTS) will be prepared, in accordance with the EIA Directive (the Directive for Environmental Impact Assessments Section 43, National	A NTS has been prepared, in accordance with the EIA Directive and presents a	NTS	NTS

No.	ToR Section	ToR Commitment	How the Commitment was Addressed in the ES	ES Stage Addressed	ES Report Section
		Conservation Law (Extraordinary No. 50/2016). The NTS will be a concise document that provides a description of the EIA process and findings in a manner that is easily understood to a member of the public. The NTS will be supported by figures, maps, tables and photographs and include in plain terms: - A description of the development, - An outline of the main alternatives studied by the applicant, - A description of the aspects of the environment likely to be significantly affected by the development, - The basis for the evaluation of impact significance, and - A description of the likely significant effects of the environment.	summary, in plain terms of the following: – A description of the development, – An outline of the main alternatives studied by the applicant, – A description of the aspects of the environment likely to be significantly affected by the development, – The basis for the evaluation of impact significance, and – A description of the likely significant effects of the environment.		
18.	4.5.1	The ES will contain a list of abbreviations or a glossary.	The ES contains a glossary	Glossary of Terms	
19.	4.5.1	The ES will also embed the figures within the main text so that it is easy for the reader to review and refer to the figures.	The ES includes figures embedded within the main text for ease of reference for the reader.	All section	All sections
20.	4.7.5 & 4.7.6	Consultation on the ES will be undertaken upon completion of the Draft ES in order to consider representations by the public or key stakeholder groups with valid concerns associated with the ES. This consultation will include as a minimum: - Publication of the Draft ES or a link thereto on the DoE's website for a period of 21 consecutive days. - Notification of the publication and public meeting on each of the three islands in the local press on two separate occasions within 10 days prior to the publication of the Draft ES. - Public meetings at venues to be agreed with the EAB to present the Draft ES. The meetings will be held at least 7 days prior to the end of the consultation period. The Proponent will respond to and address as appropriate representations received during the consultation on the Draft	The consultation program for the EIA is described in Chapter 5 of the Environmental Statement and includes: – Publication of the Draft ES or a link thereto on the DoE's website for a period of 21 consecutive days. – Notification of the publication and public meeting in the local press on two separate occasions within 10 days prior to the publication of the Draft ES.	Stakeholder Engagement and Public Consultation	5.0

No.	ToR Section	ToR Commitment	How the Commitment was Addressed in the ES	ES Stage Addressed	ES Report Section
		ES. These representations and responses will be appended to the Final ES.	– Public meetings at venues to be agreed with the EAB to present the Draft ES. The meetings will be held at least 7 days prior to the end of the consultation period. A commitment to respond to and address, as appropriate, representations received during the consultation on the Draft ES is also noted. These representations and responses will be appended to the Final ES.		
21.	5.1.4	As for the wider EIA, the marine ecological assessment will need to follow the process outlined in the Directive for EIAs (2016) issued in accordance with The National Conservation Law (2013).	The Marine Ecology assessment follows the process outlined in the Directive for EIAs.	Marine Ecology Applicable standards and guidelines	6.3.3
22.	5.1.5	The following guidance and local plans will be used in the determination of effects: - Cayman Islands National Biodiversity Action Plan (NBAP) 2009 - preservation of key habitats, through Habitat Action Plans (HAPs) and preservation of key individual species, through Species Action Plans (SAPs) with a view to ensuring that full consideration of the value of an ecologically sound environment be taken into consideration in all decisions pertaining to the future of the country. Nineteen Habitat Action Plans and thirty Species Action Plans were developed out of the BAP process. - UK Chartered Institute of Ecology and Environmental Management (CIEEM) current (2018) best practice approaches for Ecological Impact Assessment (EcIA).	NBAP was utilized for the characterization of existing conditions and determination of effects and CIEEM best practice approaches for EcIA were used in the determination of effects.	Marine Ecology Applicable standards and guidelines, Methodology, Baseline Conditions, Impact Assessment and Mitigation	6.3, 6.4, 6.5, 6.6
23.	5.1.6	Baseline information [presented in the ToR] will be further developed in the EIA, particularly following consultation with local environmental organisations.	Baseline information has been further developed in the EIA following consultation with local environmental organizations.	Marine Ecology Baseline Conditions	6.5

No.	ToR Section	ToR Commitment	How the Commitment was Addressed in the ES	ES Stage Addressed	ES Report Section
24.	5.1.23	Future EIA consultation should include but not be limited to…: – DoE – National Trust for the Cayman Islands – Central Caribbean Marine Institute (CCMI) – Shark Conservation Cayman and other conservation groups	The DoE, the National Trust for the Cayman Islands, the Central Caribbean Marine Institute, and Shark Conservation Cayman were contacted for records of protected species, species habitat mapping and additional natural features information including designated areas within the Study Area. The results of consultation efforts with these entities is summarised in the baseline conditions.	Marine Ecology Methodology, Baseline Conditions Consultation Results	6.4.1, 6.5.2
25.	5.1.24	Consultation will be used to obtain further baseline information which will then be used to determine if any specific marine surveys will be required to establish a robust baseline for the EIA of the proposed development. Consultation will also gather information on potential areas of concerns and allow discussions around mitigation should this be required.	Consultation has been used to obtain further baseline information. Specific marine surveys were deemed not to be required due to there being no direct discharge to the marine environment as part of the proposed project. Consultation also uncovered potential areas of concern such as spur and groove, hardbottom habitats, and inland mangroves and in-depth discusses have taken place.	Marine Ecology Baseline Conditions	6.5.2
26.	5.1.25	The scope of the assessment will be based on the activity-change-effect (on feature) conceptual model, where potential effects arising from the proposed development are identified, as are potential feature and pathways linking the two. If there is no pathway (direct or indirect) by which a feature can be exposed to the effects of an activity, there will be no significant effects on that feature. Pathways may be direct (e.g. removal of habitat) or indirect (e.g. changes in water quality affecting a coastal habitat which, in turn, affects food availability for other species).	The scope of the assessment has been based on the activity-change-effect (on feature) conceptual model. Potential effects arising from the proposed development as well as potential feature and pathways linking the two have been identified. Significance has been evaluated.	Marine Ecology Impact Assessment and Mitigation	6.6.1, 6.6.2, 6.6.3

No.	ToR Section	ToR Commitment	How the Commitment was Addressed in the ES	ES Stage Addressed	ES Report Section
27.	5.1.27	During the EIA a Zone of Influence (ZoI) will be established by considering the pathway of effects to features in the Study area; however, given the activities associated with the proposed development and the hydrology of the site the ZoI is likely to comprise the receiving waters, and contained marine habitat and species, of the North Sound in addition to the marine transportation routes between the Islands. The ZoI for effects will be established for all activities that will lead to environmental change and the marine ecological features within this zone will be identified as features.	ZoI has been established during the EIA by considering the pathway of effects to features in the Study area. Consideration has been given to the Hydrology Assessment and reference has been made within the chapter.	Marine Ecology Impact Assessment and Mitigation	6.6.1
28.	5.1.28	Features…initially identified [in the ToR]…will be further refined during the EIA upon receipt of more detailed information of the activities associated with the construction, operation and decommissioning of the development. This will include consideration of if there are species protected under Schedule 1 Part 1 and 2 of the National Conservation Law (NCL) that could be affected by the development.	Features initially identified in the ToR have been further refined during the EIA upon receipt of more detailed information of the activities associated with the construction and operation of the development. This includes consideration of protected species.	Marine Ecology Baseline Conditions, Impact Assessment and Mitigation	6.5.2, 6.5.5, 6.5.7, 6.6
29.	5.1.29	Once the features have been identified their value at a project scale will be assigned. This will be based on the conservation status of the species/ habitat and their ecological importance.	Features have been identified and their values at the project scale assigned.	Marine Ecology Summary of Marine Baseline Conditions	6.5.9
30.	5.1.31	Baled waste and contained wastes and recyclables will be shipped periodically by CIG by barge (between monthly to quarterly) from the Sister Islands to Grand Cayman for treatment and bulking at the main ISWMS site. The barge would deliver to the main dock on Grand Cayman. Therefore, movement of waste to and from the proposed ISWMS may disturb migratory and highly mobile marine animals e.g., hawksbill, green and loggerhead turtle, groupers, marine mammals and sharks, thus this potential effect is identified. In addition to this, the effects of potential risks associated with the movement of waste will also need to be considered, such as the potential for grounding of barges.	The potential risks associated with the movement of waste from the Sister Islands to Grand Cayman for treatment and bulking at the main ISWMS site have been examined through secondary sources. As this movement of waste from the Sister Islands already occurs, no additional impacts as a result of the proposed development are anticipated.	Marine Ecology Impact Assessment and Mitigation	6.6 (Table 6.6)
31.	5.1.32	The likely significant marine ecology effects that have been taken forward for assessment are:	Potentially significant marine ecology effects identified in the ToR and identified through the assessment of	Marine Ecology Impact Assessment and Mitigation	6.6.1 (Table 6.4), 6.6.3 (Table 6.6)

No.	ToR Section	ToR Commitment	How the Commitment was Addressed in the ES	ES Stage Addressed	ES Report Section
		– Migration of contaminates through surface water/storm water and groundwater movements (Activity: land preparation during construction) – Migration of contaminates through surface water/storm water and groundwater movements (Activity: waste processing during operation) – Disturbance (Activity: vessel movements during operation)	the marine environment baseline conditions have been validated to confirm pathways of potential effects. Potential effects for which pathways were validated were carried forward into the evaluation of significance.		
32.	5.1.36	When considering potentially significant effects on ecological features, whether these be adverse or beneficial, the following characteristics of environmental change will be taken into account: – Extent – the spatial or geographical area over which the environmental change may occur; – Magnitude – the size, amount, intensity or volume of the environmental change; – Duration – the length of time over which the environmental change may occur; – Frequency – the number of times the environmental change may occur; – Timing – the periods of the day/year etc. during which an environmental change may occur; – Reversibility – whether the environmental change can be reversed through restoration actions.	The extent, magnitude, duration, frequency, timing, and reversibility have been considered in the determination of potentially significant effects on ecological features.	Marine Ecology Impact Assessment and Mitigation	6.6.2 (Table 6.5), 6.6.3 (Table 6.6)
33.	5.1.37	Adverse effects will be assessed as being significant if the favourable conservation status of an ecological feature would be lost as a result of the Proposed Development. Beneficial effects will be assessed as those where a resulting change from baseline improves the quality of the environment. For a beneficial effect to be considered significant, the conservation status will need to positively increase in line with a magnitude of change of "high"…	A significance evaluation criterion was set when assessing adverse and beneficial effects of the Proposed Development on ecological features. Marine ecological features (i.e., habitats, protected species) within the Study Area that could be affected by the development have been assigned a value at a project scale in accordance with the ToR. These values are assigned based on the conservation status or the	Marine Ecology Methodology Feature Value at a Project Scale, Summary of Marine Baseline Conditions, Impact Assessment and Mitigation	6.4.2, 6.5.9, 6.6.2 (Table 6.5), 6.6.3 (Table 6.6)

No.	ToR Section	ToR Commitment	How the Commitment was Addressed in the ES	ES Stage Addressed	ES Report Section
			species or habitat and their ecological importance. Where numerous species of wildlife are discussed (e.g., marine mammals, marine reptiles) the highest value across the species is assigned to the group.		
34.	5.1.39 & 40	The decision as to whether the conservation status of an ecological feature would alter will be made using professional judgement, drawing upon the information produced through the baseline characterisation and assessment of how each feature is likely to be affected by the Proposed Development. A similar procedure will be used where protected sites may be affected by the Proposed Development, except that the focus is on the effects on the integrity of each site..	Marine ecological features (i.e., habitats, protected species) within the Study Area that could be affected by the development have been assigned a value at a project scale in accordance with the ToR. These values are assigned based on the conservation status or the species or habitat and their ecological importance. Where numerous species of wildlife are discussed (e.g., marine mammals, marine reptiles) the highest value across the species is assigned to the group. Professional judgement, drawing upon the information produced through the baseline characterisation and assessment of how each feature may be affected by the Proposed Development, was used to determine whether the conservation status of an ecological feature would be altered or protected sites may be affected.	Marine Ecology Methodology Feature Value at a Project Scale, Summary of Marine Baseline Conditions, Impact Assessment and Mitigation	6.4.2, 6.5.9, 6.6.2 (Table 6.5), 6.6.3 (Table 6.6)

No.	ToR Section	ToR Commitment	How the Commitment was Addressed in the ES	ES Stage Addressed	ES Report Section
35.	5.1.41	The assessment of effects on integrity will draw upon the assessment of effects on the conservation status of the features for which the site has been designated. Where these features are not clearly defined, professional judgement will be used to identify the interest features.	The assessment of effects on integrity drew upon the assessment of effects on the conservation status of the features for which the site has been designated.	Marine Ecology Impact Assessment and Mitigation	6.6.3 (Table 6.6)
36.	5.1.42	…a final conclusion for each potentially significant effect will be given, whether it is Significant or Not Significant. The assessment methodology of significance will take into account the nature of the environmental change, the sensitivity of the feature, the resulting effect and its likely scale, with consideration given to the change's extent, magnitude, duration, frequency, timing and reversibility as appropriate.	A final conclusion for each potentially significant effect has been given, whether it is Significant or Not Significant. The assessment methodology of significance has taken into account the nature of the environmental change, the sensitivity of the feature, the resulting effect and its likely scale, with consideration given to the change's extent, magnitude, duration, frequency, timing and reversibility as appropriate.	Marine Ecology Impact Assessment and Mitigation	6.6.3 (Table 6.6)
37.	5.2.4 & 5	For the wider EIA, the terrestrial ecological assessment will need to follow the process outlined in the Directive for EIAs (2016) issued in accordance with The National Conservation Law (2013). In addition, the following legislation and guidance is applicable to terrestrial ecology: – Animals Law (2013 Revision) – National Trust Law (2010 Revision – Development and Planning Act (2021) – Development and Planning regulations (2021) – Development and Planning (Amendment) Regulations (2021) – The Mangrove Conservation Plan – Wastewater Collection and Treatment (Amendment) Law, 2017 – Water Authority Act (2018 Revision) – Convention on Biological Diversity	The terrestrial ecological assessment follows the process outlined in the Directive for EIAs and the applicable legislation and guidance.	Terrestrial Ecology Applicable Standards and Guidelines	7.3

No.	ToR Section	ToR Commitment	How the Commitment was Addressed in the ES	ES Stage Addressed	ES Report Section
		– Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention) – Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)			
38.	5.2.6	The following guidance and local plans will be used in the determination of effects: – Cayman Islands National Biodiversity Action Plan – UK CIEEM	The NBAP and CIEEM have been relied upon for the determination of effects.	Terrestrial Ecology Applicable standards and guidelines, Methodology, Baseline Conditions, Impact Assessment and Mitigation	7.3, 7.4, 7.5, 7.6
39.	5.2.8	Nationally designated sites, habitats and species will be considered up to 2 km from the proposed development.	Nationally designated sites, habitats and species up to 2 km from the proposed development have been considered.	Terrestrial Ecology Methodology	7.4
40.	5.2.10	As part of the EIA process more information will be obtained through consultation with local environmental bodies (including the DoE and National Trust) to make sure all relevant protected sites, habitats and species are considered, and that lack of desk study data is not a limitation.	Information has been obtained through consultation with local environmental bodies.	Terrestrial Ecology Methodology, Baseline Conditions Consultation Results	7.4.1, 7.5.2
41.	5.2.20	During the EIA process consultation should include but not be limited to…: – DoE – National Trust for the Cayman Islands – National Conservation Council – Birdlife International	DoE, the National Trust for the Cayman Islands, the National Conservation Council, and BirdLife International were contacted for consultation purposes during the EIA. No responses have been received to date from National Trust for the Cayman Islands, the National Conservation Council, and BirdLife International.	Terrestrial Ecology Methodology, Baseline Conditions Consultation Results	7.4.1, 7.5.2

No.	ToR Section	ToR Commitment	How the Commitment was Addressed in the ES	ES Stage Addressed	ES Report Section
42.	5.2.21	Consultation will be used to obtain further baseline information which will then be used to determine if any specific ecological surveys will be required to establish a robust baseline for the EIA of the proposed development. Consultation will also gather potential areas of concerns and allow discussions around mitigation should this be required.	Further baseline information was obtained through consultation and completion of surveys.	Terrestrial Ecology Methodology, Baseline Conditions	7.4, 7.5
43.	5.2.23 & 24	Receptors have been initially identified as follows, however, these will be further refined during the EIA upon more detailed information of the activities associated with the construction, operation and decommissioning of the development: – Proposed Ramsar sites – Nationally designated sites; – Mangrove (including that immediately west of the site); – Migratory and wetland bird which are qualifying species for Ramsar sites; – Notable (e.g. BAP) habitats; – Notable (e.g. BAP) species; and – Protected animal species (likely to include bat species and invertebrates). Once the receptors have been identified their value at a project scale will be assigned.	Receptors have been further refined during the EIA following collection of more detailed information.	Terrestrial Ecology Methodology Feature Value at a Project Scale, Baseline Conditions	7.4.2, 7.5
44.	5.2.25 &26	Key to establishing which environmental changes may result in likely significant effects is the determination of a ZoI for each important ecological feature identified…[Other zones of influence (ZoI)] will be discussed with the authors of other chapters, for example the ZoI for effects dues to changes in air quality will be determined following the modelling of the spread of the plume of emissions from the proposed development.	ZoI has been established during the EIA by considering the pathway of effects to features in the Study area.	Terrestrial Ecology Impact Assessment and Mitigation	7.6.1 (Table 7.8)
45.	5.2.27	The likely significant terrestrial ecology effects that have been taken forward for assessment are: – Loss of habitat that proves foraging and sheltering habitat for fauna (Activity: land take during construction) – Killing or injury of animals (Activity: land preparation during construction) – Airborne dust creation (Activity: land preparation during construction)	Potentially significant terrestrial ecology effects identified in the ToR and identified through the assessment of the terrestrial environment baseline conditions have been validated to confirm pathways of potential residual effects. Potential	Terrestrial Ecology Impact Assessment and Mitigation	7.6.1 (Table 7.8), 7.6.2 (Table 7.10)

No.	ToR Section	ToR Commitment	How the Commitment was Addressed in the ES	ES Stage Addressed	ES Report Section
		– Noise/light/visual disturbance (Activity: land preparation during construction) – Migration of contaminates from surface water/storm water and groundwater movements (Activity: land preparation during construction) – Migration of contaminants from surface water/storm water and groundwater movements (Activity: waste processing during operation) – Deposition of contaminants on sensitive habitats or species (Activity: combustion of waste during operation) – Vehicle strikes on animals causing injury or death (Activity: lighting during operation) – Disturbance of animals (Activity: noise during operation)	effects with validated pathways were carried forward into the evaluation of significance.		
46.	5.2.29	When considering the overall magnitude of potentially significant effects on ecological features, whether these be adverse or beneficial, the following characteristics of environmental change will be taken into account: – Extent – the spatial or geographical area over which the environmental change may occur; – Magnitude – the size, amount, intensity or volume of the environmental change; – Duration – the length of time over which the environmental change may occur; – Frequency – the number of times the environmental change may occur; – Timing – the periods of the day/year etc. during which an environmental change may occur; and – Reversibility – whether the environmental change can be reversed through restoration actions.	The extent, magnitude, duration, frequency, timing, and reversibility have been considered in the determination of potentially significant effects on ecological features.	Terrestrial Ecology Impact Assessment and Mitigation	7.6.2 (Table 7.10)

No.	ToR Section	ToR Commitment	How the Commitment was Addressed in the ES	ES Stage Addressed	ES Report Section
47.	5.3.2	As for the wider EIA, the hydrology and hydrogeology element of the assessment will need to follow the process outlined in the Directive for EIAs (2016) issued in accordance with The National Conservation Law (2013) and will take into account the Water Authority Act (2018 Revision) which states in section 19 that groundwater vests in the name of the Crown and appoints the Water Authority Cayman (WAC) as the custodian of groundwater in the name of, and on behalf of, the Crown.	The hydrology and hydrogeology assessment has followed the process outlined in the Directive for EIAs (2016) issued in accordance with The National Conservation Law (2013) and has taken into account the Water Authority Act (2018 Revision) as custodian of groundwater.	Hydrology and Hydrogeology Assessment Methodology	8.3.3.1
48.	5.3.3	Consultation with the Department of Environment (DoE), WAC and DEH will be required to determine the applicable standards that should be adopted for this part of the assessment.	APEC and GHD consulted with the DoE, WAC, and DEH to determine applicable standards. This is reported in the Geothermal Cooling System Method Statement.	Geothermal Cooling System Method Statement	Appendix 8.A
49.	5.3.4	The assessment of stormwater effects will need to include reference to: – Stormwater Management (National Roads Authority (NRA)) Guidelines Levels (2008) – United States Department of Natural Resources Conservation Service (NRCS) National Engineering Handbook – Florida Department of Transportation (FDOT) Drainage Manual (February 2012) and associated FDOT Hand books.	A general site drainage system to manage surface water run-off from non-operational areas of the Site has been developed and is described in Chapter 4. The design of the Site's drainage system incorporates pollution control features and system divisions to isolate specific areas as appropriate. A detailed stormwater management plan should also be prepared for the construction phase of the proposed development, which details all areas from which runoff can arise. This should also consider if or how this system interface with existing drainage systems e.g. the neighbouring GTLF The plan should then propose	Proposed Project and Overview of Concerns/Constraints ISWMS Facilities, Hydrology and Hydrogeology Impact Assessment, Mitigation Measures	4.1.1, 8.5.2.4, 8.6.1.1

No.	ToR Section	ToR Commitment	How the Commitment was Addressed in the ES	ES Stage Addressed	ES Report Section
			appropriate and adequate runoff collection and treatment options for the identified runoff, without compromising existing systems. It is recommended that, wherever possible, the principles of Sustainable Urban Drainage Systems should be applied and associated pollution control measures.		
50.	5.3.6	The proposed development will be subject to water abstraction license and wastewater discharge permits issued by WAC under the Water Authority Act (2018 Revision).	It is understood that the proposed development will follow Water Authority Act licenses and permits.	Hydrology and Hydrogeology Assessment Methodology	8.3.3.1, Table 8.2
51.	5.3.7	The CIG has directed that the construction and operation of the proposed facilities on the Sister Islands will be managed by the DEH, and so will lie outside the scope of this EIA.	It is confirmed that the construction and operation of the proposed facilities on the Sister Islands will be managed by the DEH and thus will lie outside the scope.	Hydrology and Hydrogeology Assessment Study Area	8.2
52.	5.3.11	During the formulation of the EIA, other data will be collected as appropriate, including that within existing literature and also any ongoing and additional field monitoring of water levels, quality and flow, and to incorporate such data in a more definitive description of the baseline environment. Such a description will include the presentation of a conceptual model (with schematic sections) summarising key attributes of the baseline water environment in the vicinity of the proposed development.	A Conceptual Model was developed for the on-site stormwater management system (Chapter 4), and within the Flood Risk Assessment and the Hydrogeological Investigation – ReGen Geothermal System.	Geothermal Cooling System Method Statement	Appendix 8.A
53.	5.3.37	During the formulation of the EIA, other receptors will be identified as appropriate.	All receptors have been identified during the formulation of the EIA.	Hydrology and Hydrogeology Assessment Methodology	8.3.1, Table 8.1

No.	ToR Section	ToR Commitment	How the Commitment was Addressed in the ES	ES Stage Addressed	ES Report Section
54.	5.3.38	During the formulation of the EIA, other likely significant effects will be identified as appropriate.	Likely significant effects have been identified during the formulation of the EIA.	Hydrology and Hydrogeology Assessment Assessment of Effects	8.5.3, Table 8.12
55.	5.3.47	Additional mitigation measures which are required to avoid, reduce or remedy 'Significant' potential adverse effects will need to be listed and detailed.	Mitigation measures to avoid, reduce, or remedy 'Significant' potential adverse effects are listed in detail.	Hydrology and Hydrogeology Assessment Mitigation Measures	8.6, Table 8.13
56.	5.3.51	Wastewater disposal options will need to be assessed. Any discharges from the site to ground/surface water must meet applicable water quality discharge criteria as previously identified and will be subject to wastewater discharge permits issued by WAC under the Water Authority Act (2018 Revision). WAC will be consulted to provide information on existing large-scale discharges within the study area for consideration in the EIA. Depending on the anticipated temperature differential between abstraction and disposal, a site-specific hydrogeological study will be required by WAC. A review of the methodology to complete this work will be reviewed with the EAB in advance of commencing the study.	Wastewater disposal options are discussed in the context of potential effects.	Hydrology and Hydrogeology Assessment Potential Effects	8.5.1
57.	5.3.52	The proposed development will require potable water supply for domestic consumption and sanitary purposes and non-potable water for ERF cooling, compost application and general site maintenance purposes. Water supply sources for the site will need to be assessed, including mains potable water supply and deep groundwater abstraction (non-potable water supply subject to on-site treatment).	Water supply sources for the site have been assessed.	Hydrology and Hydrogeology Assessment Methodology, Potential Effects, Mitigation Measures	8.3.1, 8.5.1, 8.6, Table 8.13
58.	5.3.53	WAC will be consulted to provide information on existing groundwater abstractions within the study area. Groundwater abstraction will be subject to a license issued by WAC. Depending on the anticipated abstraction volume, a site-specific hydrogeological study will be required by WAC. A review of the methodology to complete this work will be reviewed with the EAB in advance of commencing the study.	APEC and GHD consulted with the DoE, WAC, and DEH to determine applicable standards. This is reported in the Geothermal Cooling System Method Statement.	Geothermal Cooling System Method Statement	Appendix 8.A

No.	ToR Section	ToR Commitment	How the Commitment was Addressed in the ES	ES Stage Addressed	ES Report Section
59.	5.3.54	A Flood Risk Assessment (FRA) will need to be undertaken for the proposed development site to demonstrate how flood risk to the development and any potential to increase flood risk to third parties due to the proposed development will be managed over the site's lifetime, taking appropriate account of climate change.	A Flood Risk Assessment has been undertaken for the proposed development site.	Flood Risk Assessment	Appendix 8.A
60.	5.3.59	A SWMP will need to be developed for the proposed development site to demonstrate that the site is able to operate effectively during intense rainfall events and it will not increase flood risk to surrounding properties or infrastructure. Specifically, the SWMP will need to address the following issues: - Identification of an appropriate location to discharge storm water from the site; - A review of the recommended design rainfall intensity, using available local rainfall data and taking into account climate change to ensure it is adequately conservative for this development; - Design of drainage infrastructure with adequate capacity to safely convey the design rainfall intensity and minimise potential flood and water quality impacts; - Provision of safe overland storm water flow routes to minimise potential flood and water quality (mobilisation of contaminants by flood waters) impacts during design exceedance events; - Design of mitigation measures to ensure the adequate attenuation of storm water prior to discharge; - Design of mitigation measures to maintain good water quality in the discharged water; and - Identification, together with any necessary mitigation measures, of existing drainage infrastructure or overland flow routes which may be affected by the proposed development.	A general site drainage system to manage surface water run-off from non-operational areas of the Site has been developed and is described in Chapter 4. The design of the Site's drainage system incorporates pollution control features and system divisions to isolate specific areas as appropriate. A detailed stormwater management plan should also be prepared for the construction phase of the proposed development, which details all areas from which runoff can arise. This should also consider if or how this system interface with existing drainage systems e.g. the neighbouring GTLF The plan should then propose appropriate and adequate runoff collection and treatment options for the identified runoff, without compromising existing systems. It is recommended that, wherever possible, the principles of Sustainable Urban Drainage Systems should be applied and	Proposed Project and Overview of Concerns/Constraints ISWMS Facilities, Hydrology and Hydrogeology Impact Assessment, Mitigation Measures	4.1.1, 8.5.2.4, 8.6.1.1

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			associated pollution control measures.		
61.	5.4.3	The land quality element of the assessment will need to follow the process outlined in the Directive for EIAs (2016) issued in accordance with The National Conservation Law (2014).	The land quality assessment followed the process outlined in the Directive for EIAs (2016) issued in accordance with The National Conservation Law (2014).	Land Quality Assessment Applicable Standards	9.3
62.	5.4.14 & 5.4.15	During the formulation of the EIA, other data will be collected as appropriate, including that within existing literature as well as site-specific geo-environmental and geotechnical data from site investigation(s). Any such data will be incorporated into the EIA to provide a more definitive description of the baseline environment. Such a description will include the presentation of a conceptual model (with schematic sections) summarising key attributes of the baseline geo-environmental and geotechnical conditions near the George Town ISWMS site and RWL that together comprises the proposed development.	Existing literature and existing site-specific geo-environmental and geotechnical data from the site was relied upon for the Land Quality Assessment to provide a more definitive description of the baseline environment. A Conceptual Site Model was also prepared as part of the Land Quality Assessment.	Baseline conditions: Geotechnical, George Town Landfill, Baseline conditions: Geoenvironmental, Conceptual site model	9.5, 9.6, 9.7, 9.8
63.	5.4.18	The EIA will consider how to incorporate the containment cell into the RWL design as part of the baseline assessment.	The containment cell is discussed in the characterisation of baseline geoenvironmental conditions and considered in the geoenvironmental impact assessment.	Current baseline: Geoenvironmental, Impact assessment: Geoenvironmental	9.7, 9.10
64.	5.4.59	The mitigation measures proposed will be clearly stated in the ES and will follow accepted engineering practice standards with clear confirmation that the proposed mitigative solutions are technically and environmentally sound.	Proposed mitigation measures are clearly stated and follow accepted engineering practice standards with clear confirmation that the proposed mitigative solutions are technically and environmentally sound.	Mitigation measures	9.11

No.	ToR Section	ToR Commitment	How the Commitment was Addressed in the ES	ES Stage Addressed	ES Report Section
65.	5.5.2	The LVIA will be undertaken in accordance with the third edition of the Guidelines for Landscape and Visual Impact Assessment (GLVIA3) produced in the UK by the Landscape Institute and the Institute of Environmental Management and Assessment. The LVIA will take account of the following technical note published by the Landscape Institute. - Visual Representation of Development Proposals. Technical Guidance Note 06/19	This LVIA chapter has been prepared in accordance with the guidance provided in GLVIA3.	Landscape and Visual Methodology Standards and Guidance	10.2.1
66.	5.5.9 – 11	A preliminary Zone of Theoretical Visibility (ZTV) has not been calculated for the proposed ISWMS to inform the scoping study and viewpoint selection. Based upon desktop studies which emphasise the flat topography of western Grand Cayman, a preliminary review of Digital Terrain Model (DTM) data and the proposed heights of the tallest components of the proposed ISWMS as shown in the BWSC drawing no. 3562-D2-111-101: Longitudinal Section, it is highly likely that a ZTV calculated using bare earth digital terrain data would extend across all the land and sea areas within the study area. Use of Digital Surface Model (DSM) data which takes account of the screening that will be provided by existing vegetation and, in particular, built development will be likely to refine the ZTV. It is understood that DSM data is commercially available at a suitable resolution of 8 m intervals and a 3 m vertical interval. A ZTV produced using such DSM data will require field verification. Separate ZTVs are to be calculated to differentiate between locations in the study area where just the stack at the ERF component of the proposed ISWMS will potentially be visible and the locations where other components will potentially be visible. The stack has a height of 48.1 m (158 feet) above ground level (AGL) and is the tallest component of the proposed ISWMS. A second ZTV will be calculated for the other components of the ERF at heights of between 37.8 m AGL (124 feet) for the boiler house and 33.4 m AGL (110 feet) for the waste bunker. These are likely to be the tallest and therefore the most visible components within the overall proposed ISWMS. The resultant ZTVs are to be overlain on a single base map to facilitate an understanding of the visibility of the proposed ISWMS.	ZTV mapping is computer-generated analysis which identifies land from which it is theoretically possible to view the components of the Project. Separate ZTV maps have not been calculated for the project due to the lack of available terrain data. Based upon desktop studies which emphasise the flat topography of western Grand Cayman, it is highly likely that a ZTV calculated using bare earth digital terrain data would extend across all the land and sea within the study area, due to the low-lying topography and long views. The proposed ISWMS will potentially be visible as the stack has a height of up to 158 feet (48 m) above ground level (AGL) and will likely be the tallest component in the study area. The Energy Recovery Facility (ERF) has heights of between 124 feet (37.8 m) AGL for the boiler house and 110 feet (33.4 m) AGL for the waste bunker. These are likely to be the tallest and	Landscape and Visual Methodology Existing Landscape and Visual Environment Zone of Theoretical Visibility assessment	10.2.3.3

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			therefore the most visible components within the overall proposed project.		
67.	5.5.18	This characterisation will use desktop and field surveys and will be based upon approaches set out in guidance provided by Natural England, and the Landscape Institute which can be readily applied outside the UK and scaled to ensure that the approach is commensurate and proportional.	Both desktop and field surveys were completed for characterisation of landscape, townscape and seascape and relied upon guidance from Natural England, Scottish Natural Heritage and Countryside Council's Landscape Character Assessment Guidance.	Landscape and Visual Methodology Impact Assessment	10.2.4
68.	5.5.26	The identification of landscape and visual receptors that could be subject to likely significant landscape or visual effects will be guided by ZTVs for the proposed ISWMS which will be generated as part of the assessment process together with field survey observations.	The study area has been classified into the following five landscape character zones (LCZs) and seascape character zones (SCZs), each with different associated sensitivities to potential changes as a result of the Project: LCZ1: Tourism foreshore and George Town centre, LCZ2: Industrial, waste and airport; LCZ3: Residential settlement; SCZ4: Mangroves and recreation; and SCZ5: Caribbean Sea and North Sound Lagoon. Based on the existing environment analysis, sensitive visual receivers were identified and viewpoint locations selected for assessment. Consideration of the nature of the Project and the context within which it will be located (i.e., within an area that is zoned 'Heavy Industrial') has led to the	Landscape and Visual Landscape and Seascape Character Assessment; Visual assessment	10.6, 10.7

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			judgement that receptors who may have an increased propensity to experience significant effects are those receptor groups assessed as being of a high or medium sensitivity to change. Sensitive visual receivers within the Project viewshed include: residents in dwellings with views to the Project; road users along the Esterly Tibbetts highway; local road users of West Bay Road; nearby workers from the industrial zone; tourists/visitors to outdoor attractions; people undertaking recreational activities where the focus of the activity involves an appreciation of the landscape or where it is likely that their surroundings have some influence upon their enjoyment (e.g., angling and golfing); and people travelling through the landscape on roads or at sea.		
69.	5.5.29	The assessment will be based on a viewpoint assessment for up to eight publicly accessible viewpoints (including the Camana Bay Observation Tower) which represent the views of the groups of visual receptors listed in the baseline section above. The viewpoint assessment will be supported by annotated photographic viewpoints presented in accordance with the Landscape Institute Advice Note 06/19 Visual Representation of Development Proposals and photomontages from four of the viewpoints to illustrate the visual effect of the proposed development. These four viewpoints will by necessity be restricted to publicly accessible locations within the study area (and ZTVs).	Eight viewpoint locations were selected within the study area for assessment in order to appropriately represent the most sensitive visual receivers who are in close proximity to the site, may have prolonged views to the Project or are in LCZs of high value. Annotated photographic viewpoints have been presented for each.	Landscape and Visual Visual Assessment Viewpoint Locations	10.7.1

No.	ToR Section	ToR Commitment	How the Commitment was Addressed in the ES	ES Stage Addressed	ES Report Section
70.	5.5.33	The LVIA will differentiate between the construction and operation periods. Where suitable design information is available, the LVIA will incorporate proposed embedded and best practice mitigation measures e.g. for the selection of cladding type and colour and the reduction/avoidance of litter generation.	Mitigation measures appropriate to Landscape and Visual are presented in the chapter.	Landscape and Visual Mitigation Measures	10.8
71.	5.5.35 and 41	The sensitivity of visual receptors will consider the susceptibility of the visual receptor to the visual change identified and the value that is likely to be attributed by the visual receptor to their baseline view… … The nature of visual effects or their magnitude of change resulting from the construction and operation of the proposed ISWMS will be assessed as high, medium, low or very low. The magnitude of visual change will be described by reference to the scale of visual change; the contrast with the baseline view; separation distance; the duration over which a view is available; the angle of view; levels of screening; and whether new visual elements are seen on a skyline or against a background.	The evaluation of potential effects on visual amenity is based on the sensitivity of the viewpoint (and the visual receiver it represents) to change, and the magnitude of change that is likely to occur. The assessment considers the likely impacts of the Project. The level of effects on a view depends on factors such as the extent of visibility, degree of obstruction of existing features, degree of contrast with the existing view, angle of view, duration of view and distance from the Project. The sensitivity and magnitude of visual effects addresses the following specific criteria: – the sensitivity of the viewpoint to proposed change considers the importance of the view, its existing scenic qualities and the presence of other existing man-made elements in the view; type of visual receiver and their likely interest in the view; susceptibility of visual receivers to	Landscape and Visual Methodology Impact Assessment Visual Assessment	10.2.4.4

No.	ToR Section	ToR Commitment	How the Commitment was Addressed in the ES	ES Stage Addressed	ES Report Section
			change, and value attached to views. – the magnitude of change to views and visual amenity considers the size or scale of change; geographical extent of effects, and duration and reversibility of effects (refer to Table 10.5). It also depends on the loss, change or addition of any feature in the field of view of the receiver including an assessment of the level to which the change contrasts with the existing view or expected view of the landscape.		
72.	5.5.43 & 44	The level of visual effects will be determined with reference to visual sensitivity and the magnitude of visual change likely to be experienced. For each receptor the evaluation process will be informed by use of a matrix. Likely significant visual effects arising from the construction and operation of the proposed ISWMS will be effects that are assessed as being likely or certain to result in effects that would be ‘major’. Effects assessed as being ‘moderate’ would have the potential to be significant and whether they are assessed as significant or not significant will be justified in the detailed assessment for the relevant landscape or visual receptor. In line with the emphasis placed in GLVIA3 upon application of professional judgement, the adoption of an overly mechanistic approach through reliance upon a matrix will be avoided. This will be achieved by the provision of clear and accessible narrative explanations of the rationale underlying the assessment made for each receptor over and above the outline assessment provided by use of the matrix. Wherever possible cross references will be made to figures to support and explain the rationale.	The combination of sensitivity and magnitude determines the significance of the impact on the landscape character or representative viewpoint. A matrix was used to determine the significance of impact. Clear and accessible narrative explanations have been included in the assessment to provide the rationale underlying the assessment made for each receptor over and above the outline assessment provided by use of the matrix and appropriate refence to supporting figures has been made.	Landscape and Visual Methodology Impact Assessment Significance of effects; Landscape and Seascape Character Assessment, Visual Assessment	10.2.4.5, 10.6, 10.7

No.	ToR Section	ToR Commitment	How the Commitment was Addressed in the ES	ES Stage Addressed	ES Report Section
73.	5.6.4	Additional baseline data will need to be collected when carrying out the EIA. The details on monitoring to establish the site-specific air quality baseline data will be agreed with the EAB prior to collecting the data. With this in mind, an Air Quality Method Statement will be prepared to supplement the ToR which will outline key parameters on the baseline monitoring program and reviewed in consultation with the EAB.	Baseline data was collected and report in the Ambient Air Monitoring Report, as agreed in the Air Quality Method Statement.	Air Quality and Greenhouse Gases (GHGs) Emissions Baseline Conditions Background Air Quality	11.5.4
74.	5.6.13	The Proponent is currently recording H2S concentrations at 5 locations (refer to Figure 5.6 for locations) proximate to the ISWMS site together with wind direction information at 3 of the monitoring locations (all at nominal 10-minute intervals), which data will be provided as part of the EIA for the ISWMS project.	Baseline data was collected at seven air monitoring stations. There were three types of monitoring: passive, intermittent, and continuous. The background concentrations for the air contaminants measured at each station during the four month air monitoring campaign are summarized in Table 11.8	Air Quality and GHGs Emissions Baseline Conditions Background Air Quality	11.5.4
75.	5.6.21-24	[Local] receptors will represent locations where people are likely to be exposed for the appropriate averaging time (dependent on the air quality objective being assessed against). The closest receptors to be considered in the assessment will include: – Locations within the Lakeside Development (residential dwelling immediately west of the ISWMS development, on the opposite side of the Esterly Tibbetts Highway). – Locations within the OLEA residential development approximately 800 m north of the ISWMS development – Properties on Parkside Close (residential dwelling approximately 800 m to the north west of the ISWMS development). – Residential receptors located along Seymour Drive, approximately 300 m to the south east of the proposed ISWMS site. – The Cayman International School (educational establishment approximately 800 m to the north west of the ISWMS development).	The following sensitive receptors, as shown in Figure 11.2, were included as part of the Assessment. – Locations within the Lakeside Development (residential dwellings immediately west of the ISWMS development, on the opposite side of the Esterly Tibbetts Highway). – Locations within the OLEA residential development approximately 2,624 ft (800 m) north of the ISWMS development. – Properties on Parkside Close (residential dwellings approximately	Air Quality and GHGs Emissions Baseline Conditions Sensitive Receptors, Dispersion Modelling Receptors	11.5.3, 11.7.4

No.	ToR Section	ToR Commitment	How the Commitment was Addressed in the ES	ES Stage Addressed	ES Report Section
		– The Seven Mile Beach corridor, which includes residential tourism properties. – The employees of the industrial park in which it is proposed. The surrounding land use zoning could result in residential, commercial, tourism and other uses which are receptors that will potentially be affected. The air quality assessment will also consider receptors up to 10 km from the ISWMS development as emissions from elevated stacks, such as the ERF, could reach receptors located several kilometres downwind of the point of release. In addition to the receptors listed above, following consultation with CIG and other relevant stakeholders, additional sensitive receptors located in any proposed future development (either already granted permission or within the local planning system at the time of the EIA) will be included in the ES.	2,624 ft (800 m) to the northwest of the ISWMS development). – The Cayman International School (educational institute approximately 2,624 ft (800 m) to the north of the ISWMS development). – The Seven Mile Beach corridor which starts approximately 4,921 ft (1,500 m) to the northwest of the ISWMS development, which includes residential tourism properties. – Health City Camana Bay's Cancer Research facility approximately 1,968 ft (600 m) to the north of the ISWMS development, estimated to be operational by the year 2024. – Jasmine Hospice facility located on West Bay Road, approximately 3,281 ft (1,000 m) west of the ISWMS development. – Royale Medical and Wellness Center is a medical laboratory located approximately 3,281 ft (1,000 m) west of the ISWMS development.		

No.	ToR Section	ToR Commitment	How the Commitment was Addressed in the ES	ES Stage Addressed	ES Report Section
			– Cayman Medical located approximately 2,952 ft (900 m) south of the ISWMS development.		
76.	5.6.25	Emissions from the proposed ISWMS facilities including the ERF, RWL and Composting Area will need to be assessed against baseline conditions to assess if they can cause a significant change in air quality conditions at locations where the sensitive receptors are found.	Emissions from the proposed ISWMS facilities were assessed against baseline conditions to assess if they can cause a significant change in air quality conditions at locations where the sensitive receptors are found.	Air Quality and GHGs Emissions Modelling Results and Discussion, Impact Assessment and Mitigation	11.8, 11.9
77.	5.6.28	The potential for impacts arising from release of bioaerosols from the green waste composting operations will be assessed qualitatively based on the potential for significant bioaerosol releases and the proximity to nearby receptors.	The Methods Statement determined that an assessment of the existing conditions of bioaerosols was not warranted as part of the EIA. The ISWMS will be designed such that the potential health affects to workers and sensitive receptors will be well within UK Guidance, and a risk assessment will not be necessary. A discussion of the potential for impacts arising from release of bioaerosols from the green waste composting operations is included in the impact assessment.	Air Quality and GHGs Emissions Impact Assessment and Mitigation	11.9, Table 11.17
78.	5.6.33 -37	The release and dispersion of pollutants from the main stack will be modelled using either the ADMS-5 model, the USEPA AERMOD model or the CALPUFF dispersion models. Emission rates will be determined using the IED emission limits (as a worst-case) combined with other plant-specific model input parameters. The ADMS-5 model will be run using 5-years of meteorological data from Owen Roberts International Airport, following international best practices.	The release and dispersion of pollutants from the main stack was modelled using the USEPA AERMOD model. The estimated emissions for background sources of NO_x and the estimated ISWMS emissions were used in the	Air Quality and GHGs Emissions Dispersion Modelling, Modelling Results and Discussion	11.7, 11.8

No.	ToR Section	ToR Commitment	How the Commitment was Addressed in the ES	ES Stage Addressed	ES Report Section
		The model will consider changing conditions of the ERF combustion efficiency with varying feed stocks and operating conditions and varying meteorological conditions such as the impact of the north-easterly prevailing winds towards the nearest development such as Lakeside and the Cayman International School and during an inversion, where dispersion is minimized. ADMS-5 will be also applied to define the optimal stack height of the ERF, in order to minimize the risk of impact at identified sensitive receptors. This will be achieved by modelling emissions of NOx, which is the pollutant of main concern in this case. The dispersion of emitted pollutants will be modelled at a series of sensitive receptor locations, representing both human exposure (e.g., residential properties and schools) and sensitive ecological habitats. A grid of receptors will also be used to allow contour plots of concentrations to be presented.	AERMOD modelling. A discussion of the results of the background NO_x modelling and the future ISWMS emissions modelling is provided in Section 11.8. The existing background NO_x emissions model results are compared with the background monitoring results for NO_x. The future ISWMS model results, including the addition of the background air contaminant concentrations, are compared with the air quality standards.		
79.	5.6.38-41	The relevant technical guidance in Table 5.32 above, will be used to predict and assess the significant effects construction and operational air and odour emissions from the facilities making up the ISWMS. The significance of air quality impacts will be defined following the Institute of Air Quality Management Guidance on land-use planning and development control: Planning for air quality 2017 v1.2. The significance of odour impacts will be defined following Institute of Air Quality Management Guidance on the assessment of odour for planning. The assessment of odours from the proposed ISWMS facilities should follow a two-stage assessment process including an odour risk assessment and odour dispersion modelling. The second stage will be performed only if the risk assessment identifies a risk for odour impacts to take place. The assessment will take into account the beneficial effect of treating waste in the ISWMS facility rather than operating the existing dump. Cumulative effects from the surrounding odour emitting uses should be considered in the assessment. Odour monitoring and control systems will need to be specified and demonstrated to ensure impacts are acceptable within the local area.	The relevant technical guidance used to predict and assess the significant effects of construction and operation on air and odour emissions from the facilities making up the ISWMS is described and applied in the Air Quality and Greenhous Gases Assessment. The significance of air quality impacts was defined following the Institute of Air Quality Management Guidance on land-use planning and development control: Planning for air quality 2017 v1.2. The significance of odour impacts was defined following Institute of Air Quality Management Guidance on the assessment of odour for planning. The odour	Air Quality and GHGs Emissions Summary of Standards and Technical Guidance, Background Air Quality Background Values Odour, Impact Assessment and Mitigation	11.3.1, 11.5.4.2, 11.9

No.	ToR Section	ToR Commitment	How the Commitment was Addressed in the ES	ES Stage Addressed	ES Report Section
			assessment concluded that once the ISWMS becomes operational there will be a reduction in odour due to diversion of waste from landfilling activities which can generate fugitive odours from the working face and from landfill gas. Therefore, the implementation of the ISWMS should result in fewer odour emissions from the Site. Given the finding that there is no risk of odour impacts from the ISWMS, odour dispersion modelling was not required per the Institute of Air Quality Management Guidance.		
80.	5.7.11	The choice of potential NSRs to be considered in the assessment will include: - Locations within the Lakeside Development (residential dwelling immediately west of the ISWMS development, on the opposite side of the Esterly Tibbetts Highway); - Properties on Parkside Close (residential dwelling approximately 800 m to the north west of the ISWMS development); - Properties on Seymour Road (residential dwelling approximately 300 m to the south east of the proposed ISWMS development); - The Cayman International School (educational establishment approximately 800 m to the north east of the ISWMS development); and - Locations within the OLEA residential development approximately 800 m north of the ISWMS development.	The choice of NSRs considered in the assessment included the five receptors identified in the ToR as well as the proposed new Health City Camana Bay Medical Campus.	Noise and Vibration Sensitive Receptor Locations ISWMS Development	12.2.4

No.	ToR Section	ToR Commitment	How the Commitment was Addressed in the ES	ES Stage Addressed	ES Report Section
81.	5.7.18	In addition, once haulage routes to and from the ports are determined for both the construction and operational phases, road traffic noise monitoring will be undertaken at agreed locations along the main route(s) to and from the facilities in accordance with the shortened method within the UK's CRTN "Calculation of Road Traffic Noise".	The assessment of operational traffic noise effects included the following roads, which encompass the haul route to/from the ports: Seymour Road, North Sound Road, Thomas Russel Avenue, Elgin Avenue, Goring Avenue, Harbour Drive and Esterly Tibbets Highway.	Noise and Vibration Assessment of Operational Traffic Noise Effects	12.4.2
82.	5.7.26	The relevant technical guidance in Table 5.3[3]…will be used to predict and assess the significant effects construction and operational noise from the facilities making up the ISWMS.	The potential noise effects associated with the ISWMS have been assessed in accordance with the technical guidance noted in Table 5.33 of the ToR and as detailed in the ES to determine whether statutory objectives are exceeded or whether undesirable/desirable consequences may arise for the receiving environment. Where potential adverse impacts are identified, appropriate mitigation measures are proposed to avoid, reduce or compensate for the adverse effects. The significance of an environmental impact is determined not only by the magnitude of the impact but also by the sensitivity of the receptor.	Noise and Vibration Applicable Standards and Guidelines	12.4

No.	ToR Section	ToR Commitment	How the Commitment was Addressed in the ES	ES Stage Addressed	ES Report Section
83.	5.7.27	An ES chapter will need to be produced detailing the results of the above and including identification of Lowest Observable Adverse Effect Level (LOAEL) and Significant Observable Adverse Effect Level SOAEL levels.	The Noise and Vibration chapter details the results of the noise and vibration impact assessment.	Noise and Vibration Assessment Criteria for Construction Noise Effects, Assessment of Effects, Noise Mitigation Measures	12.4.3, 12.6.3, 12.6.4
84.	5.7.31 & 32	Construction noise will be predicted using the methodology indicated in BS5228-1:2009+A1:2014 for all the main phases of the construction works, including any cumulative noise associated with simultaneous operation of activities within different phases. The results from these predictions will be assessed against the ABC methodology within Annex E of this Standard and will be based on the prevailing ambient noise levels measured as part of the study.	The potential noise impact during the construction phase has been assessed against the BS5228-1 ABC method.	Noise and Vibration Assessment Criteria for Construction Noise Effects	12.4.3
85.	5.7.37	Using data from any traffic assessment the baseline traffic flows will be used to generate the Basic Noise Level (BNL) from CRTN using total flows, mean speed and %HGVs. Assuming that the road gradients etc. stay the same, the construction traffic BNL will be calculated, and the significance assessment will be made against the short-term impact criteria from DMRB.	The BNL was predicted using noise emission rates in accordance with CRTN calculations using total flows, mean speed and percent HGVs.	Noise and Vibration Assessment of Operational Traffic Noise Effects, Assessment Criteria for Construction Road Traffic Noise	12.4.2, 12.4.4
86.	5.7.44	Predictions of the relative increase in traffic noise levels will be undertaken where data indicates that there will be an increase of 25% or decrease of 20% in existing traffic levels or if there is an increase of more than 1 dB(A) due to HGV traffic increases on the main route(s) to the development. Any increase will be assessed in terms of the criteria given in DMRB using the same assessment methodology that has been described for the construction noise traffic above.	Predictions of the relative increase in traffic noise levels were undertaken where data indicates that there will be an increase of 25% or decrease of 20% in existing traffic levels or if there is an increase of more than 1 dBA due to heavy goods vehicle (HGV) traffic increases on the main route(s) to the development. Any increase was assessed in terms of the criteria given in DMRB based on the magnitude of change for the long-term as the operation	Noise and Vibration Assessment of Operational Traffic Noise Effects	12.4.2

No.	ToR Section	ToR Commitment	How the Commitment was Addressed in the ES	ES Stage Addressed	ES Report Section
			traffic will be a long-term effect		
87.	5.8.2	For the Transport Statement the following guidance will be used: - Cayman Island EIA Regulations: National Conservation Council Directive for Environmental Impact Assessments Section 43, National Conservation Law, Extraordinary No.50/2016, June 2016; and - Terms of Reference and Guidelines for Conduct of TIS in Cayman Islands, Transportation & Planning Unit, National Roads Authority (March 2013).	The following guidance was relied upon in carry out the Traffic and Transport Assessment: – Cayman Island EIA Regulations: National Conservation Council Directive for Environmental Impact Assessments Section 43, National Conservation Law, Extraordinary No.50/2016, June 2016; – Terms of Reference and Guidelines for Conduct of TIS in Cayman Islands, Transportation & Planning Unit, National Roads Authority (March 2013). – 1993 Institute of Environmental Assessments (IEA) publication 'Guidance Notes No. 1: Guidelines for the Environmental Assessment of Road Traffic' (the IEMA guidelines).	Traffic and Transport Applicable Standards and Guidelines	13.3
88.	5.8.4	The access routes to the site will define the proposed study area.	The study area for Traffic and Transport consists of an area stretching from the north end of Seymour Road at the entrance to the Site, south along Seymour Road and encompass the intersection of Seymour Road with North Sound Road. The study area also extends east to the	Traffic and Transport Study Area and Background Information	13.2

No.	ToR Section	ToR Commitment	How the Commitment was Addressed in the ES	ES Stage Addressed	ES Report Section
			intersection of North Sound Road and Dorcy Drive and west to the approach to the 'Bank of Butterfield' (BOB) roundabout, where North Sound Road intersects with the Esterly Tibbetts Highway and Godfrey Nixon Way. The BOB roundabout was modelled to measure its impact on the roads within the study area.		
89.	5.8.7	An extensive baseline data gathering exercise would be preferable to underpin the statement and ideally this data will include the following: – Typical baseline traffic flows, percentage HGV and traffic speed data on links in the area (existing data or new traffic surveys). At this stage, it is assumed that Automatic Traffic Counts (ATCs) will be needed on the following links: – Site Access Road – Seymour Road, leading onto the Dump Road; – Seymour Road – Between the junction with North Sound Road and the site access; and – North Sound Road – Between the junction with Seymour Road and Esterly Tibbetts Highway. – Overview of parking, loading and servicing arrangements at the site; – Local public bus routes, bus stops and service frequencies; – Proposed site traffic generation, staff vehicles, waste loads (light and heavy vehicles) – split across daily operating schedules; – Proposed site construction traffic, number of vehicles, routes of vehicles, types of vehicles and construction staff; – Destination and origins of the trips to and from the site; – Type and size of HGV operating out of the site; – A growth rate to be agreed with the NRA;	**Traffic counts**: Data on the existing traffic flows on the surrounding road network within the study area was gathered by way of a combination of automatic traffic counters[1] and turning movement counts undertaken by APEC staff. Existing traffic data was also provided by the NRA, mainly from a 2017 island-wide traffic count study. **Existing traffic volumes – automatic traffic counters:** Traffic data from automatic traffic counters was collected at seven locations between December 2 and 16 2022. In addition, reference has been made to traffic flow data from 2012 on Seymour Road at the GTLF entrance. **Existing traffic volumes – manual turning movement counts:** Manual turning movement counts were undertaken on three dates.	Traffic and Transport Methodology, Study Area and Background Information Public Transport, Pedestrian/ Bicycle Facilities	13.4.1, 13.2.1, 13.2.2,

[1] PicoCount 2500 counter with pneumatic road tubes

No.	ToR Section	ToR Commitment	How the Commitment was Addressed in the ES	ES Stage Addressed	ES Report Section
		– Local pedestrian and cycling facilities, including public rights of way (PRoW); and – Personal injury accident records on the local highways network.	**Existing traffic volumes – NRA traffic counts:** Existing traffic flow data was received from the NRA[2] for locations in and around the study area. Traffic data from the 2016 turning movement count at Bank of Butterfield roundabout were used to establish peak period traffic flows through the intersection. The data from 2016 were increased in line with NRA established growth rates to provide 'base year', 2022, traffic flows. The classification of vehicles utilizing the roundabout intersection was taken from the data provided by the 2016 count. **Existing/ base year peak hour traffic flow analysis:** Analysis of the existing traffic flows within the study area to establish the current Level of Service (LOS) on the surrounding roads was undertaken. **Operation of existing GTLF facility:** to estimate the volume of vehicles accessing the proposed ISWMS Site, it was necessary to undertake some analysis of the current operation and usage of the GTLF. The automatic traffic count undertaken in December 2022 gathered traffic flow data on Seymour		

[2] Additional traffic data was received from the NRA but was deemed not relevant for this traffic study

No.	ToR Section	ToR Commitment	How the Commitment was Addressed in the ES	ES Stage Addressed	ES Report Section
			Road just south of the existing entrance to the GTLF. **Public transport:** An existing bus service exists within the study area. According to the Public Transport Unit within CIG (CaymanTransport.ky), bus 5A travels along North South Road passing the south end of Seymour Road. The frequency of the bus service is not known. There are no bus stops within the study area, however the bus service in Cayman typically stops upon request of the passengers. **Pedestrian/ bicycle facilities**: There are currently limited pedestrian facilities within the study area. There are isolated sections of sidewalks along both sides of North Sound Road. There is a limited section of sidewalk on one side of Seymour Road at a concrete batching facility. There are no dedicated facilities for bicycles within the study area.		
90.	5.8.9	As a minimum, the following information will be needed: – Tonnages of waste to be processed and the site operating hours; – A site visit; and – Scheme plans.	Details of the proposed ISWMS Site are provided in Chapter 4 and the pertinent details for Traffic and Transportation summarized in Chapter 13.	Traffic and Transportation Impact Assessment and Mitigation Future Conditions	13.6.1
91.	5.8.13	There are 108 official PRoW on Grand Cayman most of which are relate to beach access. Details of these PRoW will be needed as part of the baseline data collection.	An existing bus service exists within the study area. According to the Public	Traffic and Transport Study Area and Background	13.2.1

No.	ToR Section	ToR Commitment	How the Commitment was Addressed in the ES	ES Stage Addressed	ES Report Section
			Transport Unit within CIG (CaymanTransport.ky), bus 5A travels along North South Road passing the south end of Seymour Road. The frequency of the bus service is not known. There are no bus stops within the study area, however the bus service in Cayman typically stops upon request of the passengers.	Information Public Transport	
92.	5.8.21	It is also noted that there will be a degree of background traffic growth because of population growth and car ownership growth on the Island. The NRA will be contacted to discuss: – An agreed growth rate for the assessment – Details of any significant local developments that need to be considered – Any other highway schemes relevant to the study area	The NRA was consulted in the preparation of the Traffic Statement.	Traffic and Transport Purpose of the Chapter	13.1
93.	5.8.22	A discussion with the Cayman Islands NRA and EAB will be required to discuss a range of issues set out in the baseline and future baseline assessment sections above. One area for clarification will be the inclusion or exclusion of the Planned Development Area for Camana Bay and the proposed Cruise Berthing Facility within the baseline conditions, which at this stage should not be considered in the cumulative impact baseline for assessment.	The NRA and EAB were consulted in the preparation of the Traffic Statement Scoping Report subsequent to ToR approval.	Traffic and Transport Purpose of the Chapter, Traffic Statement Scoping Report	13.1, Appendix 13.A
94.	5.8.24	The receptors on these roads will be the land uses adjacent to the carriageway and users of the roads.	Receptors for the Traffic and Transport impact assessment are identified as Local road users, adjacent land uses to the carriageway, and pedestrian and cyclists on Seymour Road (from North Sound Road to the Dump Road) and North Sound Road (between Dorcy Drive and Esterly Tibbetts Highway).	Traffic and Transport Methodology Impact Assessment and Mitigation	13.4.2

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95.	5.8.25	It should be noted however that during the consultation with the NRA the scope of assessment will be discussed, and it may be widened depending on site specific details that the NRA may set out.	The NRA were consulted in the preparation of the Traffic Statement Scoping Report subsequent to ToR approval.	Traffic and Transport Purpose of the Chapter, Traffic Statement Scoping Report	13.1, Appendix 13.A
96.	5.8.26	Table 5.41 sets out the initial locations of receptors. Should further receptors be identified their sensitivity to traffic flow will be determined according to the following examples: – Receptors of high sensitivity to traffic flow include schools, accident clusters and roads without footways/sidewalks that are used by pedestrians. – Receptors with medium sensitivity to traffic flow include congested junctions, shopping areas and roads with narrow footways/sidewalks. – Receptors with low sensitivity include industrial adjacent land uses and places with adequate footway/sidewalk provision.	Additional locations of receptor were not identified in the Traffic Statement Scoping Report.	Traffic and Transport Methodology Impact Assessment and Mitigation, Traffic Statement Scoping Report	13.4.2
97.	5.8.30	The traffic and pedestrian inputs (for both the construction and operational phases of the development) used in the EIA will be informed by the baseline data capture exercise and future traffic flows estimated using a first principals' approach. The magnitude and significance of any environmental traffic and pedestrian effects will be determined and any suitable mitigation identified.	Traffic and pedestrian inputs for construction and operational were informed by the baseline data capture exercise and future traffic flows estimated using a first principals' approach. The magnitude and significance of environmental traffic and pedestrian effects was determined and any suitable mitigation identified.	Traffic and Transportation Impact Analysis	13.6.5
98.	5.8.31	The EIA assessment process will adopt the established methodology as outlined in Guidelines for the Environmental Assessment of Road Traffic (Institute of Environmental Assessment, 1993). The assessment will also be undertaken in consultation with the Proponent and agreement on the following aspects will be sought: – Identification of sensitive areas / affected parties – Forecast traffic levels and characteristics – Time(s) suitable for assessment (e.g. AM peak)	The IEMA guidelines were relied upon for the Traffic and Transport impact assessment. The NRA were consulted in the preparation of the Traffic Statement Scoping Report subsequent to ToR approval.	Traffic and Transport Purpose of the Chapter, Traffic Statement Scoping Report, Applicable Standards and Guidelines	13.1, Appendix 13.A, 13.3

No.	ToR Section	ToR Commitment	How the Commitment was Addressed in the ES	ES Stage Addressed	ES Report Section
		– Year of Assessment (year of construction and year of opening) – Geographical boundaries of the assessment			
99.	5.8.32	The screening process to define the geographical scope of the EIA study will be based upon the established guidance which recommends that detailed environmental impact studies will only be triggered where road links experience a change in traffic greater than 30% for all vehicles (or HGV) or more than 10% where the links pass sensitive areas.	The NRA were consulted in the preparation of the Traffic Statement Scoping Report subsequent to ToR approval.	Traffic and Transport Purpose of the Chapter, Traffic Statement Scoping Report	13.1, Appendix 13.A
100.	5.8.33	Traffic and pedestrian construction and operational impacts to be assessed will include: – Driver severance and delay – at junctions or links subject to traffic flow increases which are either approaching capacity, or are over capacity (or delays resulting from traffic diversions). – Pedestrian severance and delay – at locations where physical obstructions or increases in traffic flows more than 30% are forecast to result in an increase in severance. – Pedestrian amenity / intimidation – at junctions or links subject to substantial increases in traffic flow in conjunction with any changes in footway widths or crossing facilities. The presence of sensitive user groups will also be considered. – Accidents and safety – links and junctions (for which data is available) with existing accident rates more than national averages which may be subject to an increase in traffic flows. – Hazardous and dangerous loads – consideration of estimated number and composition of loads and assessment of accident risk if considered significant.	Traffic and pedestrian construction and operational impacts assessed included: – Driver severance and delay – at junctions or links subject to traffic flow increases which are either approaching capacity, or are over capacity (or delays resulting from traffic diversions). – Pedestrian severance and delay – at locations where physical obstructions or increases in traffic flows more than 30% are forecast to result in an increase in severance. – Pedestrian amenity / intimidation – at junctions or links subject to substantial increases in traffic flow in conjunction with any changes in footway widths or crossing facilities. The presence of sensitive user groups will also be considered.	Traffic and Transport Methodology Impact Assessment and Mitigation, Impact Assessment and Mitigation Impact Analysis	13.4.2, 13.6.5

No.	ToR Section	ToR Commitment	How the Commitment was Addressed in the ES	ES Stage Addressed	ES Report Section
			– Accidents and safety – links and junctions (for which data is available) with existing accident rates more than national averages which may be subject to an increase in traffic flows. – Hazardous and dangerous loads – consideration of estimated number and composition of loads and assessment of accident risk if considered significant.		
101.	5.8.34	The criteria for evaluation will be based on Table 5.41 for the sensitivity of receptors and Table 5.43 for the magnitude of change.	The criteria for evaluation were based on Table 5.41 for the sensitivity of receptors and Table 5.43 for the magnitude of change.	Traffic and Transport Methodology Impact Assessment and Mitigation, Impact Assessment and Mitigation Impact Analysis	13.4.2, 13.6.5
102.	5.8.35 & 5.8.36	Identified adverse effects will be categorised as 'slight', 'moderate' or 'substantial' as appropriate using the matrix presented in Table 5.44; with substantial, moderate/substantial and moderate classed as significant. Any departures from the guidelines will be agreed with the Proponent and will be clearly stated within the Environmental Statement. Mitigation will also be developed in consultation with the Proponent and will adopt the hierarchical principles of prevention, reduction and offsetting if required at all.	Identified adverse effects were categorised as 'slight', 'moderate' or 'substantial' as appropriate using the matrix presented in Table 5.44; with substantial, moderate/ substantial and moderate classed as significant. No departures from the guidelines were made.	Traffic and Transport Methodology Impact Assessment and Mitigation, Impact Assessment and Mitigation Impact Analysis	13.4.2, 13.6.5
103.	5.8.37	The traffic team will supply existing and forecast data and analysis, relating to peak and average flows, Annual Average Daily Traffic (AADT) flows and traffic speeds, to inform other assessments within the EIA such as noise and air quality as required.	The information contained in the Traffic Statement and Traffic and Transport Assessment Chapter was provided to inform other environmental topic assessments.	Noise and Vibration, Air Quality and GHGs Emissions	12.0, 11.0

No.	ToR Section	ToR Commitment	How the Commitment was Addressed in the ES	ES Stage Addressed	ES Report Section
104.	5.9.1	The assessment of socio-economic effects will consider the way in which the proposed development will affect people's way of life, their community, economic activity and culture.	In line with ToR for project, the objectives for the SEIA are to 'consider the way in which the proposed development will affect people's way of life, their community, economic activity and culture'. Specifically, the SEIA: – Describes the existing socio-economic conditions of the study area. – Identifies potential socio-economic benefits and impacts of the development, during construction and operation, and assesses their significance. – Outlines measures that will be undertaken by the proponent to enhance socio-economic benefits and mitigate and/or manage negative socio-economic impacts of the project.	Socio-economics Purpose	14.1
105.	5.9.2	The project will be required to follow the social laws of the Cayman Islands. Key laws relevant to socio-economic issues include: - Labour Law, 2011 Revision; - Tourism Law, 1995 Revision and Tourism Regulations, 2002 Revision; - Workmen's Compensation Law, 1996 Revision.	The legislation, policies and guidelines applicable to and set out in the SEIA include: – Labour Law, 2011 Revision – Workmen's Compensation Law, 1996 Revision – Tourism Law, 1995 Revision and Tourism Regulations, 2002 Revision	Socio-economics Applicable Legislation, Policies and Guidelines	14.3

No.	ToR Section	ToR Commitment	How the Commitment was Addressed in the ES	ES Stage Addressed	ES Report Section
			– Cayman Islands Climate Change Policy 2011 – National Tourism Plan (NTP) 2019-2023 – National Energy Policy (NEP) 2017-2037		
106.	5.9.9	Consultation will be used to obtain further baseline information which will then be used to inform the socio-economic assessment.	Consultation has been used to obtain further baseline information and inform the socio-economic assessment.	Socio-economics Consultation, Stakeholder Consultation	14.3.4, 14.4
107.	5.9.11	Considerations around the effect that the proposed development may have on tourism will also be a significant issue for the socio-economic assessment.	The effect that the proposed development may have on tourism has been assessed in the socio-economic assessment.	Socio-economics Key industries and Employment, Impact Assessment Construction and Operation	14.5.2.3.3, Table 14.15 and 14.16
108.	5.9.12	In summary, the socio-economic assessment will be primarily concerned about the effect on: – Change in the local employment structure and effect on the local employment market – Employment opportunities and displacement – Increased / decreased local expenditure – New and improved facilities – Effects on the ‘quality of life’ enjoyed by the local population	The elements of the SEIA investigation include: – Population: The characteristics, mobility and rate of change of populations, including diversity, community composition and rates of influx. – Employment and economy: The availability and accessibility of employment and business development opportunities, and the existence and role of particular industries. – Health and community wellbeing: The ability of people to maintain their health and a lifestyle that is not detrimental to their wellbeing (e.g., nutrition and diet, physical and	Socio-economics Methodology Scoping	14.3.1

No.	ToR Section	ToR Commitment	How the Commitment was Addressed in the ES	ES Stage Addressed	ES Report Section
			mental health). Also includes the overall wellbeing of a community, including its cohesion and safety, how it functions and people's sense of place. – Services and infrastructure: The quality, availability and accessibility of social services and infrastructure. This may include (but not limited to) health and emergency services, aged and childcare, utilities, roads network and infrastructure, public transport, housing and accommodation, recreational facilities. – Access and connectivity: The ability of people to maintain access to public spaces or private property and/or their ability to conveniently get from one place to another.		
109.	5.9.15 & 16	For socio-economic issues, value is a qualitative judgement. In terms of the employment base, it will take into account whether retained and / or newly created jobs were skilled or unskilled (and/or attracted high or low wages/salaries), temporary or permanent, or whether or not a local workforce will be required. Magnitude is a quantitative assessment and in respect of employment, will take into account the number and type of jobs to be retained and / or created, and how these would relate to the existing employment base.	The Socio-economic chapter has taken into account whether retained and / or newly created jobs are skilled or unskilled (and/or attracted high or low wages/salaries), temporary or permanent, or whether or not a local workforce will be required in addition to the number and type of jobs to be retained and / or created, and how these will relate to	Socio-economics Baseline Conditions, Impact Assessment Construction and Operation	14.5.2.3.2, Table 14.15 and 14.16

No.	ToR Section	ToR Commitment	How the Commitment was Addressed in the ES	ES Stage Addressed	ES Report Section
			the existing employment base		
110.	5.9.17 – 5.9.20	Baseline information will be collected from secondary data sources including but not limited to: local population census data, government planning documents, international financial institutions' statistics, nongovernmental organisations (NGOs) and business reports. Primary data sources will include consultation with key stakeholders, including local community and business representatives and NGOs. Relevant socio-economic indicator data will be gathered including information on income sources and livelihoods, and access to employment and business opportunities, as well as social services such as education and health. This information will be used to consider potential direct, indirect and cumulative impacts of the proposed ISWMS. It will assess potential impacts due to construction, operation and maintenance of the various facilities including adverse impacts and economic benefits; employment for communities, skills training and tourism activities. Based upon existing data obtained through appropriate agencies and institutions, the EIA will evaluate the implications of the ISWMS facilities on factors such as public services, tourism activities, educational institutions and housing. The ES will clearly identify the potential effects of the proposed facilities on existing socio-economic conditions in terms of population dynamics, infrastructure, economic and business status/opportunities, tourism and recreation both for the short and long term. The potential effects will be assessed based on their nature (beneficial/adverse), their temporal extent (short or long term) and their spatial context (local/national).	Baseline information has been collected from secondary data sources as well as primary sources via stakeholder interviews. This information has been used to consider potential direct and indirect impacts of the proposed ISWMS. Cumulative effects will be addressed in Chapter 15 (Cumulative Effects). The ES has clearly identified the potential effects of the proposed facilities on existing socio-economic conditions in terms of population dynamics, infrastructure, economic and business status/ opportunities, tourism and recreation both for the short and long term. The potential effects have been assessed based on their nature (beneficial/adverse), their temporal extent (short or long term) and their spatial context (local/national), and significance has been determined using clearly defined qualitative criteria considering receptor sensitivity and magnitude of impacts.	Socio-economics Methodology, Stakeholder Consultation, Baseline Conditions, Impact Assessment Construction and Operation	14.3, 14.4, 14.5, Table 14.15 and 14.16

GHD

Appendix 5.A

Summary of Comments Received and Responses (To Be Updated for Final Environmental Statement)

Appendix 6.A

Marine Ecology Report

Contents

Table index

Figure index

Appendices

Glossary

BMP	Best Management Practices
BWMC	Ballast Water Management Convention
CIG	Cayman Islands Government
DoE	Department of Environment, Cayman Islands
EAB	Environmental Assessment Board
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan

ERF	Energy Recovery Facility
ES	Environmental Statement
GTLF	George Town Landfill
IMO	International Maritime Organization
km	kilometres
m	metres
mm	millimetres
NBAP	National Biodiversity Action Plan
ISWMS	Integrated Solid Waste Management System
NCL	National Conservation Law
NCMPR	National Conservation (Marine Parks) Regulation
TOR	Terms of Reference

1. Introduction

1.1 Purpose of this report

GHD Limited (GHD) was retained by ReGen and the Cayman Islands Government (CIG) as approved by the Environmental Assessment Board (EAB) to determine the existing conditions of the marine environment in the vicinity of the proposed Integrated Solid Waste Management System (ISWMS) Site. GHD's ecologists have completed background information reviews to characterize the associated marine environment, with a focus on marine and coastal habitats, wildlife, protected species, and significant natural areas. The purpose of this report is to document:

- Environmental policy potentially applicable to proposed works
- Methodology for the background review
- Existing marine environmental conditions
- Impact of the proposed project
- Monitoring measures

Existing conditions are based on the time of EAB acceptance of the ISWMS Environmental Impact Assessment Terms of Reference (TOR) in September 2021 (Wood 2021).

1.2 Overview of the proposed development

The proposed Site for the ISWMS is located to the north of central George Town towards the western coast of Grand Cayman, immediately south-west of the existing George Town Landfill (GTLF; Figure 1).

The proposed ISWMS development consists of various new waste management facilities. The various components of the ISWMS subject to assessment in this *Marine Environment Assessment – Existing Conditions Report* are as follows:

- Energy Recovery Facility (ERF)
- Importation of waste via vessel between the Sister Islands (Cayman Brac and Little Cayman) and the port at Grand Cayman

The design life of the new facilities is 25 years.

1.3 Study area

A Study Area was developed as part of the Terms of Reference (ToR) to determine if any nationally designated sites, significant natural areas, habitats, or protected species could occur within or near the proposed ISWMS Site. This Marine Ecology Study Area included the North Sound as well as wider coastal waters from the mean high-water mark on Grand Cayman out to 12 nautical miles (22.2 kilometres (km)) (Figure 1).

1.4 Limitations

It should be noted that this assessment of existing conditions was based on secondary source material and research. Mapping of the identified seagrass beds, mangroves, and other marine and coastal habitat would be beneficial to have for this assessment; however, secondary source information was deemed sufficient due to there being no direct discharge to the marine environment as part of the proposed development.

2. Applicable standards and guidelines

This Section identifies Territory and other regulatory legislation and policies that are applicable and relevant to the Study Area and the immediate vicinity. This includes policies that triggered the study. These documents may identify natural features, protected species, and other habitat, as well as other features relevant to this Study Area.

2.1 Cayman Island National Trust Act

The *Cayman Island National Trust Act (2010 revision)* establishes the National Trust for the Cayman Islands as a body corporate. The National Trust shall manage and conserve natural and cultural beauty and wealth of Cayman Islands including submarine areas.

The purpose of the National Trust is:

– the preservation of the historic, natural, and maritime heritage of the Islands through the preservation of areas, sites, buildings, structures, and objects of historic or cultural significance,
– the conservation of lands, natural features, and submarine areas of beauty, historic or environmental importance which the Trust may have acquired through gift, bequest, purchase, lease, or other means, and
– the protection of native flora and fauna.

2.2 Cayman Islands (Territorial Sea) Order

This 1989 Order extends the boundaries of the Colony of the Cayman Islands so as to include, as territorial sea, the sea within 12 nautical miles (22.2 kilometres) of the baselines of the Cayman Islands, together with its seabed and subsoil, and makes other provisions in this connection. This includes the coast of all islands comprised in the territory. In particular, the Order defines the baseline from which the breadth of the territorial sea is measured as generally the low-water line, except where there are fringing reefs or bays.

2.3 National Conservation Law

The National Conservation Law (NCL; 2013) makes provision for the conservation of wildlife and the environment in the Cayman Islands and provides for enforcement and penalties. The NCL came into effect on 26 April 2020, which lists protected species under Part 1 or Part 2 of Schedule I. Species listed under Part 1 are protected at all times, while those listed under Part 2 may be hunted or collected in accordance with regulations or a conservation plan (if any). The Department of Environment (DoE) is the lead body for legal protection of listed species.

The purpose of the NCL is to:

– Promote and secure biological diversity and the sustainable use of natural resources in the Cayman Islands,
– To protect and conserve endangered, threatened, and endemic wildlife and their habitats,
– To provide for protected terrestrial, wetland, and marine areas,
– To give effect to the provisions of the protocol concerning specially protected areas and wildlife to the convention for the protection and development of the marine environment of the wider Caribbean region,
– To give effect to related provisions of the *Convention on Wetlands of International Importance especially as Waterfowl Habitat*, the *Convention on the Conservation of Migratory Species of Wild Animals*, the *Global Convention on Biological Diversity* and the *United Nations Framework Convention on Climate Change*, and
– To repeal the Marine Conservation Law (2013 revision); and for incidental and connected purposes.

All of the mangrove species covered by the Special Conservation Plan for Mangroves are protected under Part 2 of Schedule 1 of the NCL. Mangrove loss has been extensive in recent decades. In 2008, the IUCN (International Union for Conservation of Nature and Natural Resources) Red List listed black mangrove as endangered, white mangrove and buttonwood as vulnerable and red mangrove as near-threatened. The Development and Planning Act[1] allows for some protection and preservation of mangrove habitat through buffers. Section 26 of the Development and Planning Act provides guidance to maintain mangrove buffers.

2.4 National Conservation (Marine Parks) Regulations

The National Conservation (Marine Parks) Regulations (NCMPR; 2021 Revision) was gazetted on March 12, 2021. It defines regulations specific in determining restrictions on specified areas and designates marine protected as:

– Schedule 1 - Marine Reserve Zone: which prohibits the removal of any specimen and the anchoring of any vessel unless the requirements under Section 5(2) and 5(3) can be met,
– Schedule 2 - Environmental Zone: in which prohibited activities include the removal of any form of marine life, the use of anchors, entry into the water and exceeding a speed of five knots,
– Schedule 3 - Wildlife Interaction Zone: in which engagement of wildlife interaction in accordance with any orders, guidance notes or directives issued by the Council is allowed but the anchoring of vessels is forbidden, except in certain circumstances,
– Schedule 4 - Line Fishing Zone: in which the removal of fry and sprat are permitted but anchoring is forbidden, except in certain circumstances,
– Schedule 5 - Shoreline Fishing Zone: in which the removal of certain species of fish are permitted,
– Schedule 6 - No-Diving Overlay Zone: in which scuba diving is not permitted unless authorized by the Council to do so or under other circumstances listed in the regulation, and
– Schedule 7 - Spawning Aggregation Overlay Zone: in which the removal of any specimen, anchoring of vehicles and entering the water is prohibited during the period beginning 1st December and ending 30th April.

2.5 Wastewater Collection and Treatment Law

The Wastewater Collection and Treatment Law (*2019 Revision*) was amended in conjunction with the establishment of the Utility Regulation and Competition Office (OfReg). The OfReg was established to accept the licensing responsibilities of the Water Authority, and for incidental and connected purposes.

2.6 Water Authority Act

If the discharge of cooling water into the marine environment is required a permit under the *Water Authority Act (2022 Revision)* will need to be obtained. At this point in time no direct discharge of cooling water into the marine environment will occur.

2.7 International agreements

Cayman Islands are included in the United Kingdom's (UK) ratification of the following international agreements relevant to the marine environment and the proposed development:

Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention)
The mission of the Ramsar Convention is the wise use of all wetlands through local and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world. There is no hunting, no collecting of any species, and no littering permitted within Ramsar sites.

Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (Cartagena Convention) – Protocol on Specially Protected Areas and Wildlife

Regional legal agreement for the protection of the Caribbean Sea and supported by three technical agreements on Oil Spills, Specially Protected Areas and Wildlife (SPAW) and Land Based Sources of Marine Pollution (LBS).

Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)
Provides a global platform for the conservation and sustainable use of migratory animals and their habitats.

Convention on Biological Diversity (CBD)
This convention was set in place to provide direction to achieve goals to enhance global diversity, conserve nature and that benefits from genetic diversity are shared fairly with the population.

2.8 Chartered Institute of Ecology and Environmental Management

The Chartered Institute of Ecology and Environmental Management (CIEEM) is a registered charity based in the United Kingdom (UK) that established a set of guidelines for Ecological Impact Assessment (EcIS) in the UK and Ireland. These guidelines promote good practices when conducting EcIS relating to terrestrial, freshwater, and coastal marine environments in the UK and Ireland[2]. These guidelines were relied upon to advise the preparation of the Environmental Statement (ES). As stated in the guidelines, where an ES is required the EcIS will be presented in a way that fits the overall structure and style of the ES while utilizing best practices within the CIEEM guidelines.

The CIEEM is also a resource to obtain an ecologist or environmental manager during project construction and operation. The members and practitioners of CIEEM are professionally trained individuals who manage, protect, and improve the natural environment. While the CIEEM was recommended in the ToR it is currently limited to the UK and Europe. Therefore, the ISWMS Site will implement the oversight of ecologists or experienced environmental managers to ensure best practices are utilized on Site to maintain the integrity of the environment.

2.9 International Convention for the Control and Management of Ships' Ballast Water and Sediments

The Ballast Water Management Convention (BWMC) is the only convention which is directly aimed at reducing the transfer of invasive species into marine environments. The BWMC seeks to prevent, minimise, and ultimately eliminate the transfer of invasive species via shipping, through the control and management of ships' ballast water and sediments.

The BWMC came into force September 2017 and has been ratified by 60 countries (representing more than 70% of world merchant shipping tonnage), including the UK (and therefore the Cayman Islands). Amendments were made in 2019 and a Ballast Water Management System (BWMS) code which supersedes the 2016 guidelines was adopted in October 2019. The BWMC is regularly revised by the International Maritime Organization (IMO) and committee states and further amendments may occur.

2.9.1 The Guidelines for the control and management of ships' ballast to minimise the transfer of aquatic species

To facilitate the global and uniform implementation of the BWMC, guidelines have been developed to address the potential risks of ballast water release (BWMS 2004) which are intended to be read in conjunction with the BWMC. As previously mentioned, much of the BWMC relates to the responsibilities of ship operators however administrations of member states are responsible for certifying that vessels are compliant. Additionally, ports and marinas in member states can support appropriate ballast water management by providing ballast water treatment facilities.

– Resolution MEPC.300(72) *Code for Approval of Ballast Water Management Systems.*

Provides guidance to administrations, or their designated bodies, in order to assess whether BWMS meet the standard set out in regulation D-2 of the BWMC. The resolution describes technical requirements which a BWMS must meet to obtain approval and minimum operational and environmental safety. Section 5 also outlines approval requirements, which are to be used by administrators to certify BWMS and testing procedures which are the responsibility of signatory states or an authorised delegate.

– Resolution MEPC.152(55) *Guidelines for Sediment Reception facilities.*

Provides guidance on considerations when designing and operating sediment reception facilities such as site selection, management of sediment, testing of sediment, volume of sediments that the facility can handle, human health and staff training. Relevant to port and marina operation within countries which are signatories to the BWMC.

– Resolution MEPC.173(58) *Guidelines for Ballast Water Sampling*

The objectives of these Guidelines are to provide administrations with practical and technical guidance on ballast water sampling and analysis for the purpose of determining whether the ship complies with the BWMC according to article 9 "Inspection of Ships".

– Resolution MEPC.123(53) *Guidelines for Ballast Water Management Equivalent Compliance.*

These Guidelines apply to pleasure craft used solely for recreation or competition or craft used primarily for search and rescue less than 50 metres in overall length and with a maximum ballast water capacity of eight cubic metres. Administrators should take the guidelines into account when determining if a craft is compliant with Regulation A-5 of the BWMC.

– Resolution MEPC.127(53) Guidelines for Ballast Water Management and Development of Ballast Water Management Plans.

These Guidelines apply to pleasure craft used solely for recreation or competition or craft used primarily for search and rescue less than 50 metres in overall length and with a maximum ballast water capacity of eight cubic metres. Administrators should take the guidelines into account when determining if a craft is compliant with Regulation A-5 of the BWMC.

– Resolution MEPC.153(55) Guidelines for Ballast Water Reception Facilities.

These guidelines apply to ballast water reception facilities referred to in the Regulation B-3.6. of the BWMC and provide guidance on the provision of amenities. These guidelines do not apply to reception facilities for sediment referred to in Article 5 and Regulation B-5 of the BWMC. Administrators should take these guidelines into account when the disposal of ballast water at these reception facilities does not create a risk to the environment, human health, property and resources.

– Resolution MEPC.288(71) 2017 Guidelines for Ballast Water Exchange (G6)

These guidelines set out the obligations for vessel operators regarding the management of ballast water and ballast tank sediments when operating within Parties' territorial seas. These apply to all vessels operating internationally and domestically and administrators must carry a valid management plan.

– Resolution MEPC.289(71) 2017 Guidelines for Risk Assessment under Regulation A-4 of the BWM Convention (2004).

These guidelines apply to Parties granting exemptions to ships under regulation A-4 of the BWMC. Shipowners or operators wanting to seek an exemption under regulation A-4 should also consult these guidelines. The purpose of these guidelines is to assist Parties to ensure that the provisions of the regulation A-4 of the BWMC are applied in a consistent manner and based on scientifically robust risk assessment.

– Resolution MEPC.174(78) 2016 Guidelines for Approval of Ballast Water Management Systems

These guidelines are aimed primarily at Administrations or their designated bodies in order to assess whether ballast water management systems meet the standard as set out in regulation D-2 of the BWMC. These guidelines apply to the approval of ballast water management systems in accordance with the BWMC. They also apply to management systems intended for installation on board all ships that are required to comply with regulation D-2.

– Resolution MEPC.169(57) Procedure for Approval of Ballast Water Management Systems that make use of Active Substances.

This procedure explains the approval and withdrawal of approval of BWMS that make use of Active Substances to comply with the BWMC as set out in Regulation D-3. Administrators should comply with this procedure to ensure proper application of the provision contained in the BWMC and the safeguards required by it.

– Resolution MEPC.161(56) Guidelines for Additional Measures regarding Ballast Water Management including Emergency Situations.

These guidelines have been developed pursuant to regulation C-1 of the BWMC and provide guidance under for a party or parties to use when determining if measures are necessary to prevent, reduce or eliminate the transfer of harmful aquatic organism and pathogens through ballast water and sediments. Administrators should apply these guidelines when transferring ships' ballast water and sediments.

– Resolution MEPC.151(55) Guidelines on Designation of areas for Ballast Water Exchange.

These guidelines are intended for considering and intending to design areas for ballast water exchange in accordance with Regulation B-4.2 of the BWMC. Administrators should apply these guidelines to promote uniform applications that minimize the risk of introduction of invasive species within designated ballast water areas.

– Resolution MEPC.83(44) Guidelines for ensuring the adequacy of Port Waste Reception Facilities.

These guidelines are designed to address Member Governments, port States and port authorities for their activities aimed at provision of adequate port Waste reception facilities required under the provisions of MARPOL 73/78. Administrators of all types and sizes of ships, including sail boats should apply these guidelines in order to tackle the problems associated with the illegal discharge of ship-generated wastes. These guidelines indicate that all State Parties are obligated to prevent illegal discharge of ship-generated wastes from all types and sizes of ships, including sailboats. The guideline is intended to assist States in planning and providing adequate port waste reception facilities and encourage States to develop environmentally appropriate methods of disposing of ship's waste ashore.

2.10 United Nations Convention on the Law of the Sea (UNCLOS 1982)

The International Convention for the Prevention of Pollution from Ships (1973) is the main international convention covering prevention of pollution of the marine environment by ships from operational or accidental causes. It is a combination of two treaties adopted in 1973 and 1978 respectively and is referred to as MARPOL 73/78. This convention is an international agreement on the law of the sea. While this international agreement has a broad scope which is concerned with the law and order of the world's oceans, two articles within the convention are applicable to the prevention of invasive species being introduced into novel marine habitats. These are:

– **Article 196 Use of technologies or introduction of alien or new species**. "States (parties to the UNCLOS) shall take all measures necessary to prevent, reduce and control pollution of the marine environment resulting from the use of technologies under their jurisdiction or control, or the intentional or accidental introduction of species, alien or new, to a particular part of the marine environment, which may cause significant and harmful changes thereto."

– **Article 205 Publication of reports** "States shall publish reports of the results obtained pursuant to article 204 or provide such reports at appropriate intervals to the competent international organizations, which should make them available to all States. When States have reasonable grounds for believing that planned activities under their jurisdiction or control may cause substantial pollution of or significant and harmful changes to the marine environment, they shall, as far as practicable, assess the potential effects of such activities on the marine environment and shall communicate reports of the results of such assessments in the manner provided in article 205."

In summary, these articles state that signatory parties must not allow invasive species to be transported to novel marine environments, either by allowing invasive species to be introduced into state marine environments or to cause species with the potential to be invasive to be introduced to waters outside state control. This places responsibility of managing invasive species incursions on signatory parties and applies globally. The UK (and therefore the Cayman Islands) is a signatory to this convention.

3. Methodology

Available secondary sources of information were collected and reviewed to characterize the marine environment existing conditions within the Study Area. The following sources of secondary information were reviewed:

– Cayman Islands Department of Environment (DoE)
  - National Biodiversity Action Plan (NBAP; DaCosta-Cottam et al. 2009)
  - National Conservation Law (2013) – Part 1 & 2, Schedule 1
  - National Conservation (Marine Parks) Regulations (2021 Revision)
  - Species Conservation Plan for Mangroves National Conservation Law, section 17
– Google Earth - web-based aerial imagery (select availability representing 2004 – 2023)
– UK Overseas Territories and Crown Dependencies- 2011 Biodiversity Snapshot
– Cayman Island National Trust - 2018-2019 Annual Report
– iNaturalist - plant and animal observations in vicinity of Study Area

Relevant information has been considered herein regarding project impacts on hydrology (Chapter 8 – Hydrology and Hydrogeology).

To present the baseline conditions of the marine environment a Study Area of the North Sound as well as wider coastal waters, from mean high-water mark on Grand Cayman out to 12 nautical miles (22.2 kilometres), was established (Figure 1).

3.1 Consultation

To establish a comprehensive baseline condition of the Study Area's marine environment, the DoE, the National Trust for the Cayman Islands, the Central Caribbean Marine Institute, and Shark Conservation Cayman were contacted for records of protected species, species habitat mapping and additional natural features information including designated areas within the Study Area.

3.1.1 Feature value at a project scale

Marine ecological features (i.e., habitats, protected species) within the Study Area that could be affected by the development are assigned a value at a project scale in accordance with the ToR. These values are assigned based on the conservation status or the species or habitat and their ecological importance as outlined in Table 1 (adapted from Table 5.1 of the ToR). Where numerous species of wildlife are discussed (e.g., marine mammals, marine reptiles) the highest value across the species is assigned to the group.

Table 1 Importance of the proposed ISWMS development for marine ecological features

Geographic context of importance	Value	Description
International	I-1	Sites of international importance (e.g., Ramsar Conservation Wetland of International importance)
	I-2	Internationally endangered species (e.g., Species under the Endangered Species Act, Marine Mammal Protection Act, International Union for Conservation of Nature's Red List of Threatened Species (IUCN Red List))
National	N-1	A nationally designated site including marine parks, environmental zones, and replenishment zones
	N-2	Species protected under Schedule 1 Part 1 and 2 of the NCL
	N-3	Species and habitats listed in the NBAP
Local	L-1	Protected species that based on their extent, population size, quality, etc. are determined to be at a lesser level of importance than the geographic contexts above
	L-2	Common and widespread semi-natural habitats occurring within the Study Area in proportions greater than may be expected in the local context
	L-3	Common and widespread native species occurring within the Study Area in numbers greater than may be expected in the local context
Negligible	Ne-1	Common and widespread semi-natural habitats and species that do not occur in levels elevated above those of the surrounding area
	Ne-2	Areas of heavily modified or managed land uses (e.g., hard standing used for car parking, as roads, etc.)

4. Baseline conditions

4.1 Existing environment

The three Cayman Islands are flat, low-lying limestone islands with extensive offshore reef systems and mostly surrounded by fringing reefs and mangroves enclosing shallow, sand and seagrass filled lagoons. Associated with these habitats is a high diversity of marine species, including several molluscs and crustaceans providing commercially significant species. Baseline studies of the oceanography and biology of the shallow marine environments of Grand Cayman have been carried out by the Cayman Island Government's DoE.

4.1.1 Consultation results

The DoE was consulted on November 18, 2022, with response received on November 29, 2022. Marine habitat mapping within a 1.2 mile (2 kilometre) radius of the Site was shared and incorporated into the baseline conditions.

Shark Conservation Cayman was contacted on April 27, 2023, with a response received on May 11, 2023. Species information has been incorporated into the baseline conditions.

The National Trust for the Cayman Islands and the Central Caribbean Marine Institute were contacted on November 23, 2022, and on April 27, 2023. No responses have been received to date.

There are no anticipated impacts to the marine environment as part of the proposed development. As such, it was determined that marine surveys were not warranted in order to carry out the Marine Ecology impact assessment. Therefore, there was no further need for consultation with the EAB to scope out further surveys.

Agency correspondence is presented in **Appendix A.**

4.1.2 Zone of influence

The Zone of Influence (ZoI), as defined in the ToR, is likely to comprise the receiving waters, and contained marine habitat and species, of the North Sound in addition to the marine transportation routes between the Islands. As marine transportation between the islands is already occurring regularly, activities associated with the proposed development are not anticipated to lead to environmental change.

4.2 Designated / policy areas

Two proposed Ramsar sites (Central Mangrove Wetland and Barkers Wetland) have been identified within the marine ecology Study Area (Figure 2), these sites are discussed in Section 4.3 **ISWMS for the Cayman Islands – Terrestrial Ecology Assessment Report** (GHD 2023) in accordance with the ToR.

The Cayman Islands has a network of marine protected areas as shown in Figure 3 for Grand Cayman, with the following zones occurring within a 3.1 mile (5 kilometre) radius of the Site:

– Marine Reserve Zones: George Town and Seven Mile Beach are approximately 0.9 miles (1.5 kilometres) west of the Site. South Sound West and South Sound East are approximately 3 miles (5 kilometres) south of the Site
– Line Fishing Zone: Jackson Point is approximately 2.7 miles (4.5 kilometres) south of the Site
– Shore Line Fishing Zone: George Town approximately 0.6 miles (1 kilometres) west of the Site
– No-Diving Overlay Zone: South Sound is approximately 3 miles (5 kilometres) south of the Site
– Spawning Aggregation Overlay Zone: Southwest zone is approximately 3 miles (5 kilometres) southwest of the Site off the shore of South Sound Beach

Marine protected environments have the potential to be affected. The Marine habitats listed above are assigned a value at a project scale for direct discharge as a N-1 due to these sites being a nationally designated protected site.

4.3 Marine and coastal habitats

The DoE provided marine habitat mapping within a 1.2 mile (2 kilometres) radius of the Site with the following habitats delineated in Figure 3. The habitat descriptions were obtained from Alan et al. (2007), Shinn (2011), Allen Coral Atlas (2013), Cooper (2012), and Swanson et al. (2018) delineated in Figure 3:

– Shelf benthic classification:
  - Aggregated patch reef: coral formations that are isolated from other coral reef formations by sand or other habitats and that have no organized structural axis relative to the shore or shelf edge.
  - Beach rock: formations on shorelines of carbonate-cemented sandstone. It can form rapidly and occurs on tropical and warm temperate beaches.
  - Colonized hardbottom: hard bottom habitats that are more than 10% live coral cover.
  - Rubble: cylindrical or irregular shaped loose fragments of bedrock, or coral, bivalves, and coralline algae. Often occurring landward from well developed reef environments.
  - Sand: soft bottom reef areas that are dominated by fine sediments (finer than rubble larger particles than mud).
  - Spur and groove: a structure of a coral reef that consists of alternating elongated channels (grooves) and ridges (spurs). More developed on the windward side of coral reefs. Grooves often consist of coral rubble or carbonate sand. The spur features are covered with living corals.
  - Uncolonized hardbottom: exposed hard bottom area without visible coral structures. Occurring in areas of high energy. Having less than 10% live coral cover.
– Lagoon benthic classification:
  - Hardbottom: hard habitats that lack coral diversity and reef development.

- Seagrass beds: soft bottomed habitat that is dominated by sea grass species. Occurring in shallow lagoon habitats and back reef slopes.
- Silt: soft bottomed habitat that occur in shallow calm environments, dominated by fine particles.
- Vegetated sand: soft bottomed habitat occurring where the bottom is dominated by vegetation other than sea grass species.

A detailed habitat assessment of the Cayman Islands was conducted as part of the NBAP (DaCosta-Cottam et al. 2009). Marine habitats were divided into the open sea, coral reef, lagoons, seagrass beds, dredged seabeds, and artificial installations. Coastal habitats were classified according to vegetation, and were divided into maritime cliffs, sandy beach and cobble, mangroves, invasive coastal plants and coastal shrubland. The proposed development on Grand Cayman is located within 750 metres (m) of the North Sound which in this location comprises fringing red mangroves (*Rhyzophora mangle*), which in parts are within the Mangrove Buffer Zone, and seagrass beds. Coral reefs have been scoped out of this assessment as they are located to the west of the development approximately 1.2 km away with no pathway to effects through drainage.

Marine environments have the potential to be affected by two elements: direct discharge into the marine environment and intersecting with shipping routes. The Marine habitats listed above are assigned a value at a project scale for direct discharge as a N-3. Additionally, the intersection of the shipping route to the Port of George Town with mapped spur and groove, sand, and hardbottom habitat leads to the marine habitats being assigned a value of N-3 at a project scale due to these habitats being listed in the NBAP.

4.3.1 Seagrass beds

Seagrass beds (dominated by turtle grass [*Thalassia testudinum*]) develop in shallow subtidal areas on sand and mud. Seagrasses are flowering plants that reproduce by setting seed and gain nutrients by photosynthesising light from the water column and through absorbing nutrients through their roots and vascular tissue (DaCosta-Cottam et al. 2009). Along with coral reefs and mangroves, seagrass beds are one of the three major coastal interface communities. They are highly productive habitats and provide a nursery for the larval and juvenile stages of many marine species.

Seagrasses are highly sensitive to changes in water quality, including clarity and salinity. Since the late 1960s, local seagrass beds have been severely impacted by extensive dredging of shallow lagoons to facilitate access, and dredging for fill, using (often unscreened) cutter-head hydraulic and mechanical dredges. In 2001, the DoE resurveyed the original 1976 Wickstead Report sites and found local seagrass beds to be significantly impacted by dredging activity, both directly, through the removal of substrate and physical modification of the environment, and indirectly, through the introduction of particulate matter into the water column (DaCosta-Cottam et al. 2009).

Seagrass beds within the off-site Study Area are mapped on **Figure 3.** Seagrass beds are assigned a value of N-2 at a project scale due to seagrass beds being protected under Schedule 1 Part 2 of the NCL.

4.3.2 Mangroves

"Mangrove" habitats are a generic term describing the plant assemblages that inhabit saline coastal habitats. These habitats are also named for the dominant species associated with this habitat. In the Cayman Islands, there are four mangrove species: black mangrove (*Avicennia germinans*), white mangrove (*Laguncularia racemosa*), red mangrove, and buttonwood (*Conocarpus erectus*). All species are protected (further discussed in **Section 4.4**) and have a tolerance for wet, salty conditions. Red mangrove is a pioneering species typically comprising the seaward fringe of a mangrove forest, while buttonwood is typically found in the driest, least-saline environments of all mangroves[3].

Coastal mangroves within the off-Site Study Area are mapped on **Figure 2** and **3**. Coastal mangroves are assigned a value of N-2 at a project scale due to species being protected under Schedule 1 Part 1 of the NCL.

4.4 Wildlife

4.4.1 Marine mammals

Marine mammal species occurring within the Cayman Islands are often found offshore, rarely coming close to shore (DoE 2021). Exceptions may include species of beaked whales whose local range may be restricted to deep foraging water such as the Cayman Trench. Marine mammal sighting schemes in the Cayman Islands have led to the reporting of the presence of a number of marine mammals, for example the bottlenose dolphin (*Tursiops truncates*) and spotted dolphin (*Stenella frontalis*). According to the Volunteer Observer Sighting Scheme, two small species of whale, short-finned pilot (*Globicephala macrorhynchus*) and beaked whales (*Mesoplodon* spp.), are more regularly seen further offshore, around various submarine banks (Wood 2021). Further the sperm whale (*Physeter catadon*), Blainville's beaked whale (*Mesoplodon densirostris*), and killer whale (*Orcinus orca*) have been recorded and it is probable that other marine mammal species, such as American manatees (*Trichechus manatus*), occur in Cayman waters (DaCosta-Cottam et al. 2009).

Marine mammals as a group are assigned a value of I-2 at a project scale due to all species being internationally protected under the United States (US) *Marine Mammal Protection Act* (MMPA). Sperm and killer whales are listed as endangered under the US *Endangered Species Act*[4] (ESA). All marine mammal species are protected under Schedule 1 Part 1 of the NCL.

4.4.2 Marine reptiles

Four sea turtle species have been reported to occur in the waters of the Cayman Islands, namely the green turtle (*Chelonia mydas*), loggerhead (*Caretta caretta*), leatherback (*Dermochelys coriacea*), and hawksbill sea turtle (*Eretmochelys imbricata*). Although leatherback turtles are primarily oceanic, most hard-shell marine turtles recruit to nearshore feeding grounds such as seagrass beds and coral reefs. The Cayman Islands once supported extensive green turtle nesting grounds, and abundant loggerhead and hawksbill turtle nesting grounds. By the early 20th century nesting grounds of all three species were considered extinct due to massive exploitation. However, surveys conducted in the early 2000's found critically low levels of nesting by green and loggerhead turtles In recent years there has been an increase in the number of nests found on the islands. Between 2014 and 2018 there has been 217 green nests, 237 loggerhead nests, and 8 hawksbill nest documents annually (DoE. 2019).

Two species of crocodiles are native to the Cayman Islands: the American crocodile (*Crocodylus acutus*) and the Cuban crocodile (*Crocodylus rhombifer*). Both species were extirpated in historic times, however, individuals occasionally visit the islands, likely swimming from Cuba or Jamaica (DoE 2021).

Marine reptiles as a group are assigned a value of I-2 at a project scale due to all species being internationally listed as either endangered or threatened under the ESA, listed as critically endangered, endangered, or vulnerable on the IUCN Red List, and being protected under Schedule 1 Part 1 of the NCL.

4.4.3 Sharks

Sharks represent keystone species in the marine environment and are often observed in the waters of the Cayman Islands as a result of its deep and shallow water environments. Pelagic species include tiger shark (*Galeocerdo cuvier*), great hammerhead shark (*Sphyrna mokarran*), oceanic white tip shark (*Carcharhinus longimanus*), and silky shark (*Carcharhinus falciformis*). In addition, some shark species reside in Cayman all year round and inhabit coastal waters, these include the nurse shark (*Ginglymostoma cirratum*), lemon shark (*Negaprion brevirostris*), Caribbean reef shark (*Carcharhinus per*ezi), and blacktip shark (*Carcharhinus limbatus*) (DoE 2021).

Surveys conducted by Shark Conservation Cayman recorded seven species occurring within the upper 30 m of near coastal waters: Caribbean reef shark, nurse shark, lemon shark, blacktip shark, great hammerhead, scalloped hammerhead (*Sphyrna lewini*), and tiger shark (United States Fish and Wildlife Service 2023).

Sharks as a group are assigned a value of I-2 at a project scale due to several species being listed as critically endangered (great hammerhead, oceanic white tip, scalloped hammerhead) or endangered (Caribbean reef) on the IUCN Red List. Scalloped hammerheads are listed as threatened under the US ESA, and all shark species are protected under Schedule 1 Part 1 of the NCL.

4.4.4 Nassau grouper

The Cayman Islands is home to a number of Nassau grouper (*Epinephelus striatus*) spawning sites. Two of these sites are within Grand Cayman waters: one off the eastern side of the island, and a second off the southwestern point. All Nassau grouper spawning sites are protected under the NCL as Spawning Aggregation Overlay Zones (**Figure 2**).

Nassau grouper are assigned a value of I-2 at a project scale due to being listed as critically endangered under the IUCN Red List, protected under the US ESA, and protected under Schedule 1 Part 1 of the NCL.

4.5 Protected species

According to the NBAP (DaCosta-Cottam et al. 2009), numerous protected species have been reported to use the seagrass bed and mangrove habitats of the Study Area (**Table 2**). Species listed under Part 1 of the NCL (Schedule I) are protected at all times, while those listed under Part 2 may be hunted or collected in accordance with regulations or a conservation plan (if any). All species listed in **Table 2**, excluding those previously discussed in **Section 4.4** are assigned a value of N-2 at a project scale due to being protected under Schedule 1 Part 1 or 2 of the NCL.

Bats and birds are included in **Table 2** as mangroves provide suitable habitat for their life processes. They are discussed further in ISWMS for the Cayman Islands – Terrestrial Ecology Assessment report (GHD 2023).

Table 2 Protected species associated with the seagrass bed and mangrove habitats of the Study Area

Species	Habitat use within Study Area[1]	Legal protection under Schedule I of the National Conservation Law (2013)
Birds		
All birds (Aves all species)*	Mangroves	All birds are protected under Part 1 of the NCL, except those listed in Part 2
Mammals		
Bats (Chiroptera all species)*^	Mangroves	Protected under Part 1 of the NCL
Manatees (Sirenia all species)*	Seagrass beds	Protected under Part 1 of the NCL
Whales and dolphins (Cetacea all species)	Seagrass beds	Protected under Part 1 of the NCL
Reptiles		
Turtles: Green (*Chelonia mydas*)*^, Loggerhead (*Caretta caretta*)^, Leatherback (*Dermochelys coriacea*)^, Hawksbill (*Eretmochelys imbricata*)^	Seagrass beds, mangroves	Protected under Part 1 of the NCL
American crocodile (*Crocodylus acutus*)* Cuban crocodile (*Crocodylus rhombifer*)	Mangroves	Protected under Part 1 of the NCL
Hickatee (*Trachemys decussata angusta*)*	Mangroves	Regulated under Part 2 of the NCL
Fish		
Sharks and rays (Elasmobranchii all species)*	Seagrass beds	All sharks and rays are protected under Part 1 of the NCL, except those specifically listed in Part 2

Species	Habitat use within Study Area[1]	Legal protection under Schedule I of the National Conservation Law (2013)
All bony fish (Teleostei all species)*	Seagrass beds, mangroves	All bony fish are protected under Part 2 of the NCL, except those specifically listed in Part 1
Nassau grouper (*Epinephelus striatus*)*^	Seagrass beds, mangroves	Regulated under the NCMPR Schedule 7 (Spawning Aggregation Overlay Zones) and regulated under Part 2 of the NCL
Mosquito fish (*Limia caymanensis* and *Gambusia xanthosoma*)*^	Mangroves	Regulated under Part 2 of the NCL
Tilefish (*Malacanthus plumieri*)*	Seagrass beds	Protected under Part 1 of the NCL
Filefish (Monacanthidae all species)*	Seagrass beds	Protected under Part 1 of the NCL
Invertebrates		
All soft corals (including Gorgonians & Telestaceans) (Anthozoa all species)*	Mangroves	Protected under Part 1 of the NCL
Sponges (Porifera all species)*	Mangroves	Protected under Part 1 of the NCL
Echinoderms (Echinodermata all species)*	Seagrass beds, mangroves	Protected under Part 1 of the NCL
Conch (Strombidae all species)*	Seagrass beds	Protected under Part 1 of the NCL, except those listed in Part 2
Queen conch (*Strombus gigas*)*^	Seagrass beds, mangroves	Regulated under Part 2 of the NCL
Cassidae (*Cassis tuberosa, C. madagascariensis, C. flammea, Phalium granulatum, Cypraeacassis testiculus*)*	Seagrass beds	Protected under Part 1 of the NCL
Tulip mussel (*Cosa caribbaea*)*	Seagrass beds	Regulated under Part 2 of the NCL
Commissioner Gerrard's clam (*Transenella gerrardi*)*	Seagrass beds	Regulated under Part 2 of the NCL
Alfred's turbonille (*Turbonilla alfredi*)*	Seagrass beds	Regulated under Part 2 of the NCL
Crustaceans		
Lobsters (*Palinura* sp., *Achelata* sp.)*	Mangroves	Protected under Part 1 of the NCL, except those listed in Part 2
Spiny lobster (*Panulirus argus*)*^	Seagrass beds, mangroves	Regulated under Part 2 of the NCL
White Land crab (*Cardisoma guanhumi*)*^	Mangroves	Regulated under Part 2 of the NCL
Plants		
Black mangrove (*Avicennia germinans* [= *nitida*])*~	Mangroves	Regulated under Part 2 of the NCL
Buttonwood (*Conocarpus erectus*)*	Mangroves	Regulated under Part 2 of the NCL
White mangrove (*Laguncularia racemosa*)*	Mangroves	Regulated under Part 2 of the NCL
Red mangrove (*Rhizophora mangle*)*	Mangroves	Regulated under Part 2 of the NCL
Eel grass (*Halodule wrightii* [= *ciliate / bermudensis / beaudettei*])*	Seagrass beds	Regulated under Part 2 of the NCL
Manatee grass (*Syringodium filiforme* [= *Cymodocea manitorum*])*	Seagrass beds	Regulated under Part 2 of the NCL
Turtle grass (*Thalassia testudinum*)*	Seagrass beds	Regulated under Part 2 of the NCL

Species	Habitat use within Study Area[1]	Legal protection under Schedule I of the National Conservation Law (2013)
Algae		
Green algae (*Chlorophyta* sp.)*	Seagrass beds, mangroves	Regulated under Part 2 of the NCL
Brown algae (*Phaeophyta* sp.)*	Seagrass beds, mangroves	Regulated under Part 2 of the NCL
Red algae (*Rhodophyta* sp.)*	Seagrass beds, mangroves	Regulated under Part 2 of the NCL
Notes		
[1] Habitats identified in the Cayman Islands National Biodiversity Action Plan (NBAP; DaCosta-Cottam et al. 2009) * Denotes species listed within a Habitat Action Plan of the NBAP ^ Denotes species with own Species Action Plan detailed in the NBAP ~ Denotes species that were detected on Site		

4.6 Invasive species

An alien species is one that has been deliberately or accidentally introduced by humans to an environment it would not naturally occur in. An alien species becomes an invasive species once it starts to reproduce and proliferate in that environment. Invasive species are incredibly problematic as they take over habitat and resources once utilised by native species and cause an imbalance of the ecosystem (DoE 2021). There are numerous invasive species present in the Cayman Islands, with the majority being terrestrial species (refer to GHD 2023, for detailed information on terrestrial invasive species). Invasive species are not assigned a value at a project scale.

4.6.1 Red lionfish

Red lionfish (*Pterois volitans*) were first recorded in Little Cayman in February 2008, and in Cayman Brac in October 2008. Native to the Indo-Pacific, it is thought red lionfish became established in the Atlantic as a result of Hurricane Andrew, when several fish were introduced into marine waters at Biscayne Bay, Florida. Red lionfish are invasive in Cayman waters and require active control to prevent its spread. They are associated with seagrass beds and mangroves and can inflict painful stings with their dorsal spines. Envenomation can cause swelling, redness, bleeding, nausea, numbness, joint pain, anxiety, headache, disorientation, paralysis, and convulsions; however, the severity of the symptoms varies depending on how much venom was injected. A current Species Action Plan is available for this invasive species (DaCosta-Cottam et al. 2009).

4.6.1.1 Stony coral tissue loss disease

Stony coral tissue loss disease (SCTLD) is a threat on coral populations in Grand Cayman. SCTLD was first detected in Florida's reefs in 2014 and has now spread to several Caribbean countries. There is no known cause and method of transmission of this virus however it is expected to be transmitted by touch and water circulation (DoE 2021).

4.6.2 Summary of marine baseline conditions

CIEEM guidelines were used in the assessment of ecological receptors. The importance of the ecological features were first assessed with reference to Cayman Island legislation and then the impact to the species or habitat that would be impacted with the proposed ISWMS Site was taken into account.

Although, all the species listed have the potential to occur on-Site and potential to be impacted, it is not anticipated that any species will be greatly impacted from the development at the ISWMS Site.

The ecological receptors of concern for the marine environment include, marine and costal habitats including spur and groove, sand, and hardbottom habitats, inland mangroves, marine mammals, marine reptiles, sharks, Nassau grouper, and additional protected species not previously listed. See **Table 3** for value listed.

Table 3 Summary of marine ecological features values at a project scale

Marine ecological features	Value at project scale for receptors of concern
Marine protected areas (Section 4.2)	N-1: due to being a nationally designated site including marine parks, environmental zones, and replenishment zones
Marine and coastal habitats (Section 4.3) Spur and groove, sand, and hardbottom habitats	For direct discharge: N-3: due to these habitats being listed in the NBAP For shipping routes: N-3: due to these habitats being listed in the NBAP
Seagrass beds (Section 4.3.1)	N-2: due to seagrass beds being protected under Schedule 1 Part 2 of the NCL
Coastal mangroves (Section 4.3.2)	N-2: due to mangrove species being protected under Schedule 1 Part 2 of the NCL
Marine mammals (Section 4.1.1)	I-2: due to all species being internationally protected under the US MMPA and/or ESA, listed on the IUCN Red List, and protected under Schedule 1 Part 1 of the NCL
Marine reptiles (Section 4.4.2)	I-2: due to all species being internationally listed as either endangered or threatened under the ESA, listed as critically endangered, endangered, or vulnerable on the IUCN Red List, and being protected under Schedule 1 Part 1 of the NCL
Sharks (Section 4.4.3)	I-2: due to several species being listed as critically or endangered on the IUCN Red List. Scalloped hammerheads are listed as threatened under the US ESA, and all shark species are protected under Schedule 1 Part 1 of the NCL
Nassau grouper (Section 4.4.4)	I-2: due to being listed as critically endangered under the IUCN Red List, protected under the US ESA, and protected under Schedule 1 Part 1 of the NCL
Protected species not previously listed (Section 4.5)	N-2: due to being protected under Schedule 1 Part 1 or 2 of the NCL

5. Impact assessment and mitigation

The proposed Site development is delineated in **Figure 4**. The proposed development will result in the removal of an estimated 0.7 hectares (ha) of inland mangrove habitat and 13.35 ha of terrestrial habitat (refer to GHD 2023, for detailed information on terrestrial habitat). There is no direct discharge to the marine environment anticipated as part of the proposed development. An impact analysis was conducted based on secondary sources and it was found that, based on the absence of direct discharge during the construction phase, there are no anticipated impacts to the marine environment. However, as the facility design is not yet finalized, there is a possibility the of direct marine discharge of cooling water to the North Sound if the anticipated discharge alternatives prove to be infeasible. While this is a highly unlikely design outcome, the assessment of potential impact to North Sound seagrass beds is included herein.

Operational impacts of the importation of waste via vessel from the Sister Islands (Cayman Brac and Little Cayman) were also examined through secondary sources. Cayman Brac and Little Cayman are approximately 95 miles (152 kilometres (km)) and 80 miles (129 km) respectively from Grand Cayman. As with the construction phase, with the incorporation of best management practices (BMPs) and mitigation measures, and absence of direct discharge to the marine environment, there are no significant impacts anticipated during operation. General mitigation measures are detailed below to maintain the integrity of the natural environment throughout construction and operation of the ISWMS.

5.1 Pathways of potential effects

Potentially significant marine ecology effects identified in the approved ToR and through the assessment of the marine environment baseline conditions are validated in **Table 4** to confirm pathways of potential residual effects. The specific activities and effects as listed in the approved ToR are included in the table below as bold. Additional items were considered to have a more complete understanding of the impacts to the Study Area.

Table 4 Pathway validity of potential effects by activity

Activity (leading to environmental change)	Effect	Feature	Pathway Validity	Potential Effect Before Mitigation
Land preparation e.g., earthworks, excavation (during construction)				
	Soil erosion and sedimentation into adjacent areas	Isolated mangroves within and surrounding the ISWMS Site	Direct pathway for soil erosion and sedimentation within the isolated mangroves	Soil erosion from land preparation (e.g., earthworks, excavation) and sedimentation into adjacent areas (including isolated mangroves within and surrounding the ISWMS Site)
	Dust from land preparation	Isolated mangroves within and surrounding the ISWMS Site	Direct pathway for dust to settle on isolated mangroves	Dust from land preparation (e.g., earthworks, excavation) affecting isolated mangroves within and surrounding the ISWMS Site
	Flooding / change in water quality	North Sound habitats and species including fringing mangroves and seagrass beds	Direct pathways for flooding/change in water quality of the North Sound habitats and species	Flooding / change in water quality affecting North Sound habitats and species including fringing mangroves and seagrass beds
		Isolated mangroves within and surrounding the ISWMS Site	Direct pathway for flooding / change in water quality to effect isolated mangroves within and surrounding the ISWMS Site	Flooding / change in water quality affecting isolated mangroves within and surrounding the ISWMS Site
	Migration of contaminates through surface	**North Sound habitats and species including fringing**	**Direct pathways for the migration of contaminants through**	**Spills of oil, gasoline, and other fluids into North Sound habitats**

Activity (leading to environmental change)	Effect	Feature	Pathway Validity	Potential Effect Before Mitigation
	water/storm water and groundwater movements	**mangroves and seagrass beds**	**surface water/storm water and groundwater**	**and species including fringing mangroves and seagrass beds**
		Isolated mangroves within and surrounding the ISWMS Site	Direct pathway for the migration of contaminants	Spills of oil, gasoline, and other fluids into natural communities affecting isolated mangroves within and surrounding the ISWMS Site
	Site degradation	Isolated mangroves within and surrounding the ISWMS Site	Direct pathway for Site degradation to effect isolated mangroves within and surrounding the ISWMS Site	Site degradation affecting isolated mangroves within and surrounding the ISWMS Site
Waste processing (during operation)	**Migration of contaminates through surface water/storm water and groundwater movements**	**North Sound habitats and species including fringing mangroves and seagrass beds**	**Direct pathway for the migration of contaminants into North Sound habitats**	**Spills of oil, gasoline, and other fluids into natural communities affecting the North Sound Habitats and species**
		Isolated mangroves within and surrounding the ISWMS Site	Direct pathway for the migration of contaminants into the isolated mangroves within and surrounding the ISWMS Site	Spills of oil, gasoline, and other fluids into natural communities affecting isolated mangroves within and surrounding the ISWMS Site
Vessel movements (during operation)	Increased water pollution	Marine environment, including habitats, vegetation, and wildlife	Direct pathway for increased water pollution by vessel movements	Increased water pollution affecting the marine environment, including habitats, vegetation, and wildlife
	Increased vessel strikes	**Migratory and highly mobile marine wildlife (e.g., hawksbill, green and loggerhead turtle, groupers, marine mammals, and sharks)**	**Direct pathway for increased vessel strikes to marine wildlife by vessel movements**	**Increased vessel strikes on marine wildlife (e.g., hawksbill, green and loggerhead turtle, groupers, marine mammals, and sharks)**
	Increased turbidity	Marine environment, including habitats, vegetation, and wildlife	Direct pathway for increased turbidity by vessel movements	Increased turbidity affecting the marine environment, including

Activity (leading to environmental change)	Effect	Feature	Pathway Validity	Potential Effect Before Mitigation
				habitats, vegetation, and wildlife
	Invasives transported with ballast water	Marine environment, including habitats, vegetation, and wildlife	Direct pathway for invasives to be transported with ballast water by vessel movements	Invasives transported with ballast water affecting the marine environment, including habitats, vegetation, and wildlife
	Grounding of barges	Marine environment, including habitats, vegetation, and wildlife	Direct pathway for grounding of barges by vessel movements	Grounding of barges affecting the marine environment, including habitats, vegetation, and wildlife
	Disturbance	**Migratory and highly mobile marine wildlife (e.g., hawksbill, green and loggerhead turtle, groupers, marine mammals, and sharks)**	**Direct pathway for the disturbance of marine wildlife by vessel movements**	**Increased sound and vibration in the marine environment affecting migratory and highly mobile marine wildlife (e.g., hawksbill, green and loggerhead turtle, groupers, marine mammals, and sharks)**

5.2 Significance evaluation

The significance of a residual effect is a determination following evaluation of the identified "potential effect" with the implementation of mitigation measures. A significance evaluation of the potential effects associated with the construction and operation of the ISWMS has involved:

– Identifying those effects that could likely be significant.
– Assessing the effects of the proposed construction works against the baseline (current or future, as appropriate).
– Concluding whether or not these resultant effects are likely to be significant.

The significance of effects determination has been completed for the marine environment based on professional judgement the following:

– Predicting adverse effects from proposed construction activities and evaluating the scope and scale of those effects.
– Detailing mitigation measures triggered through regulatory requirements and/or BMPs to eliminate, reduce, or control the effect the construction activities have on environmental components.
– Determining the significance of the residual effects.

Significance evaluation is assessed using the criteria detailed in **Table 5** (adapted from Table 5.3 of the ToR).

Table 5 Significance evaluation criteria

Characterisation	Description	Quantitative Measure or Definition of Qualitative Categories
Magnitude	The size or degree of the effects compared against baseline conditions or reference levels, and other applicable measurement parameters (i.e., standards, guidelines, objectives)	**Negligible (N) |** Differing from the average baseline conditions to a small degree, but within the range of the natural variation **Very Low (VL) |** Differing from the average baseline conditions to a small degree, but very minimally out of the range of the natural variation **Low (L) |** Differing from the average baseline and outside the range of natural variation but less than or equal to appropriate guideline or threshold value **Medium (M) |** Differing from the average baseline and outside the range of natural variation and marginally exceeding a guideline or threshold value **High (H) |** Differing from the average baseline and outside the range of natural variation and exceeding a guideline or threshold value
Geographic Extent	The geographic area over which the effects are likely to be measurable	**Site Study Area (SSA) |** Occurs within the ISWMS Site boundary **Outside Study Area (OSA) |** Occurs outside of the ISWMS Site boundary
Timing	Considers when the residual environmental effect is expected to occur. Timing considerations are noted in the evaluation of the residual environmental effect, where applicable or relevant.	**Not Applicable (NA) |** Seasonal variations are not likely to change the effect **Applicable (A) |** Seasonal aspects may affect the outcome of the effect
Duration	The time period over which the effects are likely to last	**Short-Term (ST) |** The effect is reversible at the end of construction works **Medium-Term (MT) |** The effect is reversible within a defined length of time (e.g., during operation) **Long-Term (LT) |** The effect is reversible over an extended length of time (including at the end of operation)
Frequency	The rate of recurrence of the effects (or conditions causing the effect)	**Once (O) |** Effects occur once **Regular (R) |** Effects can occur at regular intervals through construction and/or operation **Continuous (C) |** Effects are continuous throughout construction and operation
Reversibility	The degree to which the effects can or will be reversed (typically measured by the time it will take to restore the environmental attribute or feature)	**Reversible (R) |** The baseline conditions will recover to their standard after the construction works are completed **Partially Reversible (PR) |** Mitigation can return the baseline conditions **Not Reversible (NR) |** Mitigation cannot guarantee a return to baseline conditions

5.2.1 Potential effects and mitigation measures

The potential residual effects identified in **Table 4** are further evaluated here as the potential effects, associated mitigations and resultant significance. A potential effect to the marine environment during construction and operation is the increase of sedimentation due to vegetation clearing causing increased sediment run-off and increased dust emissions. Most of the vegetation has already been cleared; however, erosion and sedimentation measures will be established within the ISWMS Site boundary to prevent sediment migration and dust emissions. Additional potential effects to the marine environment are habitat and wildlife interference or strikes as a result of vessel movements during operation. The effects assessment of significance is presented in Table 6. Again as with Table 5.1, the specific activities and effects that are listed in the approved ToR are included in the table below as bold. Additional items were considered to have a more complete understanding of the impacts to the Study Area.

Table 6 Marine ecology assessment of significance

Potential Effect	Mitigation Measures and Best Management Practices Proposed	Residual Environmental Effect Characterisation and Rationale						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Soil erosion from land preparation (e.g., earthworks, excavation) and sedimentation into adjacent areas (including isolated mangroves within and surrounding the ISWMS Site)	During construction: – Limit vegetation clearing only to areas where construction works are being completed to prevent sediment being exposed During construction and operation: – Establish and maintain erosion and sediment control fencing in good working order to capture any erosion whilst construction works are being completed – Maintain erosion and sediment control fencing in place until final site development, or stabilize soils with vegetation (e.g., annual seed mix and/or plantings) – Routinely inspect erosion and sediment control measures, including following storms, and repair as required – All machinery should be inspected for fluid leaks or other potential pollutants. The Contractor should evaluate each piece of equipment to ensure all risk of spills or sediment release due to its use is mitigated prior to putting it into service – Trucks and equipment shall be cleaned prior to leaving the site to prevent mud/dirt from tracking onto roads	N	SSA & OSA	A	ST	R	PR	No impacts from an erosion and sedimentation perspective to adjacent areas (including isolated mangroves within and surrounding the ISWMS Site)	Not significant as mitigations will ensure the stabilization of soils after construction and maintain sediment and erosion control fencing to limit movement of sediments.
		The magnitude of soil erosion and sedimentation into isolated mangroves within and surrounding the ISWMS site is negligible. 33 acres (13.35 hectares (ha)) of terrestrial habitat and 1.7 acres (0.7 ha) of inland mangrove habitat that has been removed to accommodate this project which results in exposed soils on the ISWMS Site. Seasonal variation may impact the outcome of effect due to level of rain occurring during different seasons. June – October there is generally more rain that could cause increased risk of sedimentation into adjacent areas of the Site during the construction phase. The impacts from soil erosion and sedimentation will return the Site to baseline conditions after construction is completed as exposed soils will be stabilized and erosion and sediment control measures will be in place until establishment. As such, the duration of the effect is listed as short-term. The effect has the ability to occur at regular frequency intervals throughout the construction process due to exposed soils and movement of trucks and equipment over these soils. This effect is partially reversible as the mitigations can ensure a return to baseline conditions as the mitigation measures ensure the sediments cannot move into the adjacent areas.							

Potential Effect	Mitigation Measures and Best Management Practices Proposed	Residual Environmental Effect Characterisation and Rationale						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Dust from land preparation (e.g., earthworks, excavation) affecting isolated mangroves within and surrounding the ISWMS Site	During construction and operation: – Manage dust emissions through the use of water or dust suppressants on non-paved roads and cleaning of paved roads, where applicable, reflecting regulatory direction and approval – In dust sensitive areas (e.g., near mangroves, etc.), control dust using water and not chemical suppressants – Establish Site speed limits for Project vehicles traveling within the Site to minimize dust emissions – Ensure that equipment maintenance and checks occur on a regular basis – Proper stockpiling of dust producing building materials such as sand or cement in low enclosures and covered, away from drainage areas where they could easily be dispersed by wind or washed away during heavy rains – All loads entering or leaving the Site must be covered	VL	SSA & OSA	A	ST	R	R	No impacts from dust generation to adjacent areas (including isolated mangroves within and surrounding the ISWMS Site)	Not significant as the effect from dust from land preparation is only anticipated throughout construction and mitigations in place will ensure the control of dust.
		There is a very low magnitude of an effect from dust from land preparation that will impact the isolated mangroves within and surrounding the Site. There is a seasonal variation of the effect due to rain conditions as the rain will supress the dust. Therefore, there are less impacts anticipated throughout June – October where there is generally more rain. Additionally, wind can impact the amount of dust that would be spread. The windy months in Cayman include October – March with a peak in December. This effect will be reversible at the end of construction due to the stabilization of soils and reduction in construction traffic creating dust. The impacts of dust would be seen at regular intervals through construction while active land preparation is occurring. Reversible to baseline conditions after construction is completed. Vehicular traffic will decline, and grounds will be stabilized as applicable.							

Potential Effect	Mitigation Measures and Best Management Practices Proposed	Residual Environmental Effect Characterisation and Rationale						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Flooding / change in water quality affecting the North Sound habitats and species including fringing mangroves and seagrass beds	During construction and operation: – Implement engineering controls to isolate any flood-prone areas from construction soil/sand/cement stockpiles, and operations materials stockpiles – Employ discharge design which does not include direct discharge to the North Sound as hydrologic and geologic feasibility allows (e.g. deep injection of cooling water). If direct discharge is the solution employed, mitigate sedimentation and contamination of the seagrass beds by including on-site cooling ponds and piping the discharge to the North Sound or lining the surface water conveyance and including sediment control structures within the conveyance. – Construct conveyance/connection to North Sound (if required), following stabilization of site soils post-construction disturbance, while risk of sediment release to the North Sound is lowest.	VL	OSA	A	LT	R	R	Minimal increased flooding/ change in water quality to North Sound habitats and species	Not significant as there is no anticipated change in water quality to the North South Habitat.
		There will be very minimal change in water quality or increased flooding to North Sound habitats and species outside of natural variation based on professional judgement of evaluating the effectiveness of the engineering design and controls. Potential sedimentation and thermal impacts on seagrass beds can be mitigated through design. Seasonal variations are likely to change the potential for impact of flooding to the North South habitat. The effect from flooding may occur during construction and operation of the ISWMS Site. The duration is listed as long term as there is the potential for this effect to occur throughout operation. It is anticipated that mitigation measures are sufficient to negate potential effect for the duration. The effect has the potential to occur at regular intervals throughout construction and operation. The effect from flooding can be mitigated and return the environment to baseline conditions, therefore the effect is reversible.							

Potential Effect	Mitigation Measures and Best Management Practices Proposed	Residual Environmental Effect Characterisation and Rationale						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Flooding / change in water quality affecting isolated mangroves within and surrounding the ISWMS Site	During construction and operation: – Implement a stormwater management plan to maintain pre-construction drainage patterns and flows during all project phases – Implement appropriate erosion and sediment controls to mitigate Site runoff of water or mud	N	OSA	A	LT	R	PR	No increased flooding/ change in water quality to isolated mangroves surrounding the ISWMS Site	Not significant as it is not anticipated to see any flooding or changes in water quality that would impact the isolated mangroves within and surrounding the ISWMS Site
		There is a negligible possibility of change in water quality affecting isolated mangroves within and surrounding the ISWMS Site. APEC has utilised documented flood data from Hurricane Ivan which it considers equate closely to a 100-year design flood event. Based on the proposed location of the facility and associated FEMA coastal zoning assessed by APEC, project Design Flood Elevation (DFE) for each facility building have been developed in accordance with their occupancy categories. These have been adopted by the project. Additionally, the location of the Site is in the centre of the island, approximately 500 m from the shoreline. This location is anticipated to reduce exposure to storm surges and exposure to flooding. Timing is applicable for flooding as it is more likely to occur during the wet season with increased rainfall; however, timing is not applicable for change in water quality as that may occur at any time of year. Flooding / change in water quality could affect the isolated mangrove habitat. The effect has the potential to occur at regular intervals throughout construction and operation, hence assignment of long-term duration. The effects due to flooding / change in water quality are partially reversible as mitigation measured can return to environment to baseline conditions. All breaches in erosion and sediment controls are to be addressed immediately with the emergency response management plan that is put into place before construction begins.							

Potential Effect	Mitigation Measures and Best Management Practices Proposed	Residual Environmental Effect Characterisation and Rationale						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Spills of oil, gasoline, and other fluids into natural communities affecting the North Sound habitats and species including fringing mangroves and seagrass beds	During construction and operation: – Implement a stormwater management plan to maintain pre-construction drainage patterns and flows during all project phases – Implement appropriate erosion and sediment controls to mitigate Site runoff of water or mud – All machinery should be inspected for fluid leaks or other potential pollutants. The Contractor should evaluate each piece of equipment to ensure risks of spills or sediment release due to its use is mitigated prior to putting it into service – Proper machinery inspections and maintenance, as well as establishing areas away from natural features that are dedicated to re-fuelling and storing machinery – Proper vessel inspections to reduce likelihood of a spill occurring – Implement an emergency and response management plan to address the potential for spills – Include a landfill cap within construction design to reduce the levels of contaminants within stormwater runoff and groundwater – Preparation and implementation of a detailed wastewater and sewerage plan, including suitable treatment options for wastewater prior to discharge	VL	OSA	NA	ST	R	PR	No residual effect to North Sound habitats and species including fringing mangroves and seagrass beds	Not significant as mitigations in place will ensure there is no impacts to natural communities impacting the North Sound
		There is a very low magnitude of potential impact due to spills of oil, gasoline, and other fluids to the fringing mangroves and seagrass beds. With low likelihood of adverse impacts anticipated to the North Sound habitat as mitigations will reduce potential for contamination. The impact caused by fluid spills is the same during all times of year due to use of equipment during construction and operation. A short-term duration of the effect is anticipated as the Site will return to baseline operation conditions after construction. As construction activities will be completed, the amount of construction machinery would decrease, and regular activities would occur on Site, resulting in less opportunity for spills to occur. The potential for spills is to occur at regular intervals throughout construction and operation due to regular refuelling required on equipment. The effects due to spills are partially reversible as mitigation measures can return to environment to baseline conditions. All spills are to be addressed immediately with the emergency response management plan that is put into place before construction begins.							

Potential Effect	Mitigation Measures and Best Management Practices Proposed	Residual Environmental Effect Characterisation and Rationale						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Spills of oil, gasoline, and other fluids into natural communities affecting isolated mangroves within and surrounding the ISWMS Site	During construction and operation: – All machinery should be inspected for fluid leaks or other potential pollutants. The Contractor should evaluate each piece of equipment to ensure risks of spills or sediment release due to its use is mitigated prior to putting it into service – Proper machinery inspections and maintenance, as well as establishing areas away from natural features that are dedicated to re-fuelling and storing machinery – Implement an emergency and response management plan to address the potential for spills – Include a landfill cap within construction design to reduce the levels of contaminants within stormwater runoff and ground water	L	SSA	NA	ST	R	PR	No residual effect into natural communitie s affecting isolated mangroves within and surrounding the ISWMS Site	Not significant as mitigations in place will ensure there is no impacts to natural communities around the site from spills.
		There is a low magnitude of potential impact to the site due to spills of oil, gasoline, and other fluids into natural communities affecting isolated mangroves within and surrounding the Site. The impact caused by fluid spills is the same during all times of year due to continuous use of equipment. The effect is listed as short-term as the effect will return to baseline conditions after construction. As construction activities will be completed, the amount of construction machinery would decrease, and regular activities would occur on Site, resulting in less opportunity for spills to occur. There is potential for spills is to occur at regular intervals throughout construction and operation, as refuelling of equipment and machinery is occurring. As such, given a frequency rating of regular. The effect from spills is partially reversible as mitigation measured can return to environment to baseline conditions. All spills are to be addressed immediately with the emergency response management plan that is put into place before construction begins.							

Potential Effect	Mitigation Measures and Best Management Practices Proposed	Residual Environmental Effect Characterisation and Rationale						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Site degradation affecting isolated mangroves within and surrounding the ISWMS Site	During construction and operation: – Enlist an experienced environmental professional onsite to provide guidance to mitigate potential negative environmental effects – All construction materials, excess materials and debris should be removed and appropriately disposed of following construction. Implement environmental inspection by an experienced environmental professional during construction to ensure that all mitigation measures are implemented properly, maintained, and repaired and remedial measures are initiated in a timely manner where warranted – Train Site staff in the identification of site-specific protected species and invasive species. Post their identification and management information in construction and operation offices	VL	SSA & OSA	NA	ST	R	PR	Minor residual effect due to habitat alteration	Not significant as mitigations in place will assist in reducing impacts as a result of site degradation.
		There is a very low magnitude of potential impact due to site degradation affecting isolated mangroves within and surrounding the Site. The impact caused by site degradation is the same during all times of year due to works occurring year-round. Will return to baseline after construction, as such, has been listed as short term. When construction activities come to a close there will be a reduction in the activity on Site. Eliminating the works on site that would largely contribute to the effect of site degradation. The potential for site degradation has the potential to occur at regular intervals throughout construction and operation as there is regular activity on Site that could contribute to site degradation. Partially reversible as mitigation measured can return to the environment to baseline conditions. Ensuring mitigations are in place will help to address site activities that are contributing to degradation.							

Potential Effect	Mitigation Measures and Best Management Practices Proposed	Residual Environmental Effect Characterisation and Rationale						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Increased water pollution affecting the marine environment, including habitats, vegetation, and wildlife	During operation: – Maintain records of waste at collection, transfer and tipping locations – Implement securing mechanisms to prevent waste falling off vessel	VL	OSA	NA	LT	R	PR	No increase in water pollution	Not significant as there are no additional impacts expected beyond current operations. Additionally, mitigations will help to ensure no impacts to water quality.
		There is a very low degree of anticipated effects compared to the baseline conditions due to increased water pollution affecting the marine environment as there is existing operations between the islands that can impact protected marine species and their habitat. Cayman Brac and Little Cayman are approximately 95 miles (152 kilometres (km)) and 80 miles (129 km) respectively from Grand Cayman. The geographic extent is outside of the study area within the marine environment. There are no seasonal variations that may affect the outcome of the pollution as the shipping is continuous between the islands. The effect from increased water pollution would occur during operation of the ISWMS Site. The duration is listed as long term as shipping between the island is ongoing as operations are occurring. It is anticipated that mitigation measures are sufficient to negate potential effects long term. The effects of increased water pollution can occur at regular frequency when the vessels are travelling between the islands. The effect from pollution is partially reversible as mitigations including waste collection records and mechanisms to secure waste can return to baseline conditions.							

Potential Effect	Mitigation Measures and Best Management Practices Proposed	Residual Environmental Effect Characterisation and Rationale						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Increased vessel strikes on marine wildlife (e.g., hawksbill, green and loggerhead turtle, groupers, marine mammals, and sharks)	During operation: – Travel at slow and safe speeds, in accordance with the Cayman Islands Port Regulations (2022 Revision), to avoid collisions with marine wildlife – Work with coast guards to utilize recommended routes to avoid species during known migration time periods – Ensure vessel operators are knowledgeable of marine wildlife seasonality and speed limits	VL	OSA	A	LT	C	PR	No net change of risk of vessel strikes on marine wildlife, therefore no residual effect	Not significant as there are no additional impacts expected beyond current operations. Additionally, mitigations will help to ensure there is no increased in vessel strikes
		There is a very low magnitude of the effect against baseline conditions as there is already shipping of waste is occurring between the islands with current operations. There is a distance from Grand Cayman of approximately 95 miles (152 kilometres (km)) and 80 miles (129 km) to Cayman Brac and Little Cayman respectively. Throughout this distance there is a potential for vessel strikes to occur with marine species. Species involved could include those of I-2 value. Seasonal aspects may impact the outcome of event as there are times of the year when species are more active in certain areas or migrating. Any effect from increased vessel strikes would occur during operation of the ISWMS Site. The duration is listed as long term as the effect will occur so long as there is operation and shipping between the islands. It is anticipated that mitigation measures are sufficient to negate potential effects long term while shipping occurs. The effect of vessel strikes is partially reversible as the implementation of mitigation measures can reverse the environment to baseline conditions. Working with the coast guard to utilize recommended routes during known migration times can help to avoid species when they are most active.							

Potential Effect	Mitigation Measures and Best Management Practices Proposed	Residual Environmental Effect Characterisation and Rationale						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Invasives transported with ballast water affecting the marine environment, including habitats, vegetation, and wildlife	During operation: – Adhere to a ballast water management plan and maintain records of ballast water exchange – Ballast water to take place mid sea in ballast water exchange areas – Flush otherwise-empty ballast tanks with open ocean water in order to reduce the risk posed by any residual ballast water and sediments	L	OSA	NA	LT	R	PR	No anticipated net change with respect to invasives transported with ballast water, therefore no residual effect	Not significant as there are no additional impacts expected beyond current operations. Additionally, mitigations will help to limit the transfer of invasive species
		There is a distance from Grand Cayman of approximately 95 miles (152 kilometres (km)) and 80 miles (129 km) to Cayman Brac and Little Cayman respectively. Throughout this distance there is a potential for invasives to be released and spread from ballast water impacting the marine environment. Although, it is anticipated that there will be very low impacts to the marine habitat, vegetation, and wildlife due to invasive species. Seasonal variations are not likely to change the effect as there is continued regular shipping between the islands throughout the year, creating opportunities for invasives to be transported. The effect from transport of invasives would occur during operation of the ISWMS Site. The duration is listed as long term as the potential for the effect to occur exist so long as there is shipping operations between the islands. It is anticipated that mitigation measures are sufficient to negate potential effect throughout the duration of operations. The effects of invasives being transporting is listed as a regular frequency as there is regular shipping between the islands. Ensuring mitigation measures are fully implemented helps to reduce the introduction and spread of species to other marine environments. The introduction and spread of species in the marine environment are partially reversible as mitigations can return the environment to the baseline conditions.							

Potential Effect	Mitigation Measures and Best Management Practices Proposed	Residual Environmental Effect Characterisation and Rationale						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Increased sound and vibration in the marine environment affecting migratory and highly mobile marine wildlife (e.g., hawksbill, green and loggerhead turtle, groupers, marine mammals, and sharks)	During operation: – Work with coast guard and DoE to identify and utilize recommended routes which avoid densely populated areas and high migration times	VL	OSA	NA	LT	R	PR	No net change with respect to increased sound and vibration in the marine environment , therefore no residual effect	Not significant as there are no additional impacts expected beyond current operations. Additionally, mitigations will help to ensure there are no impacts from sound and vibration effecting species.
		There is a very low degree to which sound and vibration from vessels during operations will deviate outside of the baseline conditions within the marine environment affecting migratory and highly mobile marine wildlife. Seasonal variations are not likely to change the effect as there is continued regular shipping between the islands throughout the year, creating opportunities for marine species to be exposed to sound and vibration. The effect from increased sound and vibration would occur during operation of the ISWMS Site. The duration is listed as long term as the potential for the effect to occur within the marine environment is present as long as there is shipping operations between the islands. It is anticipated that mitigation measures are sufficient to negate the potential effect for the duration of shipping operations. The effects of increased vibration and sound have the potential to be seen at a regular frequency as there is continuous shipping between the islands. Ensuring mitigation measures are fully implemented helps to avoid the species that would be impacted by sound and vibrations in the marine environment. The increased sound and vibrations in the marine environment are partially reversible as mitigations can return the marine environment to the baseline conditions.							

Potential Effect	Mitigation Measures and Best Management Practices Proposed	Residual Environmental Effect Characterisation and Rationale						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Grounding of barges	During operation: – Work with coast guard and DoE to identify and utilize recommended routes which avoids shallow areas – Adequate towing equipment to ensure control of the barge – Ensure vessel operators are checking and maintaining equipment	L	OSA	NA	LT	R	PR	No net change with respect to grounding of barges in the marine environment , therefore no residual effect	Not significant as this movement of waste from the sister islands already occurs, no additional impacts as a result of the proposed development are anticipated.
		It is anticipated that there will be low impacts to the marine environment, including corals, due to grounding of barges. The ground cover within the vicinity of the port largely consists of spur and groove and uncolonized hard bottom. Seasonal variations are not likely to change the effect as there is continued regular shipping between the islands throughout the year, creating opportunities for grounding of barges to occur. The effect from grounding of barges would occur during operation of the ISWMS Site. The duration is listed as long term as the potential for the effect to occur is present so long as there is operations between the islands. It is anticipated that mitigation measures are sufficient to negate the potential effect throughout the duration of the shipping operations. The effects of grounded barges are listed as regular frequency as there is shipping between the islands regularly. Ensuring mitigation measures are fully implemented helps to reduce the occurrence of groundings. The grounding of barges is partially reversible as mitigations can return the Site to the baseline conditions.							

5.2.2 Summary of effects

The predicted environmental effects on the marine environment were assessed to be adverse but not significant. However, with the implementation of mitigation measures and BMPs that will be outlined in the Environmental Management Plan (EMP) in the Environmental Statement (ES), the residual effect on the marine environment is not significant.

The effects anticipated are as summarized below:

- No offsite impacts from an erosion and sedimentation perspective
- No offsite dust impacts on marine environment
- No increased flooding/change in water quality
- Minimal site degradation
- No increase in water pollution
- No change of vessel strike risk on marine wildlife
- No change of turbidity impacting reefs
- No change with respect to invasives transported with ballast water
- No change with respect to increased sound and vibration in the marine environment
- No change with respect to grounding of barge

It should be noted that a number of the potential effects are related to ongoing/ existing activities (i.e., vessel movements between islands) and therefore no change is anticipated beyond the status quo.

5.2.3 Residual effects

There are no anticipated residual effect remaining after the implementation of mitigation measures during construction and operations identified for the marine environment.

6. Monitoring

For the purposes of construction works, limited monitoring requirements have been identified. As previously noted in **Section 5**, the potential effects are limited. The following monitoring requirements are recommended based on the residual effects identified:

During construction and operation:

- Erosion and sediment control monitoring: silt fencing will be established around the ISWMS Site to limit sediment run-off into the surrounding environment. Regular inspections (i.e., weekly, before and following 25 millimetres (mm) or more rainfall) should be conducted to identify any damage to the fencing. Prompt repairs should follow.
- Erosion and sediment control monitoring: Regular inspections (i.e., weekly, before and following 25 millimetres (mm) or more rainfall) should be conducted to identify any damage to the fencing. Prompt repairs should follow.
- Monitoring for marine wildlife is to occur for the duration of each journey when barges are travelling between islands.

Additional monitoring may be required if the vegetation clearing avoidance windows cannot be adhered to. The vegetation clearing avoidance window includes the bat breeding window and bird nesting season. The bat breeding window is from June 1 to November 15. The bird nesting season is from April 1 to June 30. Therefore, with these restrictions any clearing is recommended to occur after November 15 and before April 1 of any given year on this site.

7. Conclusions

Natural heritage information from secondary sources and associated reports were collated to provide the basis for this evaluation of potential impacts to the marine environment as a result of the proposed ISWMs facility . Although the majority of project components are outside of marine natural areas, there is some potential for protected species occurrence in select areas throughout the ISWMS Site (mainly of highly mobile, mangrove-dwelling wildlife species, such as birds and bats) and when importing waste from the Sister Islands, Cayman Brac and Little Cayman (mainly of marine wildlife). As such, general mitigation measures have been provided as recommendations to be implemented throughout construction and operation to satisfy the identified assessment and significance evaluation. Further evaluation of terrestrial wildlife species (i.e., protected birds and bats) and mitigation measures are provided in the ISWMS for the Cayman Islands – Terrestrial Ecology Assessment report (GHD 2023).

Many potential impacts typical to land development have been avoided or minimized due to the anticipated avoidance of direct discharge to the marine environment and mitigation of impacts should direct discharge be the only feasible alternative. With the implementation of the recommended mitigation efforts outlined in this report, it is anticipated that the construction of the proposed development will result in no significant residual effects to the marine environment.

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Figures

Paper Size ANSI A

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Kilometers

Map Projection: Lambert Conformal Conic
Horizontal Datum: Cayman Islands Geodetic Datum 2011
Grid: Cayman Islands National Grid 2011

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GRAND CAYMAN, CAYMAN ISLANDS
INTEGRATED SOLID WASTE MANAGEMENT
SYSTEM FOR THE CAYMAN ISLANDS
- MARINE ECOLOGY ASSESSMENT

MARINE ECOLOGY STUDY AREA

Project No. **12563972**
Revision No. **-**
Date **Jun 2, 2023**

FIGURE 1

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Data source: Google Earth Imagery, ©2023 Google, Data SIO, NOAA, U.S. Navy, NGA, GEBCO, Data LEDO-Columbia, NSF, NOAA; Imagery Date 12/13/2015

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Map Projection: Lambert Conformal Conic
Horizontal Datum: Cayman Islands Geodetic Datum 2011
Grid: Cayman Islands National Grid 2011

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GRAND CAYMAN, CAYMAN ISLANDS
INTEGRATED SOLID WASTE MANAGEMENT SYSTEM FOR THE CAYMAN ISLANDS - MARINE ECOLOGY ASSESSMENT

MARINE ECOLOGY DESIGNATED AREAS

Project No. **12563972**
Revision No. **-**
Date **Jun 2, 2023**

FIGURE 2

Q:\GIS\PROJECTS\12563000s\12563972\Layouts\MarineEcology\12563972_MarineEcology_GIS003.mxd
Print date: 02 Jun 2023 - 08:19

Data source: ESRI, GEBCO, NOAA, National Geographic, Garmin, HERE, Geonames.org, NGDC. National Conservation (Marine Parks) Regulations (2021 Revision) .

Paper Size ANSI A

0 0.25 0.5 0.75 1

Kilometers

Map Projection: Lambert Conformal Conic
Horizontal Datum: Cayman Islands Geodetic Datum 2011
Grid: Cayman Islands National Grid 2011

N

GRAND CAYMAN, CAYMAN ISLANDS
INTEGRATED SOLID WASTE MANAGEMENT
SYSTEM FOR THE CAYMAN ISLANDS
- MARINE ECOLOGY ASSESSMENT

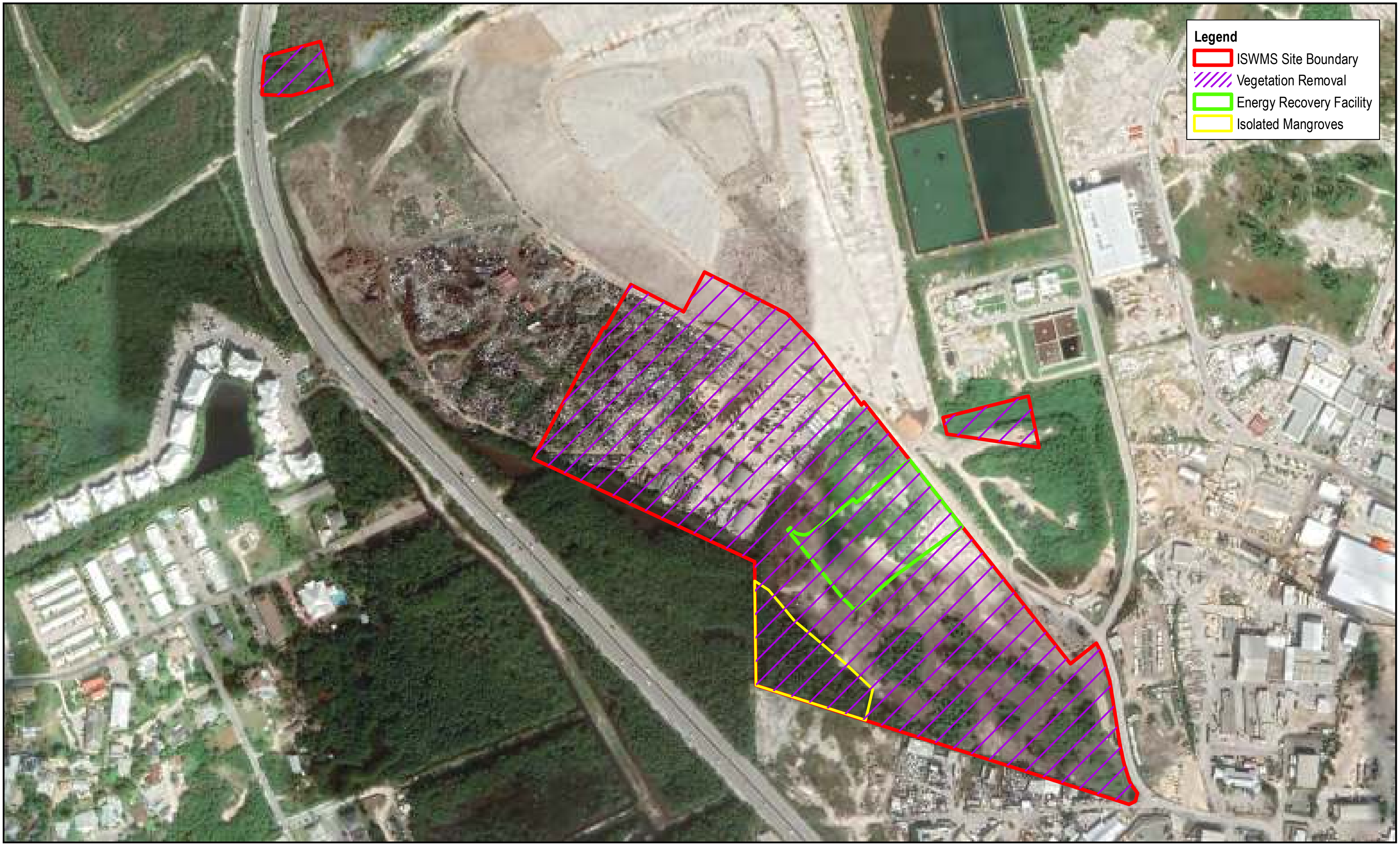
MARINE ECOLOGY
EXISTING CONDITIONS

Project No. **12563972**
Revision No. **-**
Date **Jun 2, 2023**

FIGURE 3

Q:\GIS\PROJECTS\12563000s\12563972\Layouts\MarineEcology\12563972_MarineEcology_GIS004.mxd
Print date: 02 Jun 2023 - 08:26

Data source: DoE, ESRI, GEBCO, NOAA, National Geographic, Garmin, HERE, Geonames.org, NGDC. .



Paper Size ANSI A

0 30 60 90 120

Meters

Map Projection: Lambert Conformal Conic
Horizontal Datum: Cayman Islands Geodetic Datum 2011
Grid: Cayman Islands National Grid 2011

N

GHD

GRAND CAYMAN, CAYMAN ISLANDS
INTEGRATED SOLID WASTE MANAGEMENT
SYSTEM FOR THE CAYMAN ISLANDS
- MARINE ECOLOGY ASSESSMENT

MARINE ECOLOGY IMPACT ASSESSMENT

Project No. **12563972**
Revision No. **-**
Date **Jun 2, 2023**

FIGURE 4

Q:\GIS\PROJECTS\12563000s\12563972\Layouts\MarineEcology\12563972_MarineEcology_GIS005.mxd
Print date: 02 Jun 2023 - 08:29

Data source: Google Earth, Image © 2023 Maxar Technologies, Imagery Date 7/11/2022

Appendices

Appendix A

Agency Correspondence

Amy Douglas

From:	Dombowsky, Lauren <Lauren.Dombowsky@gov.ky>
Sent:	Tuesday, November 29, 2022 2:13 PM
To:	Amy Douglas
Cc:	Katrina Greenfield; Olynik, Jeremy; Richard McAree; Ebanks-Petrie, Gina
Subject:	RE: Grand Cayman - Terrestrial Ecology Information Request

Hi Amy,

Thank you, please find a link to download our terrestrial and marine data here:

[redacted]

Kind regards,

Lauren Dombowsky, CEnv | Manager, Environmental Management Unit
Department of Environment | Cayman Islands Government
Environmental Centre | 580 North Sound Road
Box 10202| Grand Cayman KY1-1002
CAYMAN ISLANDS | Tel: (345) 244-5932

From: Amy Douglas [mailto:Amy.Douglas@ghd.com]
Sent: 29 November 2022 09:43
To: Dombowsky, Lauren <Lauren.Dombowsky@gov.ky>
Cc: Katrina Greenfield <Katrina.Greenfield@ghd.com>; Olynik, Jeremy <Jeremy.Olynik@gov.ky>; Richard McAree <Richard.McAree@dart.ky>; Ebanks-Petrie, Gina <Gina.Ebanks-Petrie@gov.ky>
Subject: [EXTERNAL] RE: Grand Cayman - Terrestrial Ecology Information Request

Hi Lauren,

Signed agreement attached. Thanks for your help on this. Much appreciated!

Amy Douglas
[she/her]

M.Sc.
Ecologist

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GHD FIRST Emergency Spill Hotline: +1 800 679 9082

→ The Power of Commitment

Connect

From: Dombowsky, Lauren <Lauren.Dombowsky@gov.ky>
Sent: Monday, November 28, 2022 11:03 AM
To: Amy Douglas <Amy.Douglas@ghd.com>

Cc: Katrina Greenfield <Katrina.Greenfield@ghd.com>; Olynik, Jeremy <Jeremy.Olynik@gov.ky>; Richard McAree <Richard.McAree@dart.ky>
Subject: RE: Grand Cayman - Terrestrial Ecology Information Request

Hi Amy,

Please see the attached spatial data sharing agreement. Once you sign, we will release the data we have. Some of the questions below refer to matters which have already been settled as part of the ToR, so it is vital that this is followed.

Kind regards,

Lauren Dombowsky, CEnv | Manager, Environmental Management Unit
Department of Environment | Cayman Islands Government
Environmental Centre | 580 North Sound Road
Box 10202| Grand Cayman KY1-1002
CAYMAN ISLANDS | Tel: (345) 244-5932

From: Amy Douglas [mailto:Amy.Douglas@ghd.com]
Sent: 18 November 2022 15:06
To: Dombowsky, Lauren <Lauren.Dombowsky@gov.ky>
Cc: Katrina Greenfield <Katrina.Greenfield@ghd.com>; Olynik, Jeremy <Jeremy.Olynik@gov.ky>
Subject: [EXTERNAL] RE: Grand Cayman - Terrestrial Ecology Information Request

Hi Lauren,
Thanks back to you for also being so speedy!
Correct, we are following the final Terms of Reference dated October 4, 2021.

We are also looking to contact:
- National Trust for the Cayman Islands
- National Conservation Council
- Birdlife International
- Central Caribbean Marine Institute
- Shark Conservation Cayman

If you have any other recommendations, I would be grateful for the local input.

As for useful information, ideally were looking for any habitat mapping you may have, any designated areas within the study area, and if there are any protected species that we have missed off our list.

Thanks,

Amy Douglas
[she/her]

M.Sc.
Ecologist

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Please consider the environment before printing this email

From: Dombowsky, Lauren <Lauren.Dombowsky@gov.ky>
Sent: Friday, November 18, 2022 2:49 PM
To: Amy Douglas <Amy.Douglas@ghd.com>
Cc: Katrina Greenfield <Katrina.Greenfield@ghd.com>; Olynik, Jeremy <Jeremy.Olynik@gov.ky>
Subject: RE: Grand Cayman - Terrestrial Ecology Information Request

Hi Amy,

Thanks for getting back to me so quickly. I will ask our Senior GIS Officer (cc'd) to clip our habitat mapping extent to 2 km from the terrestrial study area site.

Could I please check that you are following the scope outlined in the final Terms of Reference? It outlined what kind of information was available and should be used for the assessment.

With respect to your final questions, could you clarify what kind of additional information would be useful?

Kind regards,

Lauren Dombowsky | Manager, Environmental Management Unit
Department of Environment | Cayman Islands Government
Environmental Centre | 580 North Sound Road
Box 10202| Grand Cayman KY1-1002
CAYMAN ISLANDS | Tel: (345) 244-5932

From: Amy Douglas [mailto:Amy.Douglas@ghd.com]
Sent: Friday, November 18, 2022 2:18 PM
To: Dombowsky, Lauren <Lauren.Dombowsky@gov.ky>
Cc: Katrina Greenfield <Katrina.Greenfield@ghd.com>
Subject: [EXTERNAL] RE: Grand Cayman - Terrestrial Ecology Information Request

Hi Lauren,

The terrestrial study area extends 2 km from the site boundary, apologies, I should have included that on the snips.

Our marine study area extends 12 nautical miles from site.

Amy Douglas
[she/her]

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From: Dombowsky, Lauren <Lauren.Dombowsky@gov.ky>
Sent: Friday, November 18, 2022 2:12 PM
To: Amy Douglas <Amy.Douglas@ghd.com>
Cc: Katrina Greenfield <Katrina.Greenfield@ghd.com>
Subject: RE: Grand Cayman - Terrestrial Ecology Information Request

Hi Amy,

Could you confirm the study area? Is it restricted to the site or do you have an extent beyond that?

Kind regards,

Lauren Dombowsky, CEnv | Manager, Environmental Management Unit
Department of Environment | Cayman Islands Government
Environmental Centre | 580 North Sound Road
Box 10202| Grand Cayman KY1-1002
CAYMAN ISLANDS | Tel: (345) 244-5932

From: Amy Douglas [mailto:Amy.Douglas@ghd.com]
Sent: Friday, November 18, 2022 2:04 PM
To: Dombowsky, Lauren <Lauren.Dombowsky@gov.ky>
Cc: Katrina Greenfield <Katrina.Greenfield@ghd.com>
Subject: [EXTERNAL] Grand Cayman - Terrestrial Ecology Information Request

Hi Lauren,
Sharing the terrestrial ecology request this time. Please share with the appropriate team, thanks.

GHD Limited (GHD) was retained by DECCO Limited to determine the existing conditions of the terrestrial environment in the vicinity of the proposed Integrated Solid Waste Management System (ISWMS) site. The proposed site for the ISWMS is located to the north of central George Town towards the western coast of Grand Cayman, immediately south-west of the existing George Town Land Fill. The proposed ISWMS development consists of various new waste management facilities.

Please find mapping of the proposed site below.


West Bay
Rum Point
Old Man Bay
Grand Cayman
Breakers
George Town
Bodden Town

GHD's ecologists have completed background information reviews to characterize the associated terrestrial environment, with a focus on habitats, wildlife, protected species, and significant natural areas. Through the background review it was found that several species use the terrestrial habitats of the study area. A complete list of these species is attached.

We are seeking any additional natural environment assessments and protected species information for the listed location, and in particular any information about the mangroves east of the Esterly Tibbetts Highway.

Please let me know if you have any questions or require further information. We look forward to your response to our request.

Thank you,

Amy Douglas
[she/her]

M.Sc.
Ecologist

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GHD FIRST Emergency Spill Hotline: +1 800 679 9082

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Connect

Please consider the environment before printing this email

From:	Amy Douglas
To:	info@nationaltrust.org.ky
Cc:	Katrina Greenfield
Subject:	RE: Marine and Terrestrial Information for Grand Cayman
Date:	Thursday, April 27, 2023 1:49:42 PM
Attachments:	image003.png image004.png image005.png image006.png image007.png image008.png image009.png Terrestrial Protected Species.pdf

Good afternoon,
Please see the below request for information sent late last year.
We are hoping to receive a response to comprehensively complete our marine and terrestrial assessments of the proposed site.

Thanks in advance for your help.
Kind regards,
Amy

Amy Douglas
[she/her]

M.Sc.
Ecologist

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D +1 519 340 3871 **M** +1 226 748 9930 **E** amy.douglas@ghd.com
-
-
GHD FIRST Emergency Spill Hotline: +1 800 679 9082

From: Amy Douglas <Amy.Douglas@ghd.com>
Sent: Wednesday, November 23, 2022 1:39 PM
To: info@nationaltrust.org.ky
Cc: Katrina Greenfield <Katrina.Greenfield@ghd.com>
Subject: Marine and Terrestrial Information for Grand Cayman

Good afternoon,

GHD Limited (GHD) was retained by DECCO Limited to determine the existing conditions of the marine and terrestrial environment in the vicinity of the proposed Integrated Solid Waste Management System (ISWMS) site. The proposed site for the ISWMS is located to the north of central George Town towards the western coast of Grand Cayman, immediately south-west of the existing George Town Land Fill. The proposed ISWMS development consists of

Amy Douglas

From: Amy Douglas
Sent: Wednesday, November 23, 2022 1:39 PM
To: info@nationaltrust.org.ky
Cc: Katrina Greenfield
Subject: Marine and Terrestrial Information for Grand Cayman
Attachments: Terrestrial Protected Species.pdf

Good afternoon,

GHD Limited (GHD) was retained by DECCO Limited to determine the existing conditions of the marine and terrestrial environment in the vicinity of the proposed Integrated Solid Waste Management System (ISWMS) site. The proposed site for the ISWMS is located to the north of central George Town towards the western coast of Grand Cayman, immediately south-west of the existing George Town Land Fill. The proposed ISWMS development consists of various new waste management facilities. We have contacted the Department of Environment and are also reaching out to The National Trust for the Cayman Islands to ensure our information is complete.

Please find mapping of the proposed site below.

GHD's ecologists have completed background information reviews to characterize the associated marine and terrestrial environments, with a focus on marine, coastal and terrestrial habitats, wildlife, protected species, and significant natural areas.

<u>Marine Ecology</u>
Through the background review it was found that the following are found within a 5-kilometre radius of the site:

- Marine Reserve Zones: George Town and Seven Mile Beach are approximately 1.5 km west of the Site. South Sound West and South Sound East are approximately 5 km south of the Site
- Line Fishing Zone: Jackson Point is approximately 4.5 km south of the Site
- Shore Line Fishing Zone: George Town approximately 1 km west of the Site
- No-Diving Overlay Zone: South Sound is approximately 5 km south of the Site
- Spawning Aggregation Overlay Zone: Southwest zone is approximately 5 km southwest of the Site off the shore of South Sound Beach.

As well, the following protected species were reported to use the seagrass bed and mangrove habitats of the Study Area (i.e., the Site including a 12 nautical mile buffer):

- All birds (mangroves)
- Bats (mangroves)
- Manatees (seagrass beds)
- Whales and dolphins (seagrass beds)
- Turtles (both)
- American and Cuban crocodile (mangroves)
- Sharks and rays (seagrass beds)
- All bony fish (both)

<u>Terrestrial Ecology</u>
Through the background review it was found that several species use the terrestrial habitats of the Study Area (i.e., the Site including a 2 kilometre buffer). A complete list of these species is attached.

We are seeking any additional natural environment assessments and protected species information for the listed location, and in particular any information about the mangroves east of the Esterly Tibbetts Highway. Please let us know if you have any questions or require further information. We look forward to your response to our request.

Thank you,

Amy Douglas
[she/her]

M.Sc.
Ecologist

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D +1 519 340 3871 **M** +1 226 748 9930 **E** amy.douglas@ghd.com

GHD FIRST Emergency Spill Hotline: +1 800 679 9082

The Power of Commitment

Connect

From:	Amy Douglas
To:	info@reefresearch.org
Cc:	Katrina Greenfield
Subject:	RE: Marine Information for Grand Cayman
Date:	Thursday, April 27, 2023 1:52:42 PM
Attachments:	image001.png image002.png image003.png image004.png image005.png image006.png image007.png

---

Good afternoon,
Please see the below request for information sent late last year.
We are hoping to receive a response to comprehensively complete our marine assessment of the proposed site.

Thanks in advance for your help.
Kind regards,
Amy

Amy Douglas
[she/her]

M.Sc.
Ecologist

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-
-
GHD FIRST Emergency Spill Hotline: +1 800 679 9082

The Power of Commitment

Connect

From: Amy Douglas
Sent: Wednesday, November 23, 2022 1:48 PM
To: 'info@reefresearch.org' <info@reefresearch.org>
Cc: Katrina Greenfield <Katrina.Greenfield@ghd.com>
Subject: Marine Information for Grand Cayman

Good afternoon,

GHD Limited (GHD) was retained by DECCO Limited to determine the existing conditions of the marine environment in the vicinity of the proposed Integrated Solid Waste Management System (ISWMS) site. The proposed site for the ISWMS is located to the north of central George Town towards the western coast of Grand Cayman, immediately south-west of the existing George Town Land Fill. The proposed ISWMS development consists of various new waste management facilities. We have contacted the Department of Environment and are

Amy Douglas

From: Amy Douglas
Sent: Wednesday, November 23, 2022 1:48 PM
To: 'info@reefresearch.org'
Cc: Katrina Greenfield
Subject: Marine Information for Grand Cayman

Good afternoon,

GHD Limited (GHD) was retained by DECCO Limited to determine the existing conditions of the marine environment in the vicinity of the proposed Integrated Solid Waste Management System (ISWMS) site. The proposed site for the ISWMS is located to the north of central George Town towards the western coast of Grand Cayman, immediately south-west of the existing George Town Land Fill. The proposed ISWMS development consists of various new waste management facilities. We have contacted the Department of Environment and are also reaching out to the Central Caribbean Marine Institute to ensure our information is complete.

Please find mapping of the proposed site below.

GHD's ecologists have completed background information reviews to characterize the associated marine environments, with a focus on marine and coastal habitats, wildlife, protected species, and significant natural areas.

Through the background review it was found that the following are found within a 5-kilometre radius of the site:

- Marine Reserve Zones: George Town and Seven Mile Beach are approximately 1.5 km west of the Site. South Sound West and South Sound East are approximately 5 km south of the Site
- Line Fishing Zone: Jackson Point is approximately 4.5 km south of the Site
- Shore Line Fishing Zone: George Town approximately 1 km west of the Site
- No-Diving Overlay Zone: South Sound is approximately 5 km south of the Site
- Spawning Aggregation Overlay Zone: Southwest zone is approximately 5 km southwest of the Site off the shore of South Sound Beach.

As well, the following protected species were reported to use the seagrass bed and mangrove habitats of the Study Area (i.e., the Site including a 12 nautical mile buffer):

- All birds (mangroves)
- Bats (mangroves)
- Manatees (seagrass beds)
- Whales and dolphins (seagrass beds)
- Turtles (both)
- American and Cuban crocodile (mangroves)
- Sharks and rays (seagrass beds)
- All bony fish (both)

We are seeking any additional natural environment assessments and protected species information for the listed location, and in particular any information about the mangroves east of the Esterly Tibbetts Highway.

Please let us know if you have any questions or require further information. We look forward to your response to our request.

Thank you,

Amy Douglas
[she/her]

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Ecologist

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GHD FIRST Emergency Spill Hotline: +1 800 679 9082

From:	Johanna Kohler
To:	Amy Douglas
Cc:	Katrina Greenfield; Tim Austin; John Bothwell; Lauren.Dombowsky@gov.ky
Subject:	Re: Shark Conservation Cayman - Background Info Request
Date:	Thursday, May 11, 2023 9:40:17 AM
Attachments:	image001.png image002.png image003.png image004.png image005.png image006.png image007.png

Hello Amy,

Thank you for your patience. Here are the information you requested. Please see my answers to each of your points below.

- **any species information (e.g., shark breeding grounds, home ranges)**

Our surveys showed that the following 7 shark species occur in the upper 30m of our near coastal waters:

Caribbean reef shark (Carcharhinus perezi)

Nurse shark (Ginglymostoma cirratum)

Lemon shark (Negaprion brevirostris)

Blacktip shark (Carcharhinus limbatus)

Great Hammerhead (Sphyrna mokarran)

Scalloped hammerhead (Sphyrna lewini)

Tiger shark (Galeocerdo cuvier)

The most common species that are resident in Cayman throughout the year are the Caribbean reef shark, nurse shark and hammerhead sharks. Caribbean reef and nurse sharks have relatively small home ranges (<20km) and hammerheads have larger home ranges (>20km).
The exact breeding grounds are not identified however these species occur inside the North Sound and young sharks are present. Pregnant females and new-born sharks are more abundant during summer, which is evidence for reproductive activities (e.g. mating and pupping) to occur. appears to be the mating and pupping).
The blacktip shark, one of the lesser abundant species in Cayman, occurs almost entirely inside the North Sound on Grand Cayman.

- **any reports/locations of shark/ray vessel strikes**

To our knowledge we had no reports of a shark vessel strike in Cayman. At the Stingray City Sandbar occur ray vessel strikes on occasion.

- **any protected shark/ray species information available**

All shark species are protected within Cayman waters (coastal and off shore). More information can be found on our website www.doe.ky and in the National Conservation Law

(2013).

- **anything else you think may be beneficial to our assessment**

Regarding protected species information for the listed location: This location is on land and has no access to the ocean. Therefore sharks are not present at the listed location.

Please let me know if you have additional questions.

Best regards,
Johanna

Dr Johanna Kohler | Shark Project Officer
Department of Environment
P.O. Box 10202 // Grand Cayman KY1-1002 // The Cayman Islands | www.doe.ky
Phone: 949 - 8469
Mobile: 926 - 0135
| Earth provides enough to satisfy every man's need, but not every man's greed - Mahatma Gandhi

On Wed, May 3, 2023 at 12:45 PM Amy Douglas <Amy.Douglas@ghd.com> wrote:

> Hi Johanna and team,
>
> Thanks for the reply.
>
> We are seeking the following:
>
> - any marine environment assessments/information for Grand Cayman
> - any species information (e.g., shark breeding grounds, home ranges)
> - any reports/locations of shark/ray vessel strikes
> - any protected shark/ray species information available
> - anything else you think may be beneficial to our assessment
>
> While we do not believe this project will result in any pathway of effects to the marine environment, we want to be sure we have characterised the existing conditions correctly.
>
> Thanks for your help with this!
>
> **Amy Douglas**
> **[she/her]**
>
> **M.Sc.**
> **Ecologist / Project Manager**
>
> **GHD**
>
> **Proudly employee-owned |** ghd.com
>
> 455 Phillip Street Waterloo Ontario N2L 3X2 Canada

D +1 519 340 3871 **M** +1 226 748 9930 **E** amy.douglas@ghd.com

---

From: Johanna Kohler <sharkloggers@gmail.com>
Sent: Friday, April 28, 2023 11:38 AM
To: Amy Douglas <Amy.Douglas@ghd.com>
Cc: Katrina Greenfield <Katrina.Greenfield@ghd.com>; Johanna Kohler <johanna.k.kohler@gmail.com>; Tim Austin <Timothy.Austin@gov.ky>; John Bothwell <John.Bothwell@gov.ky>; Lauren.Dombowsky@gov.ky
Subject: Re: Shark Conservation Cayman - Background Info Request

Hello Amy,

Thank you for reaching out to us. I am the Shark Project Officer at the Cayman Islands Department of Environment (DoE). I have cc'd my coworkers at the Department including Timothy Austin (DoE Deputy Director), John Bothwhell (Manager of DoE's Legislation Implementation & Coordination Unit), and Lauren Dom (Manager of DoE's Environmental Management Unit) who will be happy to assist you.

Please let us know what exact information you are looking for.

Best regards,

Johanna

Dr Johanna Kohler | Shark Project Officer

Department of Environment

P.O. Box 10202 // Grand Cayman KY1-1002 // The Cayman Islands | www.doe.ky

Phone: 949 - 8469

Mobile: 926 - 0135

> "Never doubt that a small group of thoughtful, committed citizens can change the world; indeed, it's the only thing that ever has." - Margaret Mead

On Thu, 27 Apr 2023 at 14:11, Amy Douglas <Amy.Douglas@ghd.com> wrote:

> Good afternoon,
>
> We're trying to get into contact with a representative from Shark Conservation Cayman for our below request. If you are able to help us, or know someone who can, we greatly appreciate your efforts! Please see our request below…
>
> GHD Limited (GHD) was retained by DECCO Limited to determine the existing conditions of the marine environment in the vicinity of the proposed Integrated Solid Waste Management System (ISWMS) site. The proposed site for the ISWMS is located to the north of central George Town towards the western coast of Grand Cayman, immediately south-west of the existing George Town Land Fill. The proposed ISWMS development consists of various new waste management facilities.
>
> Please find mapping of the proposed site below.

GHD's ecologists have completed background information reviews to characterize the associated marine environment, with a focus on marine and coastal habitats, wildlife, protected species, and significant natural areas.

Through the background review it was found that the following are found within a 5-kilometre radius of the site:

- Marine Reserve Zones: George Town and Seven Mile Beach are approximately 1.5 km west of the Site. South Sound West and South Sound East are approximately 5 km south of the Site
- Line Fishing Zone: Jackson Point is approximately 4.5 km south of the Site
- Shore Line Fishing Zone: George Town approximately 1 km west of the Site
- No-Diving Overlay Zone: South Sound is approximately 5 km south of the Site
- Spawning Aggregation Overlay Zone: Southwest zone is approximately 5 km southwest of the Site off the shore of South Sound Beach.

As well, it was found that sharks were reported to use the seagrass bed habitats of the study area.

We are seeking any additional natural environment assessments/information and protected species information for the listed location.

Please let us know if you have any questions or require further information. We look forward to your response to our request.

Thank you,

Amy Douglas
[she/her]

M.Sc.
Ecologist

GHD

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Appendix 7.A
Terrestrial Ecology Report

Contents

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Appendix A	Agency Correspondence
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Appendix C	Bat Detector Results
Appendix D	Audiofauna Monitoring Results
Appendix E	Wildlife Camera Monitoring Results
Appendix F	Protected Species List

Glossary

BMP	Best Management Practices
CBD	Convention on Biological Diversity
CIG	Cayman Islands Government
DoE	Department of Environment, Cayman Islands
EAB	Environmental Assessment Board
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
ERF	Energy Recovery Facility
ES	Environmental Statement
GTLF	George Town Landfill
km	kilometres
m	metres
mm	millimetres
NBAP	National Biodiversity Action Plan
ISWMS	Integrated Solid Waste Management System
NCL	National Conservation Law
TOR	Terms of Reference

1. Introduction

1.1 Purpose of this report

GHD Limited (GHD) was retained by ReGen and the Cayman Islands Government (CIG) as approved by the Environmental Assessment Board (EAB) to determine the existing conditions and impact assessment of the terrestrial environment in the vicinity of the proposed Integrated Solid Waste Management System (ISWMS) Site. GHD's ecologists have completed background information reviews to characterize the associated terrestrial environment, with a focus on the terrestrial habitats, wildlife, protected species, and significant natural areas. The purpose of this report is to document:

– Environmental policy potentially applicable to proposed works
– Methodology for the background review
– Methodology for completing targeted surveys
– Existing terrestrial environmental conditions
– Impact of the proposed project
– Monitoring measures

Existing conditions are based on the time of EAB acceptance of the ISWMS Environmental Impact Assessment Terms of Reference (TOR) in September 2021 (Wood 2021).

1.2 Overview of the proposed development

The proposed ISWMS Site is located to the north of central George Town towards the western coast of Grand Cayman, immediately south-west of the existing George Town Landfill (GTLF; **Figure 1**).

The proposed ISWMS development consists of various new waste management facilities. The various components of the ISWMS subject to assessment in this *Terrestrial Ecology Assessment – Existing Conditions Report* are as follows:

– Energy Recovery Facility (ERF)
– Non-ERF infrastructure:
  - Green Waste Processing Facility
  - Construction and Demolition Waste Processing Facility
  - Bottom Ash Processing Facility
  - Abandoned and End-of-Life / Scrap Metal Processing Facility
  - Medical Waste Facility
  - Landfill Gas Facility
  - Residual Waste Landfill

The design life of the new facilities is 25 years.

1.3 Study area

A Study Area was developed as part of the TOR (Wood 2021) to determine if any nationally designated sites, significant natural areas, habitats, or protected species could occur within or near the proposed ISWMS Site. This Study Area included the ISWMS Site and a 2-kilometre (km) buffer (**Figure 1**).

2. Applicable standards and guidelines

This section identifies Territory and other regulatory legislation and policies that are applicable and relevant to the Study Area and the immediate vicinity. This includes policies that triggered the study. These documents may identify natural features, protected species, and other habitats as well as other features relevant to this Study Area.

2.1 Cayman Island National Trust Act

The *Cayman Island National Trust Act (2010 revision)* establishes the National Trust for the Cayman Islands as a corporate body. It shall manage and conserve natural and cultural beauty and wealth of Cayman Islands including submarine areas.

The purpose of the Trust is:

– the preservation of the historic, natural, and maritime heritage of the Islands through the preservation of areas, sites, buildings, structures, and objects of historic or cultural significance
– the conservation of lands, natural features, and submarine areas of beauty, historic or environmental importance which the Trust may have acquired through gift, bequest, purchase, lease, or other means
– the protection of native flora and fauna

2.2 National Conservation Law

The *National Conservation Law* (NCL; 2013) makes provision for the conservation of wildlife and the environment in the Cayman Islands and provides for enforcement and penalties. The NCL incorporated the Species Conservation Plan for Mangroves which came into effect on 26 April 2020, which lists species under Part 1 are protected at all times, while those listed under Part 2 may be hunted or collected in accordance with regulations or a conservation plan (if any). The Department of Environment (DoE) is the lead body for legal protection of listed species.

The purpose of the NCL is to:

– Promote and secure biological diversity and the sustainable use of natural resources in the Cayman Islands
– Protect and conserve endangered, threatened, and endemic wildlife and their habitats
– Provide for protected terrestrial, wetland, and marine areas
– Give effect to the provisions of the protocol concerning specially protected areas and wildlife to the convention for the protection and development of the marine environment of the wider Caribbean region
– Give effect to related provisions of the *Convention on Wetlands of International Importance especially as Waterfowl Habitat*, the *Convention on the Conservation of Migratory Species of Wild Animals*, the *Global Convention on Biological Diversity* and the *United Nations Framework Convention on Climate Change*
– Repeal the Marine Conservation Law (NCL, 2013); and for incidental and connected purposes

The NCL establishes the hierarchy to develop conservation plans as Part of Protected Species under Part 1 & 2. Sections 25 of the Development and Planning Act (DoE 2021) provides conditions in order to preserve trees and woodlands.

All of the mangrove species covered by the Special Conservation Plan for Mangroves are protected under Part 2 of Schedule 1 of the NCL. Mangrove loss has been extensive in recent decades. In 2008, the IUCN (International Union for Conservation of Nature and Natural Resources) Red List listed black mangrove (*Avicennia germanans*) as endangered, white mangrove (*Laguncularia racemosa*) and buttonwood (*Conocarpus erectus*) as vulnerable, and red mangrove (*Rhizophora mangle*) as near-threatened. The Development and Planning Act allows for some protection and preservation of mangrove habitat through buffers. Section 26 of the Development and Planning Act provides guidance to maintain mangrove buffers.

The NCL also provides grounds to establish the Animals Law (2013) in which makes provisions for the protection of animals against diseases and cruel treatment, goals for developing livestock areas for breeding and control of animals and the protection of wildlife.

2.3 Wastewater Collection and Treatment Law

The *Wastewater Collection and Treatment Law* (*2019 Revision*) was amended in conjunction with the establishment of the Utility Regulation and Competition Office (OfReg). The OfReg was established to accept the licensing responsibilities of the Water Authority, and for incidental and connected purposes.

2.4 Water Authority Act

If any sewage effluent, trade effluent, or other wastes are proposed to be discharged into or onto the ground, a permit under the *Water Authority Act (2022 Revision)* will need to be obtained.

2.5 International agreements

Cayman Islands are included in the United Kingdom's (UK) ratification of the following international agreements relevant to the marine environment and the proposed development:

Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention)
The mission of the Ramsar Convention is the wise use of all wetlands through local and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world. There is no hunting, no collecting of any species, and no littering permitted within Ramsar sites.

Convention on Biological Diversity (CBD)
This convention was set in place to provide direction to achieve goals to enhance global diversity, conserve nature and that benefits from genetic diversity are shared fairly with the population.

Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)
Provides a global platform for the conservation and sustainable use of migratory animals and their habitats.

Convention on Biological Diversity (CBD)
This convention was set in place to provide direction to achieve goals to enhance global diversity, conserve nature and that benefits from genetic diversity are shared fairly with the population.

2.6 Local guidance

The National Biodiversity Action Plan (NBAP; DaCosta-Cottam et al. 2009) was developed by the DoE of the Cayman Islands to help guide and inform design and planning agencies to formulate sustainable and functional uses of the resources of the islands. The NBAP is planned to evolve with the changes and needs constantly addressed through revisions.

The NBAP attempts to address the concern for loss of biodiversity as outlined under the CBD and it identifies goals in order to strive to maintain biodiversity. The plan gathers available information on the ecosystems and environment that are present within the Cayman Islands. The baseline information that is gathered and applied in a multi branched approach by developing Habitat Action Plans (HAPs) and Species Action Plans (SAPs). These plans a set number of targets and proposed actions that are aimed at supporting and maintaining biodiversity.

The ultimate goal of the NBAP is zero extinction in the Cayman Islands.

2.7 Ecology and Environmental Management

The Chartered Institute of Ecology and Environmental Management (CIEEM) is a registered charity based in the United Kingdom (UK) that established a set of guidelines for Ecological Impact Assessment (EcIS) in the UK and

Ireland (CIEEM 2018). These guidelines promote good practices when conducting EcIS relating to terrestrial, freshwater, and coastal marine environments in the UK and Ireland. These guidelines were relied upon to advise the preparation of the Environmental Statement (ES). As stated in the guidelines where an ES is required the EcIS will be presented in a way that fits the overall structure and style of the ES while utilizing best practices within the CIEEM guidelines.

The CIEEM is also a resource to obtain an ecologist or environmental manager during project construction and operation. The members and practitioners of CIEEM are professionally trained individuals who manage, protect, and improve the natural environment. While the CIEEM was recommended in the ToR it is currently limited to the UK and Europe. Therefore, the ISWMS Site will implement the oversight of ecologists or experienced environmental managers to ensure best practices are utilized on Site to maintain the integrity of the environment.

3. Methodology

Available secondary sources of information were collected and reviewed to characterize the terrestrial environment existing conditions within the Study Area. The following sources of secondary information were reviewed:

– Cayman Islands Department of Environment:
  - NBAP (DaCosta-Cottam et al. 2009)
  - National Conservation Law (2013) – Part 1 & 2, Schedule 1
  - Species Conservation Plan for Mangroves[1] (National Conservation Act, section 17)
– Google Earth - web-based aerial imagery (select availability representing 2004 – 2023)
– UK Overseas Territories and Crown Dependencies- 2011 Biodiversity Snapshot
– Cayman Island National Trust - 2018-2019 Annual Report
– iNaturalist - plant and animal observations in vicinity of Study Area

The following tasks were completed to collect primary information from the Study Area:

– Field reconnaissance assessment of existing conditions and sensitivities that may be affected by the proposed project, including Site photographs
– Installation of stationary equipment within the Site to complete targeted surveys to determine presence or absence of any wildlife

3.1 Consultation

To establish a comprehensive baseline condition of the Study Area's terrestrial environment, the DoE, the National Trust for the Cayman Islands, the National Conservation Council, and BirdLife International were contacted for records of protected species, species habitat mapping and additional natural features information including designated areas within the Study Area.

3.2 Feature value at a project scale

Terrestrial ecological features (i.e., habitats, protected species) within the Study Area that could be affected by the development are assigned a value at a project scale in accordance with the ToR. These values are assigned based on the conservation status or the species or habitat and their ecological importance as outlined in **Table 1** (adapted from Table 5.5 of the ToR). Where numerous species of wildlife are discussed (e.g., bats, birds) the highest value across the species is assigned to the group.

[1] National Conservation Council (NCC). *Species Conservation Plan for Mangroves*. 2021. URL: Species-Conservation-Plan-for-Mangroves-FINAL.pdf.

Table 1 Importance of the proposed ISWMS development for terrestrial ecological features

Geographic context of importance	Value*	Description
International	I-3	Sites of international importance (e.g., Ramsar Conservation Wetland of International importance)
	I-4	Internationally endangered species (e.g., Species on the International Union for Conservation of Nature's Red List of Threatened Species (IUCN Red List)
	I-5	Species endemic to the Cayman Islands
National	N-4	A nationally designated site including National Trust parks
	N-5	Species protected under Schedule 1 Part 1 and 2 of the NCL
	N-6	Species and habitats listed in the NBAP
Local	L-4	Protected species that based on their extent, population size, quality, etc. are determined to be at a lesser level of importance than the geographic contexts above
	L-5	Common and widespread semi-natural habitats occurring within the Study Area in proportions greater than may be expected in the local context
	L-6	Common and widespread native species occurring within the Study Area in numbers greater than may be expected in the local context
Negligible	Ne-3	Common and widespread semi-natural habitats and species that do not occur in levels elevated above those of the surrounding area
	Ne-4	Areas of heavily modified or managed land uses (e.g., hard standing used for car parking, as roads, etc.)
Notes		
* Value numbering continues from M*arine Ecology Assessment – Existing Conditions Report* **Table 1**		

3.3 Terrestrial habitat assessment

The following tasks were completed to collect primary information from the Study Area:

- Field reconnaissance assessment of existing conditions and sensitivities that may be affected by the proposed project, including Site photographs
- Installation of stationary equipment within the Site to complete targeted surveys to determine presence or absence of any wildlife

Additional terrestrial habitat assessment was conducted using the pre-existing mapped data of the Site. A botanical inventory was completed using photos collected by others, from areas where access permitted. Vegetation mapping was refined using Vegetation Classification for the Cayman Islands scheme through analysis of the deployed cameras.

3.4 Wildlife surveys

3.4.1 Bat acoustics surveys

Bat acoustic survey devices (i.e., bat detectors) were installed at two locations (**Figure 2**) (an example of a bat acoustic survey equipment set-up is shown in **Figure 3**). The detectors were placed within potentially suitable roosting habitat and left to record during the maternity roosting period. Potentially suitable habitat was identified as mixed, deciduous, or coniferous forests, or any wooded areas with less than 60 percent canopy cover, but where large potentially suitable roost trees were present. These locations aimed to capture the variety of treed habitats that may be impacted within the Site, and to detect which high intensity echolocating bat species are present. No systematic cavity or roost tree surveys were carried out; however, observations of potentially suitable habitat were made during background review, aerial imagery analysis, and detector installation. Observations during detector set up did not reveal a high abundance of suitable forested/wooded areas within the Site. Wooded potential habitat along the northeast perimeter of the Site was targeted with the location of Bat Detector 1 (Bat 1), while mangrove potential habitat along the south-central perimeter of the Site was targeted with the location of Bat Detector 2 (Bat 2; **Figure 2**).

The bat detectors (Wildlife Acoustics SM4BAT+ model) were deployed on October 28, 2021. Bat 1 was deployed through to December 10, 2021, while Bat 2 deployed through to February 15, 2022. Each detector was set to record nightly from 30 minutes before sunset to 30 minutes after sunrise, and to record files of up to 15 seconds in duration any time they detected a sound in the frequencies typically used by bats.

Call files were subsequently downloaded and processed in Kaleidoscope Pro using the Bats of the Neotropics v5.4.0 with a +1 conservative classifier option to aide in assigning species identifications to each file. Manual review of recorded bat calls followed the hierarchical steps below:

- Evaluation of the Maximum Likelihood Estimator[2] (MLE) output by Kaleidoscope for each species and the total numbers of calls, calls identified as bat calls by the software but not identified as specific species, and noise files.
- Visual signature confirmation of the presence of species with an MLE value of 0 (to confirm presence) by manual review of selected calls.
- Manual review of all calls identified to species level for species which were given an MLE of 1 (i.e., considered false positives by the software).
- Review of 5 percent of the calls for which no auto-identification was possible, biased towards calls with the highest number of call pulses, with a focus on identifying any species calls not already recorded.

Bat acoustic surveying only records bat species that echolocate at a high intensity (i.e., those bolded in **Table 2**) The Cayman Islands is also home to two low intensity echolocating species and three species that are non-echolocating. While it is possible for these species to be present on Site, acoustic survey devices are not sensitive enough to pick up low intensity calls, and species that are non-echolocating need to be assessed using other methods (i.e., mist netting, roost exit/entry surveys).

Table 2 Potential bat species by echolocation type

Bat species	Echolocating/Non-echolocating
Antillean nectar bat, *Brachyphylla nana nana*	Non-echolocating
Big brown bat, *Eptesicus fuscus minor*	**Echolocating – high intensity**
Brazilian free-tailed bat, *Tadarida brasiliensis muscala*	**Echolocating – high intensity**
Buffy flower bat, *Erophylla sezekorni*	Non-echolocating
Eastern red bat, *Lasiurus borealis*	**Echolocating – high intensity**
Jamaican fruit bat, *Artibeus jamaicensis parvipes*	Echolocating – low intensity
Pallas's mastiff bat, *Molossus molossus*	**Echolocating – high intensity**
Waterhouse's leaf-nosed bat, *Macrotus waterhousii minor*	Echolocating – low intensity
White-shouldered bat, *Phyllops falcatus*	Non-echolocating
Notes	
Acoustic survey devices will only detect species in bold (i.e., high intensity echolocating species).	

3.4.2 Audiofauna surveys

One Wildlife Acoustics Songmeter SM4 acoustic recorder with omnidirectional microphones was deployed in a mapped Urban and Man-Modified area with occasional shrubs. This area was identified to have suitable habitat for resident and migratory bird species (**Figure 2**). The device was installed 1.5 metres (m) above ground level and recorded calls at an interval of 5 minutes on/15 minutes off for a total of 1 hour during dawn and dusk periods (an

[2] The maximum likelihood estimator determines what the most likely distribution of different species are that would result in the observed classifications given the classifier error rate (Wildlife Acoustics 2021).

example of an audiofauna survey equipment set-up is shown in **Figure 3)**. The device was actively recording from October 28, 2021, to February 1, 2022. Data was processed using Kaleidoscope Pro Analysis Software to sort, label, and identify bird songs. A manual auditory review was conducted by an experienced GHD ecologist to verify the species identified by the software and to identify other distinguishing faunal sound recordings.

3.4.3 Wildlife camera monitoring

Five wildlife cameras were deployed from October 28, 2021, to January 17, 2022, to detect incidental wildlife on the Site (**Figure 2**) (an example of a wildlife camera survey equipment set-up is shown in **Figure 3**). These cameras were orientated towards potential high traffic wildlife areas to photograph incidental wildlife that may traverse the Site. The cameras were set to trigger following motion detection 24-hours per day. Photos were downloaded bi-weekly by a Site staff member and were analysed by GHD ecologists. Camera 5 was moved to the location indicated on **Figure 3** on November 18, 2021.

Figure 3 ***Survey Devices***

4. Baseline conditions

4.1 Existing environment

The Site consists of areas of filled land, mangrove, poorly vegetated land, and bare ground. The southwest part of the Site comprises a mangrove community. The remainder of the Site is a combination of bare ground, landfilled ground, and a few small operations buildings with little or no vegetative cover. Vegetation removal has been on-going in the southeast part of the Study Area since the TOR was in development as part of Site operations associated with the GTLF.

The Site lies within a landscape which is mostly heavily developed, and construction has occurred on all sides. Immediately north of the Site lies the GTLF – the northwestern part of the proposed ISWMS Site is formed of part of the landfilled area. An inland remnant mangrove and the Esterly Tibbetts Highway are to the west, and to the northeast is the Cayman Islands wastewater treatment plant. Immediately south and east of the Site is an industrial area comprising bare land, open air storage of plant and equipment, and a series of (generally) low rise industrial buildings.

This current characterization of the Site as filled land, mangrove, poorly vegetated land, and bare ground is the baseline used for the impact assessment for the proposed ISWMS as it is surrounded by developed or developing lands.

4.2 Consultation results

The DoE was consulted on November 18, 2022, with response received on November 29, 2022. Terrestrial mapping within a 1.2 mile (2 km) radius of the Site was shared and incorporated into the baseline conditions. This mapping delineated mangroves, wetlands, bat house and colony locations, lands protected by the National Conservation Act and by the National Trust for the Cayman Islands (**Figure 4**), habitat mapping (discussed further in **Section 4.4.1; Figure 5**), and historical vegetation mapping (discussed further in **Section 4.4.3; Figure 6**).

The National Trust for the Cayman Islands, the National Conservation Council, and BirdLife International were contacted on November 23, 2022 and April 27, 2023. No responses were received to date.

All agency correspondence is presented in **Appendix A**.

4.3 Designated / policy areas

Within the defined desktop study radius there are two proposed Ramsar sites, details of which are provided in **Table 3**. These features are located outside the Study Area; however, data was collected within the TOR (Wood 2021) which included a 7.46 mile (12 km) radius from Site for the purposes of this evaluation.

On February 27, 2023, the CIG issued an Interim Directive for the Protection of the Grand Cayman Blue Iguana (*Cyclura lewisi*) in accordance with Section 17 (7) of the National Conservation Act (2013). This interim directive focuses on the immediate protection of the portion of the Cayman Island blue iguana population residing in the east end of Grand Cayman (greater than 25 km east of the proposed ISWMS.

Table 3 Designated / policy areas in and near the Study Area

Name	Status	Approximate distance and direction from proposed development site	Description	Feature value at a project scale
Central Mangrove Wetland, Little Sound, Ponds and associated Marine Zones	Proposed Ramsar site	4.5 km east	A 98 percent pristine mangrove wetland covering approximately 30 percent of the area of Grand Cayman. It supports important habitats, marine invertebrates, and internationally important populations of migratory birds.	I-3: as a proposed site of international importance (i.e., Ramsar Conservation Wetland of International importance)
Barkers Wetland	Proposed Ramsar site	7.5 km north	One of the largest areas of undeveloped land on the western peninsula of Grand Cayman, it is a continuum from coral reef to coastal forest and mangrove. The wetland supports breeding and migratory birds as well as important invertebrates and endemic fish.	I-3: as a proposed site of international importance (i.e., Ramsar Conservation Wetland of International importance)
DoE Primary habitat and Land use "Wetland" (**Figures 4** and **5**)	Mapped under CBD and NCL	On Site. Adjacent the west Site boundary and the further west Esterly Tibbetts Highway; along the north edge of the property line.	Primary habitat is mature habitat in its natural state, otherwise uninfluenced by human activity where ecological processes are not significantly disturbed. This is the preferred habitat where species can persist. These locations are areas where important ecological processes and vital interface interactions between ecosystems occur.	Discussed in **Section 7.5.4.1.1** and **7.5.4.2**
DoE Land use "Man-Modified" (**Figure 4**)	Mapped under NCL	On Site. South end of study Site, east of Dump Road.	Defined as the populated areas of the Cayman Island, and those areas of land subject to direct modification by humans.	Discussed in **Section 7.5.4.1.2**

4.4 Terrestrial habitat assessment

Site primary source data collection was limited to the acoustic and camera methodologies outlined in **Section 3.4**, and supplemented with secondary source information.

A key reference of secondary source information relied upon was the detailed terrestrial habitat assessment of the Cayman Islands conducted as part of the NBAP. Terrestrial habitats were divided into salt-tolerant succulents, pools, ponds, and mangrove lagoons, dry shrubland forest and woodland, caves, farms and grassland, urban and man-modified areas, and roads.

4.4.1 Land use

DoE habitat mapping (**Figure 5**) shows that the proposed development on the Grand Cayman is primarily located on Wetland and Urban and Man-modified Areas on Site.

Wetland

Wetland is a vegetation community that contain any amount marsh, swamp, mangrove, or other non-marine water areas, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish, or salt, and includes any terrestrial or marine area forming part of the same ecological system (Ramsar Convention 2016). **Figure 4** presents a large area in the southeast portion of the ISWMS Site as wetland; however, Site investigations have confirmed the majority of these lands have been previously disturbed and used for waste disposal activities dating back 18 years or more.

The NBAP defines the habitat of 'pools, ponds and mangrove lagoons' as "natural and man-modified areas of standing permanent and temporary water and associated vegetation, including pools, ponds, ditches and flooded marl pits"[3]. Given their similarity by definition, wetlands are assigned a value of N-6 at a project scale due to pools, ponds and mangrove habitat being listed in the NBAP.

Urban and man-modified areas

Urban and Man-modified areas of the Caymans Islands are defined as the populated areas that have been subject to direct modification by humans. This may include residential areas, commercial areas, public and private green-space, land cleared for development, active farmland, or historically cleared areas. Roads are a component of this feature but can also be classified under their own habitat. (DaCosta-Cottam et al. 2009). Within the Site, the majority of the western section and the perimeter of the eastern section are mapped as man-modified areas. While not mapped as such, Site investigations have confirmed that the majority of the southeast portion of the ISWMS Site has been previously disturbed and should be considered man-modified areas.

Urban and Man-Modified areas are assigned a value of N-6 at a project scale due to the habitat being listed in the NBAP.

4.4.2 Primary habitat

Primary Habitat is defined as mature habitat in its natural state, otherwise uninfluenced by human activity where ecological processes are not significantly disturbed (DoE 2020). As part of international agreements that were set for the CBD, Ramsar and Bonn Agreements, Primary Habitat has been mapped in the Cayman Islands. **Figure 5** demonstrates the areas on and surrounding the Site that have been mapped as Primary Habitat. Within the Site, Primary Habitat represents the same areas as defined previously as wetland (**Figure 4**).

Site investigations have confirmed that the terrestrial habitat within the southeast portion of the ISWMS Site, while mapped previously as Primary Habitat, is no longer consistent with the definition. Prior to acquisition by DART in November 2020, these lands were cleared and used for waste disposal activities. As such, this habitat is assigned a

[3] DaCosta-Cottam, M., J. Olynik, J. Blumenthal, K. D. Godbeer, J. Gibb, J. Bothwell, F. J. Burton, P. E. Bradley, A. Band, T. Austin, P. Bush, B. J. Johnson, L. Hurlston, L. Bishop, C. McCoy, G. Parsons, J. Kirkconnell, S. Halford, and G. Ebanks-Petrie. *Cayman Islands National Biodiversity Action Plan 2009, Cayman Islands Government, Department of Environment*. 2009

value of Ne-3 at a project scale due to common and widespread semi-natural habitats that do not occur in levels elevated above those of the surrounding area.

4.4.3 Vegetation reconnaissance

The lands within the Site are predominantly industrial, occasional shrubland, and thickets inundated with water. Vegetation communities that were mapped as part of historical data, are shown on **Figure 6**. The composition of shrub communities was variable, ranging from deciduous lowland shrublands, frequently containing red mangrove or black mangrove. There are numerous culturally disturbed areas within the limits of the Site to the operations of the Site. Many of the areas noted as wetland vegetation communities have been historically cleared.

The historical vegetation mapping (**Figure 6**) identifies the western side of the property abutting Esterly Tibbetts Highway as being dominated by medium height black mangrove (10-30 feet (3 - 9 m)) and sub-dominated by medium height white mangrove (10-30 feet (3 – 9 m)). This same community is identified on **Figure 6** as being present in the Caribbean Utility Company (CUC) substation Study Area to the northwest, north of Esterly Tibbitts Highway.

A swamp dominated by red mangrove in which tall black mangrove occurs occasionally is found along the northeastern portion of the property, beyond the Site boundaries, but within the Study Area. A portion of the Study Area in the south, east of Seymour Road is identified as being dominated by tall black mangrove, sub dominated by tall red mangrove, with patches of golden leather fern (*Acrostichum aureum*). The DoE habitat mapping (**Figure 5**) identifies this area as Man-modified and falls outside the Primary Habitat areas.

Certain areas of vegetation were dominated primarily by unidentified mangrove. While other areas were observed with other tree species present, which include Florida thatch palm (*Thrinax radiata*) and river tamarind (*Leucaena leucocephala*). One shrub species, golden leather fern, was identified. Other plants included tridax daisy (*Tridax procumbens*) and chamberbitter (*Phyllanthus urinaria*). A preliminary list of vascular plant species can be found in **Appendix B.**

Given that these lands were cleared and used for waste disposal activities prior to acquisition by DART in November 2020, these on-Site vegetation communities are assigned a value of Ne-3 at a project scale due to being common and widespread semi-natural habitats not occurring in levels elevated above those of the surrounding area.

4.5 Wildlife

Several species of wildlife were recorded on Site during Site investigation and through the deployed survey devices. These included green iguana (*Iguana iguana*), red junglefowl (*Gallus gallus*), and stray animals such as feral dogs (*Canis familiaris*), and cats (*Felis catus*). These species are all common to Grand Cayman. Additional wildlife observations are presented below.

4.5.1 Bat acoustic survey results

Given the abundance of bat houses and colonies within the Study Area (delineated on the DoE existing conditions mapping, **Figure 5**), bat detectors were installed at two locations (**Figure 2**). The estimated bat passes recorded during the survey are presented in **Table 5** by species and location. Complete bat acoustic monitoring results are presented in **Appendix C**.

Of the four species of bats with a reasonable likelihood of detection through acoustic surveys (i.e., high intensity echolocating species), Pallas's mastiff bat and Brazilian free-tailed bat were confirmed on Site. Eastern red bat and big brown bat calls could not be positively confirmed upon manual review of the call data. Overall, the auto-identified eastern red bat calls (18 at Bat 1, 53 at Bat 2) were generally Pallas's mastiff bat search phase calls and feeding buzzes where the higher frequency pulses of this species confused the auto-classifier, or calls misidentified due to poor call quality for auto analysis (typical Pallas's call characteristics evident on manual review were not picked up by the software). Auto-identified big brown bat calls (four at Bat 1, 14 at Bat 2) were generally of insufficient call quality to determine species, but many were deemed likely to be Brazilian free-tailed based on the visible call characteristics. The majority of the sampled "no ID" call files were Pallas's mastiff bat, or either non-bat or small fragments of bat calls that could not be identified. The species could not be identified due to too few call pulses and/or poor quality to confirm species identity.

Bats as a group are assigned a value of N-5 at a project scale due to all species being protected under Schedule 1 Part 1 of the NCL, and species and their habitats being listed in the NBAP.

Table 4 Bat acoustic survey results summary

Detector	Pallas's Mastiff Bat Calls*	Brazilian Free-tailed Bat Calls*	Noise Files (Auto-ID)
Bat 1	1,896	114	30,962
Bat 2	11,173	1,200	3,046
Notes			
* Call totals reported include all auto-identified calls for the species, vetted/manually corrected calls auto-identified as an alternative species (eastern red bat or big brown bat), and 5 percent of the calls noted as "no ID" by the Kaleidoscope auto-classifier. Refer to section 3 for methodology on call analysis details.			

Bats, as protected species, are further discussed in **Section 4.6.1**.

4.5.2 Audiofauna survey results

Audiofauna surveys identified the presence of 20 birds, three amphibians (Cuban treefrog [*Osteopilus septentrionalis*], eastern narrowmouth toad [*Gastrophryne carolinensis*], and greenhouse frog [*Eleutherodactylus planirostris*]) and one mammal (agouti [*Dasyprocta punctata*]) species.

Amphibians and mammals are assigned a value of Ne-3 at a project scale due to common and widespread semi-natural species that do not occur in levels elevated above those of the surrounding area.

Of the 20 bird species identified through audiofauna surveys, 19 species are protected under Schedule 1 Part 1 of the NCL. Birds as a group are assigned a value of N-5 due to most species being protected under Schedule 1 Part 1 of the NCL. Protected bird species are further discussed in **Section 4.6.3**. Complete results of avifauna surveys are presented in **Appendix D**.

4.5.3 Wildlife camera survey results

Wildlife camera surveys identified the presence of four arthropods, 15 birds, three reptiles, and one mammal species. Limitations with survey equipment led to the inability to accurately identify arthropods and reptiles captured on camera to a genus or species level due to poor camera imagery. Critical identification features were not visible due to the nature of the survey and are documented in our results table accordingly. For that reason, these unidentified arthropods and reptiles are not assigned a value at a project scale.

The one mammal identified through wildlife camera surveys was feral dogs. Given their feral status, they are not assigned a value at a project scale.

Of the 15 bird species identified, 14 species are protected under Schedule 1 Part 1 of the NCL. As previously stated in **Section 4.6.3**, birds as a group are assigned a value of N-5 due to most species being protected under Schedule 1 Part 1 of the NCL. Protected species are further discussed in **Section 4.6**.

Complete results of wildlife camera surveys are presented in **Appendix E.**

4.6 Protected species

According to the NBAP ((DaCosta-Cottam et al. 2009), numerous protected species have been reported to use the terrestrial habitats of the Study Area. Species listed under Schedule 1 Part 1 of the NCL are protected at all times, while those listed under Part 2 may be hunted or collected in accordance with regulations or a conservation plan (if any). A complete list of these species is included in **Appendix F**. Those species confirmed on Site or with potential to occur within the Site are discussed further below.

4.6.1 Bats

There are no endemic bat species in the Cayman Islands, however, all bat species on the Cayman Islands are protected under Part 1 of Schedule 1 of the NCL and are therefore protected at all times. The breeding season for bats in the Cayman Islands occurs from June 1 to November 15. Threats to bat species are primarily due to loss and disturbance of natural habitats and roosts. Clearance of vegetation and in-filling of caves for development, anthropogenic disturbances (humans, powerlines, wind turbines, etc.), non-native landscaping, and predation from non-native species negatively impacts roosting and feeding habitat (DaCosta-Cottam et al. 2009).

Acoustic surveying confirmed two species of bats to be present within the proposed ISWMS Site; however, all nine bat species listed below have the potential to occur within the Site based on the available habitat. Since the acoustic survey equipment does not pick up those species that are non-echolocating or are low-intensity echolocating there is a limitation to the data set for this Site in determining if those species are not present and are therefore discussed here based on available habitat.

Antillean nectar bat is distributed only in Cuba, Isla de Pinos, Grand Cayman, Hispaniola and Middle Caicos (Nowak 1994). Antillean nectar bat are primarily a cave dwelling species and prefer habitat consisting of deep hot caves. Where no deep caves exist, Antillean nectar bat have a more opportunistic habitat selection and have been documented to live in cooler, less humid caves (Swanepoel and Genoways 1978). Antillean nectar bat has a low potential to occur within the Site as no caves are present. Antillean nectar bats are nectarivore and rely on pollen, but their diet also includes fruit and insects (Silva-Taboada and Pine 1969). This species of bat relies on non-echolocating foraging strategies to forage for food.

Big brown bat ranges from southern Canada to the very northern edge of South America, and includes islands of the Greater Antilles, The Bahamas, Grand Cayman, Barbuda, and Dominica (Gannon et al. 2005). *Eptesicus fuscus minor* is the smallest known representative of the *E. fuscus* genus and is a subspecies endemic to Grand Cayman. Big brown bat is known to roost in a range of habitats such as tree hollows, natural caves, rock ledges, and anthropogenic structures such as buildings, roofs, etc. This species roosts in large colonies in well ventilated, open areas of caves, or in smaller groups in other cavities (Silva-Taboada 1979). Big brown bat is an aerial insectivore with a diet consisting primarily of beetles and occasionally other insects such as moths, flies, wasps, flying ants, lacewing flies, and dragonflies. Foraging occurs throughout the night, beginning soon after sunset and ending just before sunrise (Silva-Taboada 1979). In the tropics, there is no evidence of hibernation, but these bats may become torpid if temperatures drop below 20˚C rather than leaving the roost to hunt (Silva-Taboada 1979). Big brown bat has the potential to occur within the Site and may utilize treed vegetation and anthropogenic structures as roosting habitat.

Brazilian free-tailed bat is widely distributed across the southern United States, Mexico and Central America, portions of South America, and the Greater and Lesser Antilles, making it one of the most widely distributed species of bat in the Americas. Brazilian free-tailed bat is known to utilize a range of habitats including caves, mine tunnels, old wells, tree hollows, and anthropogenic habitats such as bridges, buildings, and residences. Solitary individuals or small groups are found in fissures or on walls and ceilings of caves and manmade structures, whereas larger groups of tens of bats occupy bell holes, and groups of hundreds or thousands roost in large places on the ceiling of caves. Brazilian free-tailed bats are an insectivorous species and foraging is mainly at dusk and dawn during peak insect activity (Silva-Taboada 1979). Brazilian free-tailed bat has the potential to occur within the Site given the presence of treed vegetation and anthropogenic habitats that are present.

Buffy flower bats live in subtropical and tropical forests, including pine woodlands. Roosts have been found to contain a few hundred to a few thousand individuals. These bats hang alone or bunched from cave walls and ceilings. Buffy flower bats have been found both in the inside portions of the hot caves where it is dark, as well as exterior. Buffy flower bats tend to choose hot caves with only slight climate changes. It is thought that buffy flower bats may visit numerous caves throughout their home range (Goodwin 1970). These animals have been detected from low to medium levels of elevation; they have been captured in dry washes from sea level to 100 m elevation. In The Bahamas and Caymans, colonies range in size from a few individuals to a few hundred (Hall et al. 1998; Murray and Fleming 2008). No caves are present within the Site and therefore buffy flower bat has a low potential of occurring. This species of bat relies on non-echolocating foraging strategies to forage for food. The diet of buffy flower bat consists of insects, fruit, and nectar, but are known to specialize in nectar and pollen feeding (Soto-Centeno and Kurta 2006).

Eastern red bat is known to prefer habitat that is sparsely to moderately populated by humans and are rarely seen in urbanized areas. Eastern red bats primarily choose roosting sites in dense foliage within areas that range from 0.5 – 12 m off the ground. They are an aerial insectivore that uses echolocation at a high intensity interval. The diet of eastern red bats consists of beetles, flies, moths, leafhoppers, and termites, therefore, can likely be found foraging in open areas above tree canopy or along forest edges (Rodríguez-Durán 1998). Eastern red bats have also been observed foraging around streetlights due to the high concentration of insects (Hickey and Fenton 1990). Eastern red bat has the potential to occur within the Site due to the presence of preferred roosting and foraging habitat such as treed vegetation and forest edge habitat.

Jamaican fruit bat distributed from Mexico and Central America to northwest South America and is found throughout the Greater and Lesser Antilles (Larsen et al. 2007). Jamaican fruit bat is known to occur throughout many habitat types including evergreen forests, cloud forests, and arid habitats (Ortega and Castro-Arellano 2001). They have been found in trunks and foliage trees, caves, and manmade structures. Jamaican fruit bat has the potential to occur within the Site and may utilize forest habitat and anthropogenic structures as roosting and foraging habitat. Jamaican fruit bat is a generalist frugivore but has been known to feed on plant materials such as pollen, nectar, flowers, and leaves as well (Gannon et al. 2005). In some areas of their range, Jamaican fruit bats have been observed to visit the same fruiting plant on consecutive nights (Gannon et al. 2005).

Pallas's mastiff bat prefers habitat in subtropical and tropical moist lowlands. Pallas's mastiff bats are known to roost in cavities found in tree hollows or utility poles, in leaves, as well as buildings and roofs. Pallas's mastiff bat is one of the most abundant insectivorous species of bats in urban areas. Pallas's mastiff bat is also known to forage in very open areas and usually at higher altitudes (Holland et al. 2011). Pallas's mastiff bat has the potential to occur within the Site given the presence of preferred roosting habitat of treed vegetation and anthropogenic structures.

Waterhouse's leaf-nosed bat occurs on the mainland from the southwestern United States, through western Mexico to Guatemala, and in the West Indies in Cuba, Hispaniola, Jamaica, Turks and Caicos, The Bahamas, and the Cayman Islands (Anderson and Nelson 1965). In Grand Cayman, abandoned roosts of Waterhouse's leaf-nosed bat have been identified at Old Man Bay, Spotts Bat Cave, the Agriculture Pavilion Cave, and Pirate's Cave side tunnel. Waterhouse's leaf-nosed bat is found primarily in dry areas and rarely in evergreen lowland forests (Anderson and Nelson 1965). This species prefers roosting in humid, dark, sheltered caves but when roosting in buildings will tolerate more light (Silva-Taboada 1979). Waterhouse's leaf-nosed bat prefers foraging in densely foliated habitats and is considered a gleaning insectivore as it captures insects from a surface rather than in the air (Emrich et al. 2014). Waterhouse's leaf-nosed bat has a low potential to occur within the Site due to the absence of caves; however, these bats have been observed roosting in anthropogenic structures and may still occur within the Site.

White-shouldered bat is a foliage-roosting bat and prefers forested habitats at low elevations (below 680 m) such as lowlands and low mountains (Tavares and Mancina 2008). Forested habitat such as evergreen, submontane, pine, and semideciduous forests, and urban parks have had documented observations of white-shouldered bat. Very little is known about the diet of white-shouldered bat, but a few observations and fecal samples have documented the fruit of *Syzygium jambos* and seeds of *Cecropia scheberiana* to be present in their digestive tract (Mancina and Garcia-Rivera 2000). White-shouldered bat has the potential to occur within the Site and may utilize edge forest habitat present.

Of the nine bat species with the potential to occur within the Site, five species (buffy flower bat, Antillean nectar bat, white-shouldered bat, Waterhouse's leaf-nose bat, and Jamaican fruit bat) would not have been able to be detected through acoustic surveys as they either do not use echolocation as a means of foraging for food or use echolocation at too low of a frequency to accurately detect through acoustic monitoring. Of the non-echolocating species though, only white-shouldered bat and Jamaican fruit bat have more than a low potential of occurrence on Site based on an assessment of habitat. Of the four bat species with the potential to occur within the Site and able to be detected via acoustic monitoring, two bat species were identified on Site including: Pallas's mastiff bat and Brazilian free-tailed bat.

Pallas's mastiff bat is listed as Least Concern on the IUCN red list (Barquez et al. 2015). Currently there is no critical concern for the status of the local population of *Molossus molossus minor*, which is known only from the Cayman Islands and Cuba. This species of bats is not known to be migratory, however little information exists for their movement patterns. Pallas's mastiff bat is known to utilize mangrove, pools, ponds, mangrove lagoons, forest, woodland, caves, farmland, grassland, and urban habitat for either roosting or foraging activity, some of which can be found on Site (DaCosta-Cottam et al. 2009).

Brazilian free-tailed bat is listed as Least Concern on the IUCN red list (Barquez et al. 2015). The status of the Cayman Islands' population is currently unknown, though calls have been documented via Anabat and a D-20 Petterson bat detector (Freeman 1979, Simmons et al. 1978). A colony of an estimated 8,000-30,000 bats appears to have abandoned the large cave in Old Man Bay (DoE 2021). Previously, sixteen individuals were observed in the Salina Cave, pre-hurricane Ivan (DoE 2021. Brazilian free-tailed bat is known to utilize pools, ponds, mangrove lagoons, forest, woodland, caves, farmland, grassland, and urban habitat for either roosting or foraging activities (DaCosta-Cottam et al. 2009), some of which can be found on Site. This species has the variety of migration strategies known throughout its range, including some long-distance seasonal migrations and some residents that do not migrate due to appropriate temperatures and food availability.

Bats as a group are assigned a value of N-5 at a project scale due to all species and their habitats being listed in the NBAP. The four species assessed as potentially or confirmed to be associated with the Site are white-shouldered bat, Jamaican fruit bat, Palla's mastiff bat and Brazilian free-tailed bat.

4.6.2 Inland mangroves

"Mangrove" habitats are a generic term describing the plant assemblages that inhabit saline coastal habitats. These habitats are also named for the dominant species associated with this habitat. In the Cayman Islands, there are four mangrove species: black mangrove, white mangrove, red mangrove, and buttonwood. All species are listed under Part 2 of Schedule 1 of the NCL and have a tolerance for wet, salty conditions. Red mangrove is a pioneering species typically comprising the seaward fringe of a mangrove forest, while buttonwood is typically found in the driest, least-saline environments of all mangroves (DoE 2013).

The inland mangrove wetland located east of Esterly Tibbetts Highway and in the western portion of the Site is understood to be isolated from an active marine connection as a result of surrounding development in the last 20 years. Black mangrove was the only species identified to be present on Site during the preliminary surveys of vascular plants. This species is often observed growing up to 9 m tall with a large diameter of a trunk. Black mangrove can tolerate more saline conditions then other mangroves species present in the Cayman Islands and tend to grow landward. Threats to this species are primarily related to unsustainable removal, over development, and climate change (DoE 2013). The inland mangrove wetland is assigned a value of N-5 at a project scale due to mangrove species being protected under Schedule 1 Part 2 of the NCL.

4.6.3 Birds

Twenty-seven bird species identified on-Site through audiofauna and wildlife camera surveys are protected under Schedule 1 Part 1 of the NCL on the Cayman Islands. Swamp and mangrove habitat located within the southeast portion of the Site may provide breeding and feeding habitat for 16 of these protected bird species (**Table 5**). The primary threats related to these bird species are loss of habitat and habitat fragmentation due to development and urbanization.

Birds as a group are assigned a value of N-5 due to most species being protected under Schedule 1 Part 1 of the NCL.

Table 5 Protected bird species utilizing habitat on/immediately adjacent the Site

Species	Habitat
Black and white warbler, *Mniotilta varia*	Woods; trunks, limbs of trees. Breeds in mature or second-growth forests, deciduous and mixed. Often in woods on dry, rocky hillsides and ravines. Also nests in dry portions of **wooded swamps**. In migration, seen most often on trunks and low branches of trees within woodlands and thickets. In winter in the tropics, found in trees from sea level to high in the mountains.
Black-crowned night heron, *Nycticorax nycticorax*	**Marshes**, shores; roosts in trees. Found in a wide variety of aquatic habitats, around both fresh and salt water, including marshes, rivers, ponds, mangrove swamps, tidal flats, canals, rice fields. Nests in groves of trees, in thickets, or on ground, usually on islands or above water, perhaps to avoid predators.
Cayman parrot, *Amazona leucocephala*	Endemic to Cayman Island, utilizes mature **mangrove** and dry forest as breeding habitat. Nest in cavities of dead and live black mangrove (*Avicennia germinans*), and in dry forest in mango (*Mangifera indica*), strangler fig (*Ficus aurea*), royal palm (*Roystonea regia*), and red birch (*Bursera simaruba*).

Species	Habitat
Common gallinule, *Gallinula galeata*	**Fresh marshes**, reedy ponds. May be on still or slow-moving waters. Favors fresh marshes with some open water, ideally with some open ground and some dense cover along margins. Sometimes on more open ponds with only small amount of marsh cover.
Common yellowthroat, *Geothlypis trichas*	**Swamps, marshes**, wet thickets, edges. Breeds most abundantly in marshes and other very wet habitats with dense low growth. Also nests in briars, moist brushy places, tangles of rank weeds and shrubbery along streams, and overgrown fields, but is generally scarce in drier places. In migration and winter, still most common in marshes, but also occurs in any kind of brushy or wooded area.
Gray catbird, *Dumetella carolinensis*	Undergrowth, brush, thorn scrub, suburban gardens. At all seasons, favors dense low growth. Most common in leafy thickets along the edges of woods and streams, **shrubby swamps**, overgrown brushy fields, and hedges in gardens. Avoids unbroken forest and coniferous woods.
Great blue heron, *Ardea herodias*	**Marshes, swamps**, shores, tide flats. Very adaptable. Forages in any kind of calm fresh waters or slow-moving rivers, also in shallow coastal bays. Nests in trees or shrubs near water, sometimes on ground in areas free of predators. "Great White" form is mostly in saltwater habitats.
Great egret, *Ardea alba*	**Marshes**, ponds, shores, mud flats. Usually forages in rather open situations, as along edges of lakes, large marshes, shallow coastal lagoons, and estuaries, also along rivers in wooded country. Usually nests in trees or shrubs near water, sometimes in thickets some distance from water, sometimes low in marsh.
Greater Antillean grackle, *Quiscalus niger*	Greater Antillean Grackle frequents the open areas with trees and the urban areas. It is often seen along water on beaches, lakeshores, and other aquatic areas. It also frequents **mangroves** and **marshes**. It is very common in lowlands.
Greater yellowlegs, *Tringa melanoleuca*	Open marshes, mudflats, streams, ponds; in summer, wooded muskeg, spruce bogs. During migration and winter, found in wide variety of settings, including tidal flats, estuaries, open beaches, **salt and fresh marshes**, shores of lakes and ponds, riverbanks. Breeds in boggy and marshes places within northern coniferous forest.
Green heron, *Butorides virescens*	Lakes, ponds, **marshes, swamps**, stream sides. May be found foraging in practically any aquatic habitat, but most common around small bodies of fresh water, especially those lined with trees, shrubs, tall marsh vegetation. Nests in a wide variety of situations, including willow thickets, mangroves, dry woods, open marsh.
Northern parula, *Setophaga americana*	Breeds mainly in humid woods where either Usnea or Spanish Moss hangs from the trees (but also in some woods where neither is found.) Nests mainly in humid coniferous and deciduous forests, especially those with abundant tree lichens, in **swamps** or along edges of ponds, lakes, or slow-moving streams. In migration and winter, frequents almost any kind of trees.
Snowy egret, *Egretta thula*	**Marshes, swamps**, ponds, shores. Widespread in many types of aquatic habitats, including fresh and salt water; in coastal areas, may seek sheltered bays. Inland, favors extensive marshes and other large wetlands. Sometimes forages in dry fields. Nests in colonies in trees, shrubs, **mangroves**, sometimes on or near the ground in marshes.
Tricolored heron, *Egretta tricolor*	**Marshes, swamps**, streams, shores. Mainly in waters of coastal lowlands. In breeding season usually near salt water, on shallow, sheltered estuaries and bays, tidal marshes, **mangrove swamps**. Also, locally inland around freshwater marshes, lakes, rivers. Nests in colonies in trees, mangroves, or scrub near water.
Yellow warbler, *Setophaga petechia*	Bushes**, swamp edges**, streams, gardens. Breeds in a variety of habitats in east, including woods and thickets along edges of streams, lakes, **swamps**, and **marshes**, favoring willows, alders, and other moisture-loving plants. Also, in dryer second-growth woods, orchards, roadside thickets. In west, restricted to streamside thickets. In winter in the tropics, favors semi-open country, woodland edges, towns.
Yellow-crowned night heron, *Nyctonassa violacea*	**Marshes, wooded swamps**, and lakeshores for inland populations, and thickets, **mangroves,** and cliff-bound coasts for coastal populations.
Notes	
Bold font denotes habitat found within the Site.	

4.6.4 Grand Cayman blue iguana

The Grand Cayman blue iguana (*Cyclura lewisi)* species are protected under Part 1 of Schedule 1 of the NCL and is therefore protected at all times. Of the 100, 000 photos experts reviewed from the Site wildlife cameras, one iguana was observed who's identidixa5ion could not be verified due to poor camera imagery. The gular patch was not visible in the imagery and differentiation between Cayman Island iguana species was not possible. Grand Cayman blue iguanas can be highly variable in colour depending on season and age and can lead to confusion between iguana species. Similarly, the invasive green iguana can be variable in colour based on these factors and activities (e.g. mud coverage when emerging from mangroves). However, the ISWMS Site and immediately adjacent areas are not part of the recently mapped critical habitat for *C. lewisi* (DoE, 2023).

The Grand Cayman blue iguana is listed as Endangered on the IUCN red list (Burton 2012). Grand Cayman Blue Iguana only occurs inland, in natural dry shrubland, and along the margins of dry forest habitat (DaCosta-Cottam et al. 2009). Adults are primarily terrestrial, occupying rock holes and low tree cavities while younger individuals tend to be more arboreal. Like all *Cyclura* species, the Grand Cayman blue iguana is primarily herbivorous, feeding on leaves, flowers and fruits and rarely supplemented with insects. Threats to this species include habitat loss and fragmentation mainly due to development and urbanization, illegal hunting, non-native predators, and road mortality (DaCosta-Cottam et al. 2009). Based on the available characterization of Primary Habitat and wetland boundaries, suitable habitat is not likely present on Site. Further, Grand Cayman blue iguanas have been historically released in the east end of Grand Cayman (NCC 2023) over 25 km from the proposed ISWMS Site, and there are no known Grand Cayman blue iguana communities in the vicinity of the Site. Consultation with the EAB (DaCosta-Cottam et al. 2009) supports the interpretation that it is very unlikely that blue iguana would be present on this Site.

Grand Cayman blue iguana are assigned a value of I-4 at a project scale due to the species being listed as endangered on the IUCN Red List and protected under Schedule 1 Part 1 of the NCL.

4.7 Invasive species

An alien species is one that has been deliberately or accidentally introduced by humans to an environment it would not naturally occur in. An alien species becomes an invasive species once it starts to reproduce and proliferate in that environment. Invasive species are incredibly problematic as they take over habitat and resources once utilised by native species and cause an imbalance of the ecosystem (DoE 2021). There are numerous invasive species present in the Cayman Islands, with the majority being terrestrial species (**Table 6**). Those species with a high likelihood of occurring on Site are discussed further below. Invasive species are not assigned a value at project scale.

Table 6 Cayman Island invasive species

Common Name	Scientific Name
Birds	
Monk parakeet	*Myiopsitta monachus*
Peafowl	*Pavo cristatus*
Pigeon	*Columba livia*
Red junglefowl	Gallus gallus
Yellow-naped Amazon parrot	*Amazona auropalliata*
Mammals	
Black rat	*Rattus rattus*
Brown rat	*Rattus norvegicus*
Feral cat	*Felis catus*
Goat	*Capra hircus*
Reptiles	
Brahminy blind snake	*Indotyphlops braminus*

Common Name	Scientific Name
Birds	
Green iguana	*Iguana iguana*
Red-eared slider	*Trachemys scripta elegans*
Tropical house gecko	*Hemidactylus mabouia*
Plants	
Beach naupaka	*Scaevola taccada*
Brazilian pepper	*Schinus terebinthifolia*
Casuarina pine	*Casuarina equisetifolia*
Curly bean	*Adenanthera pavonina*
Wild tamarind	*Leucaena leucocephala*
Water snowflake	*Nymphoides indica*

4.7.1 Feral cat

Feral cats (*Felis catus*) are members of the domestic cat species that are recorded in the wild. Feral cats were recorded during Site investigations. This species can be found throughout both urban and natural areas on the island[62]. There are no predators on the island to control the populations. The feral cats stalk, catch, and/or eat pretty animals. The increase in populations is threatening the endangered species found on the island. On the island both blue iguanas and seabirds are directly threatened by feral cats. Within the first two years of the iguana's life the species are extremely vulnerable to predation and few iguanas are making it to breeding age. Additionally, seabirds nesting on the Caymans Island are directly threatened vulnerable with their chicks and the feral cats take out entire families near their nests.

4.7.2 Green iguana

Green iguanas were originally thought to have been introduced to the Cayman Islands through intentional releases or escapes from the pet trade and as a food source. Their population has grown exponentially since 2014 and is causing overpopulation issues effecting daily public life and the ecosystem. They cause degradation and complete destruction of vegetation, potentially hybridize with endangered Grand Cayman blue iguanas, and cause public health issues from road collisions to defecating in recreational swimming pools (DoE 2021). Widespread control efforts were commenced in 2018 and reduced the population from an estimated 1.3 million individuals to an estimated 25,000 individuals by mid-2020 (Harding et al. 2021).

An iguana was observed during wildlife camera monitoring; however, identification could not be verified due to poor camera imagery. The gular patch was not visible in the imagery and differentiation between iguana species was not possible. Green iguanas are also highly variable in colour depending on season and age and can lead to confusion between iguana species. Based on the cull activities also observed on Site via wildlife camera monitoring, green iguana is inferred to be present on Site.

4.7.3 Red junglefowl

Red junglefowl (also known as chickens) were originally imported for agricultural use but have become feral following escape/release into the wild (DoE 2021). While they do not pose a direct, significant threat to the environment, they are a neighbourhood nuisance and a road safety hazard and are controlled by the Department of Agriculture (DoE 2021). Red junglefowl were observed numerous times on Site.

4.7.4 Wild tamarind

Wild tamarind are medium sized tree species that are known to quickly grow as well as spread especially when clearing has recently occurred (DoE 2021). They are a tolerant species which allows them to establish and out compete other more sensitive species. Wild tamarind is seen to be a threat as the species is a prolific seed producer and will resprout after its stems experience damage. Wild tamarind is confirmed to be on site by DART.

4.8 Summary of terrestrial baseline conditions

CIEEM guidelines were used in the assessment of ecological receptors. The importance of the ecological features were first assessed with reference to Cayman Island legislation and then the impact to the species or habitat that would be impacted with the proposed ISWMS Site was taken into account.

In the absence of suitable mitigation measures, all the species confirmed or identified with potential to occur on-Site (e.g., non-echolocating bat species) have potential to be impacted from the development at the ISWMS Site directly or through change/loss of habitat.

The ecological receptors of concern for the terrestrial environment include Central Mangrove Wetland, Little Sound, Ponds and associated Marine Zones (proposed Ramsar site), Barkers wetland (proposed Ramsar site), land use wetlands, land use urban and man-modified areas, primary habitat, on-Site vegetation, bats, amphibians, mammals, birds, and Grand Cayman blue iguana.

Table 7 Summary of terrestrial ecological features values at a project scale

Terrestrial ecological features	Value at project scale for receptors of concern
Central Mangrove Wetland, Little Sound, Ponds and associated Marine Zones - proposed Ramsar site (Section 4.3)	I-3: due to being a proposed site of international importance
Barkers Wetland - proposed Ramsar site (Section 4.3)	I-3: due to being a proposed site of international importance
Land Use – Wetlands (Section 4.4.1)	N-5: due to pools, ponds and mangrove habitat being listed in the NBAP
Land Use - Urban and Man-Modified areas (Section 4.4.1)	N-5: due to the habitat being listed in the NBAP
Primary Habitat (Section 4.4.2)	Ne-3: due to the Site containing common and widespread semi-natural habitats not occurring in levels elevated above those of the surrounding area
On-Site vegetation communities (Section 4.4.3)	Ne-3: due to the Site containing common and widespread semi-natural habitats not occurring in levels elevated above those of the surrounding area
Bats (Section 4.6.1)	N-5: due to all species and their habitats being listed in the NBAP
Amphibians and mammals (Section 4.6)	Ne-3: due to common and widespread semi-natural species that do not occur in levels elevated above those of the surrounding area
Inland mangroves (Section 4.6.2)	
Birds (Section 4.6.3)	N-5: due to most species being protected under Schedule 1 Part 1 of the NCL
Grand Cayman blue iguana (Section 7.5.6.4)	I-4: due to the species being listed as endangered on the IUCN Red List and protected under Schedule 1 Part 1 of the NCL

5. Impact assessment and mitigation

The proposed Site development is delineated in **Figure 7**. The proposed ISWMS consists of various new waste management facilities The proposed development will result in the removal of 33 acres (13.35 hectares (ha)) of terrestrial habitat and 1.7 acres (0.7 ha) of inland mangrove habitat. An impact assessment of the identified species

and their habitats was conducted based on data collected along with secondary source data. This assessment was completed for both the construction and operation phases of Site activity. General mitigation measures are detailed below to maintain the integrity of the natural environment throughout construction and operation of the ISWMS.
Pathways of potential effects

Potentially significant terrestrial ecology effects identified in the TOR (Wood 2021) and identified through the assessment of the terrestrial environment baseline conditions are validated below to confirm pathways of potential effects.

Table 8 Pathways of potential effects by activity

Activity (leading to environmental change)	Effect	Feature	Pathway validity	Potential Effect Before Mitigation
Land take (during construction)	Loss of habitat that provides foraging and sheltering habitat for fauna	Protected and notable habitats and species around the Site	Direct pathway for the loss of habitat for species	Loss of habitat that provides forging and sheltering habitat for protected and notable species around the ISWMS Site
	Introduction or spread of invasive species	Protected and notable habitats and species around the Site	Direct pathway for the introduction or spread of invasive species	Introduction or spread of invasive species within the ISWMS Site
Land preparation e.g., earthworks, excavation (during construction)	Killing or injury of animals	Protected and notable species using the Site	Direct pathway for the killing or injury of animals during construction	Killing or injury of protected and notable species within the ISWMS Site
	Airborne dust creation	Protected and notable habitats and species around the Site	Direct pathway for the impact on notable habitats and species around the Site from airborne dust	Dust from land preparation affecting protected and notable habitats around the ISWMS Site
	Noise / light / visual disturbance including from movement of construction workers disturbing sensitive fauna	Wetland / migratory birds potentially on habitat functionally linked to the proposed Ramsar sites; Protected and notable species around the Site	Direct pathway for the disturbance of species from noise, light and visual disturbance during construction	Noise / light / visual disturbance including from movement of construction workers disturbing wetland/migratory birds potentially on habitat linked to proposed Ramsar sites and protected and notable species around the ISWMS Site
	Migration of contaminates from surface water/storm water and groundwater movements	Aquatic/riparian invertebrates, wetland/migratory birds using fringing mangroves and seagrass beds	Addressed in Chapter 6 - Marine Ecology Assessment	Addressed in Chapter 6 - Marine Ecology Assessment
	Spills of oil, gasoline, and other fluids	Terrestrial environment within and surrounding the ISWMS Site during construction	Direct pathway for the spills to migrate into the terrestrial environment within and surrounding the ISWMS Site	Spills of oil, gasoline, and other fluids into natural communities around the ISWMS Site
	Soil erosion and sedimentation	Terrestrial environment within and surrounding the ISWMS Site	Direct pathway for the soil erosion and sedimentation into	Soil erosion and sedimentation into

Activity (leading to environmental change)	Effect	Feature	Pathway validity	Potential Effect Before Mitigation
			adjacent areas to the ISWMS Site	adjacent areas to the ISWMS Site
Waste processing (during operation)	Migration of contaminants from surface water/storm water and ground water movements	Aquatic/riparian invertebrates, wetland/migratory birds using fringing mangroves and seagrass beds	Addressed in Chapter 6 - Marine Ecology Assessment	Addressed in Chapter 6 - Marine Ecology Assessment
	Spills of oil, gasoline, and other fluids	Terrestrial environment within and surrounding the ISWMS Site during operation	Direct pathway for spills to migrate into the terrestrial environment within and surrounding the ISWMS Site	Spills of oil, gasoline, and other fluids into natural communities around the ISWMS Site
Combustion of waste (during operation)	Deposition of contaminants on sensitive habitats or species	Designated sites, protected and notable habitats and species within range of emissions of the plant	Direct pathway for the deposition of contaminants on sensitive habitats or species	Deposition of contaminants on sensitive habitats or species within the range of emissions from the ISWMS Site
Uncontrolled vehicular movement (during operation)	Vehicle strikes on animals causing injury or death	Protected and notable species around the Site	Direct pathway for the killing or injury of species during operation	Vehicle strikes on protected and notable species causing injury or death around the ISWMS Site
Lighting (during operation)	Disturbance of animals	Protected and notable species around the Site	Direct pathway of the disturbance of species from lighting during operation	Lighting from operation causing disturbance to protected and notable species around the ISWMS Site
Noise (during operation)	Disturbance of animals	Wetland/migratory birds potentially on habitat functionally linked to the proposed Ramsar sites; Protected and notable species around the Site	Direct pathway for the disturbance of terrestrial wildlife from noise during operation	Noise from operation causing disturbance to protected and notable species around the ISWMS Site

5.1 Significance evaluation

The significance of a residual effect is a determination following evaluation of the identified "potential effect" with the implementation of mitigation measures. A significance evaluation of the potential effects associated with the construction and operation of the ISWMS has involved:

- Identifying those effects that could likely be significant.
- Assessing the effects of the proposed construction works against the baseline (current or future, as appropriate)
- Concluding whether or not these resultant effects are likely to be significant.

The significance of effects determination has been completed for the terrestrial environment based on professional judgement and the following:

- Predicting adverse effects from proposed construction activities and evaluating the scope and scale of those effects.
- Detailing mitigation measures triggered through regulatory requirements and/or best management practices to eliminate, reduce, or control the effect the construction activities have on environmental components.

– Determining the significance of the effects.

Significance evaluation is assessed using the criteria detailed in **Table 9** (adapted from Table 5.7 of the ToR).

Table 9 Significance evaluation criteria

Characterisation	Description	Quantitative Measure or Definition of Qualitative Categories
Magnitude	The size or degree of the effects compared against baseline conditions or reference levels, and other applicable measurement parameters (i.e., standards, guidelines, objectives)	**Negligible (N) |** Differing from the average baseline conditions to a very small degree, but within the range of the natural variation **Very Low (VL) |** Differing from the average baseline conditions to a small degree, but very minimally out of the range of the natural variation **Low (L) |** Differing from the average baseline and outside the range of natural variation but less than or equal to appropriate guideline or threshold value **Medium (M) |** Differing from the average baseline and outside the range of natural variation and marginally exceeding a guideline or threshold value **High (H) |** Differing from the average baseline and outside the range of natural variation and exceeding a guideline or threshold value
Geographic Extent	The geographic area over which the effects are likely to be measurable	**Site Study Area (SSA) |** Occurs within the ISWMS Site boundary **Outside Study Area (OSA)** | Occurs outside of the ISWMS Site boundary
Timing	Considers when the environmental effect is expected to occur. Timing considerations are noted in the evaluation of the environmental effect, where applicable or relevant.	**Not Applicable (NA) |** Seasonal variations are not likely to change the effect **Applicable (A) |** Seasonal aspects may affect the outcome of the effect
Duration	The time period over which the effects are likely to last	**Short-Term (ST) |** The effect is reversible at the end of construction works **Medium-Term (MT) |** The effect is reversible within a defined length of time (e.g. during operation) **Long-Term (LT) |** The effect is reversible over an extended length of time (including at the end of operation)
Frequency	The rate of recurrence of the effects (or conditions causing the effect)	**Once (O) |** Effects occur once **Regular (R) |** Effects can occur at regular intervals through construction and/or operation **Continuous (C) |** Effects are continuous throughout construction and/or operation
Reversibility	The degree to which the effects can or will be reversed (typically measured by the time it will take to restore the environmental attribute or feature)	**Reversible (R) |** The baseline conditions will recover to their standard after the construction works are completed **Partially Reversible (PR) |** Mitigation can return the baseline conditions **Not Reversible (NR) |** Mitigation cannot guarantee a return to baseline conditions

5.1.1 Potential effects and mitigation measures

The potential residual effects identified in **Table 8** are further evaluated here as the potential effects, associated mitigation and resultant significance. A potential effect to the terrestrial environment during construction is the loss of vegetation that could serve as habitat to species that have been found within and around the landfill site. However, as noted before most of the vegetation has already been cleared and the site is not considered suitable for species to inhabit due the ongoing activities. This evaluation is prepared in the understanding that the vegetation removal has been conducted under an approval mechanism of the Cayman Islands government.

Direct mortality of fauna species could result from construction works, particularly due to the increase in heavy machinery and commercial trucks during the Site preparation. Erecting exclusion fencing is recommended to avoid mortality of fauna (**Figure 8**)**.** A potential indirect impact resulting from the removed vegetation is increase in erosion and sedimentation. Erosion and sedimentation measures will be established within the ISWMS Site boundary to prevent off-site migration of soils.

Direct mortality of fauna species could result from construction works and operation, particularly due to the increase in heavy machinery and commercial trucks during the Site preparation. Erecting exclusion fencing is recommended to avoid mortality of fauna (**Figure 8**). A potential indirect impact resulting from the removed vegetation is increase in erosion and sedimentation. Erosion and sedimentation measures will be established within the ISWMS Site boundary to prevent off-site migration of soils. The effects assessment of significance is presented in **Table 10**.

Figure 8 ***Example of wildlife exclusion fence (fencing on the right side of the figure)***

Table 10 Marine ecology assessment of significance

Potential Effect	Mitigation Measures and Best Management Practices Proposed	Residual Environmental Effect Characterisation and Rationale						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Loss of habitat that provides foraging and sheltering habitat for protected and notable species within the ISWMS Site	During construction: – Clearly demarcate work limits at outset of construction and minimize unnecessary vegetation clearing – Any removal of mangroves on the Site should be outside the bat breeding window and bird nesting season. The bat breeding window is from June 1 to November 15. The bird nesting season is from April 1 to June 30. Therefore, with these restrictions any clearing is recommended to occur after November 15 and before April 1 of any given year – Restabilize and revegetate exposed surfaces as soon as possible following disturbance	M	SSA	A	MT	O	PR	Minor vegetation removal and habitat provided by this vegetation where the clearing occurred within the ISWSM Site.	Not significant as removal has already occurred on Site and mitigations will be utilized to reduce further impacts.
		Medium magnitude due to a permanent change to the environment that causes habitat loss to species that utilize mangroves. There is 33 acres (13.35 hectares (ha)) of terrestrial habitat and 1.7 acres (0.7 ha) of inland mangrove habitat that has been removed to accommodate this project. All the vegetation removal is within the Site boundary. Vegetation clearing is restricted to occur after November 15 and before April 1 of any given year. Partial revegetation will be observed over time once out of the construction phase. Therefore, medium term is listed as duration. The vegetation removal will only occur once at the onset of this protect. It is not anticipated that additional clearing to occur whence operations begin. Mitigations listed can be utilized to assist to ensure a gradual return to partial baseline conditions, therefore partially reversible. Ensuring the stabilization of land and revegetation of disturb surfaces where possible after construction has been completed.							

Potential Effect	Mitigation Measures and Best Management Practices Proposed	Residual Environmental Effect Characterisation and Rationale						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Introduction or spread of invasive species within the ISWMS Site	During construction and operation: – Machinery, equipment, and materials shall arrive at Site cleaned – Cleaning shall occur a minimum of 98 feet (30 m) from waterbodies – Equipment to be used in or near water shall be cleaned before and after use. Cleaning shall remove any visible attached material (mud, vegetation, fauna).	VL	SSA	A	MT	R	PR	Limited ability for introductio n or spread of invasive species on the Site	Not significant as mitigations will limit the spread of invasives.
		Although it cannot be ensured there is absolutely no spread or introduction of invasive species due to current presence of species on the Island, it is anticipated that there will be very low impacts to the Site due to invasive species. This assumes that best practices regarding cleaning of machinery, handling of any encountered invasive species plants, and training in the identification of invasive species on Site will be incorporated. Seasonal aspects may impact the amount of invasives spread on Site as conditions are more wet or windy. June – October where there is generally more rain it is expected that invasive plant species can spread easier. Additionally, wind can impact the amount movement of seeds/vegetation. The windy months in Cayman include October – March with a peak in December. The effect is reversible with a defined length of time if equipment is clean prior to entering the Site, species will be contained. Therefore, a medium-term duration has been listed. Effects have the potential to occur at regular intervals throughout construction and operation, as invasives are present on the island and can be moved around at any point. Ensuring mitigation measures are fully implemented will ensure there is no introduction and spread of species. The introduction and spread of species on Site is partially reversible as mitigations can return the Site to the baseline conditions.							

Potential Effect	Mitigation Measures and Best Management Practices Proposed	Residual Environmental Effect Characterisation and Rationale						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Killing or injury of protected and notable species within the ISWMS Site	During construction: – The bird nesting season for the Site has been identified as April to June and tree and vegetation removal activities are to avoid this window where possible. If vegetation clearing within the bird nesting season is required, a nest survey will be required, to be completed by a qualified professional to identify any active nests of birds, and breeding activity of birds that may indicate nesting – The active bat roosting season for the Site has been identified as June 1 to November 15. Removal of large trees (i.e., greater than 10 cm diameter at breast height) will not occur during this season to protect bats during their active season – All vehicles and equipment will follow the posted speed limit, to reduce the potential for wildlife collisions – All Site personnel should be trained in general protected species awareness and identification of protected species with the potential to occur on Site – Visual inspections will be completed daily before works commence. If fauna is found on Site during the work measures will be taken to allow fauna to leave the work area passively. Active relocation should be a last resort; if it is required, it will be completed in a manner that prevents harm to fauna – Should the animal be resident within the Site (remaining on-Site longer than 24 hours), injured, or eggs/nests are observed, additional measures to avoid impacts may be required before work can restart – Information posted in construction offices of	VL	SSA	NA	ST	R	R	No mortality or injury of protected and notable species due to constructio n and operations works with the implement ation of mitigation measures listed	Not significant as killing or injury of species in only anticipated to be a potential effect throughout construction and mitigations in place will ensure species are not impacted
		There is a very low potential impact to various protected species due to the removal of habitat and heightened risk of species collisions when all mitigation measures are utilized on Site. Killing or injury of notable species within the Site does not have seasonal variation as there is continued movement of equipment that has the potential to kill/injure species on Site. The impact to species is determined to be a short-term impact as the potential effect will be eliminated after construction. With construction there is an increased presence of machinery on Site that has the potential to impact species and their habitats. These species impacts have the potential to occur at a regular interval throughout construction while a heightened number of equipment is present on Site. Baseline conditions will return once construction has been completed. As the Site will return to vehicular/equipment traffic similar to what is currently experienced with the adjacent landfill.							

Potential Effect	Mitigation Measures and Best Management Practices Proposed	Residual Environmental Effect Characterisation and Rationale						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
	protected species and siting management plan – Have an experienced environmental professional on Site to confirm species presence and identification								

Potential Effect	Mitigation Measures and Best Management Practices Proposed	Residual Environmental Effect Characterisation and Rationale						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Dust from land preparation affecting protected and notable habitats around the ISWMS Site	During construction: – Manage dust emissions through the use of water or dust suppressants on non-paved roads and cleaning of paved roads, where applicable, reflecting regulatory direction and approval – In dust sensitive areas (e.g., near wetlands, etc.), control dust using water and not chemical suppressants – Establish Site speed limits for vehicles traveling within the Site to minimize dust emissions – Ensure that equipment maintenance and checks occur on a regular basis – Proper stockpiling of dust producing building materials such as sand or cement in low enclosures and covered, away from drainage areas where they could easily be dispersed by wind or washed away during heavy rains – All loads entering or leaving the Site must be covered – Restabilize and revegetate exposed surfaces as soon as possible following construction to limit dust generation	VL	OSA	A	ST	R	R	No offsite dust impacts on protected and notable habitats with the implement ation of mitigation measures to control dust emissions from leaving the Site.	Not significant as the effect from dust from land preparation is only anticipated throughout construction and mitigations in place will ensure the control of dust.
		It is not anticipated to see dust levels outside study area on protected and notable areas differing from baseline conditions, much of the dust will be limited with the proposed mitigation measures. There are seasonal aspects that may affect the outcome of dust impacts including rain. Therefore, there are less potential impacts anticipated throughout June – October where there is generally more rain. Additionally, wind can impact the amount of dust that would be spread. The windy months in Cayman include October – March with a peak in December. The impacts of this potential effects are anticipated to be reversible at end of construction. The impacts of dust would have the potential to be seen at regular intervals through construction of the ISWMS infrastructure while active land preparation is occurring. The potential impacts from dust are reversible to baseline conditions after construction is completed. Vehicular traffic will decline, and grounds will be stabilized as applicable.							

Potential Effect	Mitigation Measures and Best Management Practices Proposed	Residual Environmental Effect Characterisation and Rationale						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Noise / light / visual disturbance including from movement of construction workers disturbing wetland/ migratory birds potentially on habitat linked to proposed Ramsar sites and protected and notable species around the ISWMS Site	During construction: – Limit construction activities to daylight hours – Ensure equipment meets industry standards with respect to noise level thresholds – Undertake regular maintenance of the equipment as part of the preventative maintenance plans implemented for all mobile and stationary equipment – Train Site personnel to ensure equipment is used in ways that minimize noise – Control noise by maintaining separation distance between source and receptor and equipment design, where feasible – Establish an exclusion barrier within the Site boundary to restrict fauna access to the Site; maintain throughout construction – Ensure engines are turned off when possible; vehicles will not be left to idle – Broadband reversing alarms will be chosen instead of tonal alarms	VL	SSA OSA	A	ST	R	R	Minimal offsite and onsite disturbance effects to fauna including noise, light, visual disturbances with the implementation of mitigation measures	Not significant as effects from noise and light disturbance are only anticipated during construction and mitigations in place to maintain equipment will eliminate the effects to species
		There is a very low impact anticipated to overall disturbance on wetland and migratory birds on Ramsar sites and on and around the Site. The Ramsar sites are approximately 2.8 miles (4.5 km) east and 4.7 miles (7.5 km) north away from the Site and therefore will not be disrupted by construction activities. Seasonal variations of this impact may impact the outcome of this effect including wind speed and cloud cover that may allow for light and sound to travel further. This is a short-term impact as the impacts are reversible at end of construction due to the reduction of construction activities causing potential effects. Effects would occur at regular intervals through construction as there is continued disturbance on Site. Therefore, the frequency is listed as regular. The impacts are reversible at end of construction as the construction causing the potential impacts would be eliminated. Although it is not anticipated for impacts to reach these areas with the implementation of mitigation measures. Thus, the residual effect is listed as partially reversible.							

Potential Effect	Mitigation Measures and Best Management Practices Proposed	Residual Environmental Effect Characterisation and Rationale						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Spills of oil, gasoline, and other fluids into natural communities around the ISWMS Site	During construction and operation: – All machinery should be inspected for fluid leaks or other potential pollutants. The Contractor/Operator should evaluate each piece of equipment to ensure all risk of spills or sediment release due to its use is mitigated prior to putting it into service – Proper machinery inspections and maintenance – Conduct equipment maintenance and refuelling at the designated and properly contained maintenance areas located well away from watercourses and wetlands and outside retained vegetation areas – Implement an emergency and response management plan to address the potential for spills	L	SSA	NA	ST	R		PR No residual effects from spills into natural communitie s around the ISWMS Site	Not significant as mitigations in place will ensure there is no impacts to natural communities around the Site from spills.
		There is a low magnitude of potential impact to the Site due to spills of oil, gasoline, and other fluids into natural communities on Site due to machinery on Site utilizing these materials to operate. The impact caused by fluid spills is the same during all times of year as there is refueling of construction and operation equipment occurring. Therefore, given a timing ranking of not applicable. Will return to baseline after construction as construction activities will be completed, and the amount of construction machinery would decrease, and regular activities would occur on Site, resulting in less opportunity for spills to occur. Therefore, resulting in a short-term duration. There is potential for spills is to occur at regular intervals throughout construction and operation, as refuelling of equipment and machinery is occurring. As such, given a frequency rating of regular. This effect is partially reversible as mitigation measured can return to environment to baseline conditions. All spills are to be addressed immediately with the emergency response management plan that is put into place before construction begins.							

Potential Effect	Mitigation Measures and Best Management Practices Proposed	Residual Environmental Effect Characterisation and Rationale						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Soil erosion and sedimentation into adjacent areas to the ISWMS Site	During construction: – Limit vegetation clearing only to areas where construction works are being completed to prevent sediment being exposed During construction and operation: – Establish and maintain erosion and sediment control fencing in good working order to capture any sediment migration whilst construction works are being completed – Maintain erosion and sediment control fencing in place until final Site development, or stabilize soils with permanent vegetation (e.g., annual seed mix and/or plantings) – Routinely inspect erosion and sediment control measures, including following storms, and repair as required All machinery should be inspected for fluid leaks or other potential pollutants. The Contractor should evaluate each piece of equipment to ensure all risk of spills or sediment release due to its use is mitigated prior to putting it in to service – Trucks and equipment shall be cleaned prior to leaving the Site to prevent mud/dirt from tracking onto roads	L	OSA	A	ST	R	PR	No offsite impacts from soil erosion or sedimentation into adjacent areas	Not significant as mitigations will ensure the stabilization of soils after construction and maintain sediment and erosion control fencing to limit movement of sediments.
		The magnitude of soil erosion and sedimentation into adjacent to the ISWMS Site outside of the study area is low due to the 33 acres (13.35 hectares (ha)) of terrestrial habitat and 1.7 acres (0.7 ha) of inland mangrove habitat that has been removed to accommodate this project which results in exposed soils on the ISWMS Site. Seasonal variation may impact the outcome of effect due to level of rain occurring during different seasons. June – October there is generally more rain that could cause increased risk of sedimentation into adjacent areas of the Site. The impacts from soil erosion and sedimentation will return to baseline after construction is completed as exposed soils will be stabilized and erosion and sediment control measures will be in place until establishment. As such the effect is listed as short-term. The effect has the ability to occur at regular frequency intervals throughout the construction phase due to exposed soils and movement of trucks and equipment. This effect is partially reversible as the mitigations can ensure a return to baseline conditions as the mitigation measures ensure any sediments cannot move to other areas that are adjacent to the Site.							

Potential Effect	Mitigation Measures and Best Management Practices Proposed	Residual Environmental Effect Characterisation and Rationale						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Deposition of contaminants on sensitive habitats or species within the range of emissions from the ISWMS Site	During operation: – Implementation of the Air Pollution Control (APC) System to capture emission contaminants. A system of humidification of the APC Residues will be provided for the flue gas residue discharge process. – Appropriate disposal of APC materials into designated engineered Residual Waste Landfill (RWL) – Regular inspection of facility and implementing good housekeeping action when required. – The Construction and Demolition processing operations will be undertaken in the open air and crushing and screening equipment will be fitted with water misters to reduce dust emissions. – Detail design shall consider including dedusting (suction to filter) in order to avoid dust emissions during the residues discharge from silo the truck.	VL	OSA	NA	LT	C	PR	No offsite impacts to sensitive habitats or species from deposition of contamina nts during operation	Not significant as the APC system will capture the contaminants will be in place throughout operation.
		This effect would have a very low magnitude impact on sensitive habitats within the range of the ISWMS as the APC system implemented will capture the contaminants upon release. There are no seasonal variants that will impact the effect as the emissions will be released continuously throughout operation. The effect from emissions would occur during operation of the ISWMS Site. The duration is listed as long term as emissions will be released throughout operations of the ISWMS Site. Though, it is anticipated that mitigation measures are sufficient to negate potential effect throughout operations. The effect is listed as continuous frequency as the emissions will be released continuously throughout operation. The effect of deposition of contaminants on sensitive habitats is listed as partially reversible as the APC system will capture the contaminants upon release. Additional mitigation measures listed will also ensure limited impacts from this effect.							

Potential Effect	Mitigation Measures and Best Management Practices Proposed	Residual Environmental Effect Characterisation and Rationale						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Vehicle strikes on protected and notable species causing injury or death on the ISWMS Site	During operation: – All Site personnel should be trained in general protected species awareness and identification of protected species with the potential to occur on Site – Visual inspections will be completed daily before works commence. If fauna is found on Site during the work measures will be taken to allow fauna to leave the work area passively. Active relocation should be a last resort; if it is required, it will be completed in a manner that prevents harm to fauna – Should the animal be resident within the Site (remaining on-Site longer than 24 hours), injured, or eggs/nests are observed, additional measures to avoid impacts may be required before work can restart – All vehicles and equipment will follow the posted speed limit, to reduce the potential for wildlife collisions – Information posted in construction and operation offices of protected species and siting management plan – Have an ecologist or experienced environmental professional on Site to confirm species presence and identification	L	SSA	NA	LT	C	PR	No increase in mortality of protected species due to constructio n and operations works	Not significant as mitigations will ensure there is limited vehicle strikes on protected species.
		The impact on all terrestrial protected and notable species from vehicle strikes magnitude is low on Site. The ISWMS Site will be accessed along the same route as the current GTLF operations: from the South via Seymour Drive. Security has been addressed on the ISWMS Site by the proposed construction of a 12 foot (ft) (3.66 metre (m)) high metal chain link perimeter fence, which will also aid in keeping fauna outside of the ISWMS Site. Additionally, the fencing will be reinforced by species exclusion fencing. There is no seasonal variation of the effect. Impacts will be the same throughout all conditions on Site as species can pre present on Site throughout the year. The effect from vehicle strikes would occur during operation of the ISWMS Site. The duration is listed as long term as there is a potential for vehicle strikes to occur throughout the operation of the Site. It is anticipated that mitigation measures are sufficient to negate potential effect throughout operation. There is a continuous potential risk of the effect as there is continuous vehicular traffic on Site that has to potential to cause vehicular strikes on protected species. The effect from vehicle strikes is partially reversible as with mitigations utilized the risk of vehicle strikes is lowered and will return the effect to baseline conditions.							

Potential Effect	Mitigation Measures and Best Management Practices Proposed	Residual Environmental Effect Characterisation and Rationale						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Lighting from operation causing disturbance to protected and notable species around the ISWMS Site	During operation: – Limit operation activities to daylight hours – Reduce the intensity of lighting fixtures – Ensure downcast lighting on building where lights are required overnight	VL	OSA	NA	LT	C	PR	Minimal effects to fauna from lighting during operation	Not significant as the mitigation measures in place limit the light causing disturbance to species.
		The impact to terrestrial notable species outside of the Site from light is anticipated to be very low. Operations should be limited to during day light hours allowing for minimal light pollution to the Site during evening hours when impacts to species would occur from light. As 90 percent of the activity at the ISWMS Site occurs from dawn to dusk, lighting is restricted to the main access road (to allow for solid waste deliveries) and building eves. The impacts will not be seasonally variant as the lighting conditions will be the same throughout the year for security purposes. The effect of lighting would occur during operation of the ISWMS Site. The duration is listed as long term as lightening on the buildings will be consistent throughout operation for safety of the Site. It is anticipated that mitigation measures are sufficient to negate potential effects from lighting. With continued implementation of mitigation measures will ensure no impacts to species. There is a frequency of continuous listed for this effect, as throughout operation lighting will be used for safety of the Site. The impacts to species are partially reversible due to the fact that mitigation measures listed can return the impacts to baseline conditions.							

Potential Effect	Mitigation Measures and Best Management Practices Proposed	Residual Environmental Effect Characterisation and Rationale						Residual Effect	Significance of Residual Effect
		Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Noise from operation causing disturbance to protected and notable species around the ISWMS Site	During operation: – Ensure equipment meets industry standards with respect to noise level thresholds – Undertake regular maintenance of the equipment as part of the preventative maintenance plans implemented for all mobile and stationary equipment, to ensure all equipment is well-maintained to minimise noise emissions. – Train Site personnel to ensure equipment is used in ways that minimize noise – Control noise by maintaining separation distance between source and receptor and equipment design, where feasible – Establish an exclusion barrier within the Site boundary to restrict fauna access to the Site; maintain throughout operation – Ensure engines are turned off when possible; vehicles will not be left to idle – Legio-type blocks utilized for internal pushwalls providing additional noise absorption. – Construction and demolition process operations that have a high noise level (shredder and crusher) will only be activated intermittently which will reduce noise emission duration. – Bottom Ash process operations that have a high noise level (trommel) will only be activated intermittently which will minimise noise emissions duration. – High noise emitting equipment (baler and shear in particular) will only be used intermittently to minimise noise exposure time.	VL	SSA OSA	A	MT	R	R	Minimal offsite effects to fauna from noise during operation	Not significant as mitigations in place will reduce the noise impacts from operation on species.
		It is anticipated that the degree of noise effects on protected and notable species within and surrounding the Site are very low. Noise will mainly be confined within the ISWMS buildings. The project Site is located within a designated industrial area, therefore species in the area are used to movement and noise from industrial operations. There is a potential for a seasonal variation of noise impact due to wind speed and cloud cover that may allow for sound to spread more. The effect is seen to occur at regular intervals through operation due to the operation of machinery throughout working hours on Site. Effects causing disturbance from operations noise are reversible as the operations noise will be similar to baseline conditions based on adjacent landuses. Additional mitigation measures will be implemented to further reduce noise through noise absorption blocks incorporated into the facility design.							

5.1.2 Summary of effects

The predicted environment effects on the terrestrial environment are assessed to be adverse but not significant. Effects are associated with vegetation loss, fauna collision, soil erosion, dust, noise and vibration, invasive species, and spills. However, with the implementation of mitigation measures, best management practices that will be outlined in the Environmental Management Plan (EMP) in the Environmental Statement (ES), and any restoration or offsetting conditions from the Central Planning Authority or Development Control Board, the residual effect on the terrestrial environment is not significant. The effects anticipated are as summarized below:

– Minor vegetation removal and habitat provided by this vegetation
– Limited ability for introduction or spread of invasive species on Site
– No increase in mortality or injury of protected species due to construction and operations works.
– No offsite dust impacts on protected and notable habitats
– Minimal offsite noise, light and visual disturbance effects to fauna during construction and operation.
– No offsite impacts from soil erosion or sedimentation into adjacent areas
– No residual effects from spills into natural communities around the ISWMS Site
– No offsite impacts to sensitive habitats or species from deposition of contaminants during operation

While not significant, effects to the terrestrial environment will occur but will be mitigated through the implementation of the identified BMPs outlined in this ES. An EMP will be established to consolidate all mitigation measures and BMPs, which will be implemented prior to the start of the ISMWS construction.

5.1.3 Residual effects

The residual effects remaining after the implementation of mitigation measures during construction and operations identified for the terrestrial environment is minor vegetation removal and habitat provided by this vegetation.

6. Monitoring

For the purposes of construction works and operations, limited monitoring requirements have been identified. As previously noted in **Section 5**, the potential effects are adverse but not significant. The following monitoring requirements are recommended based on the residual effects identified:

During pre-construction:

– Fauna monitoring: exclusion fencing will be established around the ISWMS Site to mitigate fauna from entering areas where clearing or construction works are to be undertaken. Fencing is to be installed prior to construction works commencing. However, even with this fencing there is a potential for fauna to enter the Site. If fauna is found on Site measures will be taken to allow fauna to leave the work area passively. Active relocation should be a last resort; if it is required, it will be completed in a manner that avoids injury to the identified fauna.
– Erosion and sediment control monitoring: silt fencing will be established around the ISWMS Site to limit sediment run-off into the surrounding environment. Regular inspections (i.e., weekly, before and following 25 millimetres (mm) or more rainfall) should be conducted to identify any damage to the fencing and ensure a prompt repair.

During construction and operation:

– Fauna monitoring: If fauna is found on Site measures will be taken to allow fauna to leave the work area passively. Active relocation should be a last resort; if it is required, it will be completed in a manner that avoids injury to the identified fauna.
– Erosion and sediment control monitoring: Regular inspections (i.e., weekly, before and following 25 millimetres (mm) or more rainfall) should be conducted to identify any damage to the fencing and ensure a prompt repair.

Additional monitoring may be required based on approvals from the Central Planning Authority, Development Control Board, or if the vegetation clearing avoidance windows cannot be adhered to.

7. Conclusions

Grand Cayman is the most developed of the three islands, hosting 95 percent of the population. Wildlife have shown adaptation to artificial habitats resulting in complaints of wildlife inhabiting the developed environment. Protection of the natural environment is encouraged as this will maintain biodiversity within these landscapes (DaCosta-Cottam et al. 2009).

Natural heritage information from secondary sources and associated reports, and primary field data were collated to establish this document. There is potential for protected species occurrence in select areas throughout the Site, mainly of highly mobile, mangrove-dwelling wildlife species, such as birds and bats. As such, general habitat and species interaction mitigation measures have been provided as recommendations to be implemented throughout construction and operation phases.

Potential impacts associated with land development will be avoided or minimized through the implementation of recommended mitigation efforts outlined in this report. It is anticipated that the construction and operation of the proposed facility will result in limited residual effects to the terrestrial environment.

8. References

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Figures

Paper Size ANSI A

0 0.2 0.4 0.6 0.8

Kilometers

Map Projection: Lambert Conformal Conic
Horizontal Datum: Cayman Islands Geodetic Datum 2011
Grid: Cayman Islands National Grid 2011

N

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GRAND CAYMAN, CAYMAN ISLANDS
INTEGRATED SOLID WASTE MANAGEMENT
SYSTEM FOR THE CAYMAN ISLANDS
- TERRESTRIAL ECOLOGY ASSESSMENT

TERRESTRIAL ECOLOGY STUDY AREA

Project No. **12563972**
Revision No. **-**
Date **Jun 2, 2023**

FIGURE 1

Q:\GIS\PROJECTS\12563000s\12563972\Layouts\TerrestrialEcology\12563972_TerrestrialEcology_GIS001.mxd
Print date: 02 Jun 2023 - 11:08

Data source: Google Earth Imagery, ©2023 Google, Data SIO, NOAA, U.S. Navy, NGA, GEBCO, Data LEDO-Columbia, NSF, NOAA; Imagery Date 9/10/2022

Paper Size ANSI A

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Meters

Map Projection: Lambert Conformal Conic
Horizontal Datum: Cayman Islands Geodetic Datum 2011
Grid: Cayman Islands National Grid 2011

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GRAND CAYMAN, CAYMAN ISLANDS
INTEGRATED SOLID WASTE MANAGEMENT
SYSTEM FOR THE CAYMAN ISLANDS
- TERRESTRIAL ECOLOGY ASSESSMENT

TERRESTRIAL ECOLOGY SURVEY LOCATIONS

Project No. **12563972**
Revision No. **-**
Date **Jun 2, 2023**

FIGURE 2

Q:\GIS\PROJECTS\12563000s\12563972\Layouts\TerrestrialEcology\12563972_TerrestrialEcology_GIS002.mxd
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Data source: Google Earth, Image © 2023 Maxar Technologies, Imagery Date 7/11/2022

Paper Size ANSI A

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Kilometers

Map Projection: Lambert Conformal Conic
Horizontal Datum: Cayman Islands Geodetic Datum 2011
Grid: Cayman Islands National Grid 2011

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GRAND CAYMAN, CAYMAN ISLANDS
INTEGRATED SOLID WASTE MANAGEMENT
SYSTEM FOR THE CAYMAN ISLANDS
- TERRESTRIAL ECOLOGY ASSESSMENT

TERRESTRIAL ECOLOGY EXISTING CONDITIONS

Project No. 12563972
Revision No. -
Date Jun 2, 2023

FIGURE 4

Q:\GIS\PROJECTS\12563000s\12563972\Layouts\TerrestrialEcology\12563972_TerrestrialEcology_GIS004.mxd
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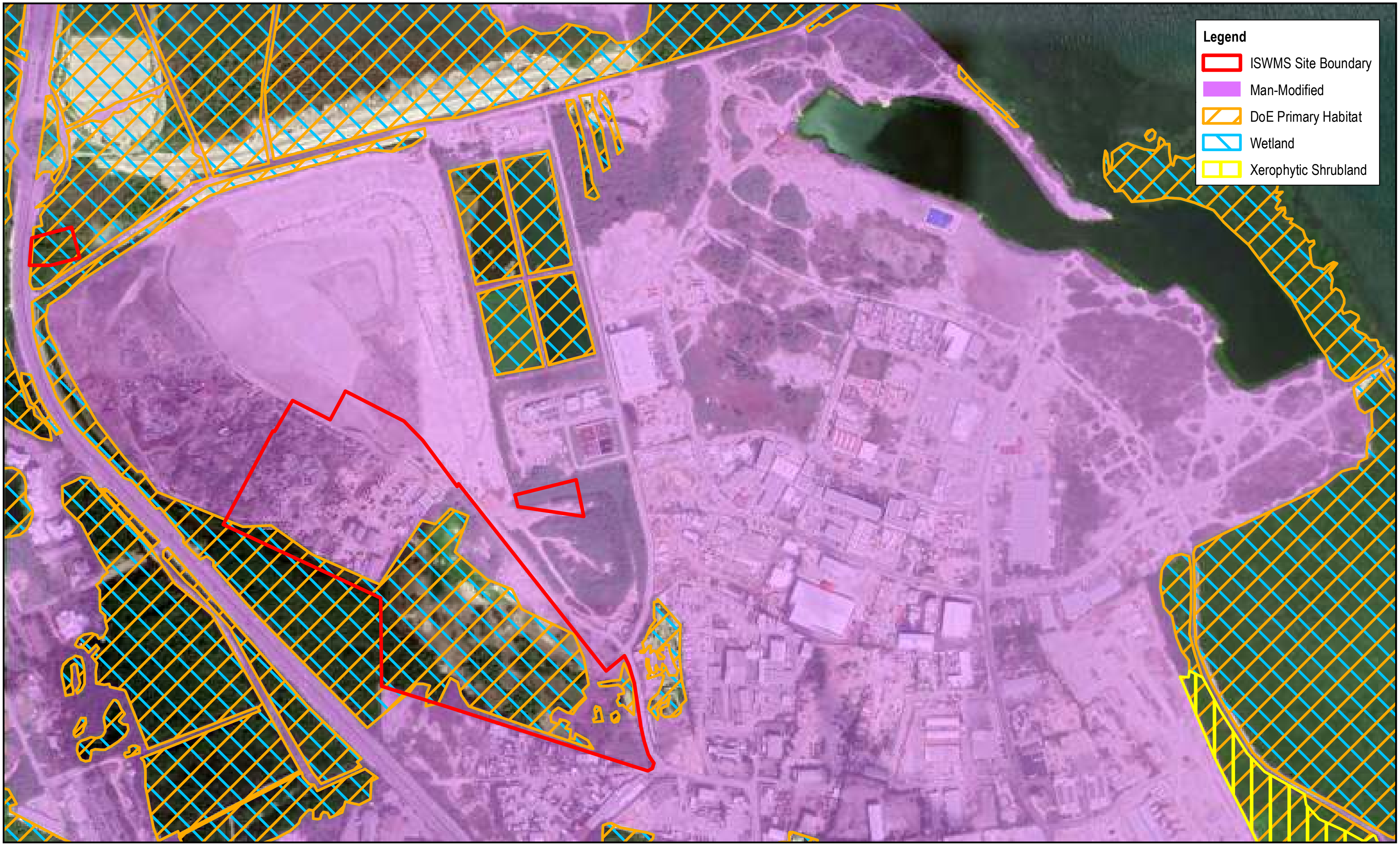
Data source: DoE, ESRI, GEBCO, NOAA, National Geographic, Garmin, HERE, Geonames.org, NGDC. .



Paper Size ANSI A

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Meters

N

Map Projection: Lambert Conformal Conic
Horizontal Datum: Cayman Islands Geodetic Datum 2011
Grid: Cayman Islands National Grid 2011

GHD

GRAND CAYMAN, CAYMAN ISLANDS
INTEGRATED SOLID WASTE MANAGEMENT
SYSTEM FOR THE CAYMAN ISLANDS
- TERRESTRIAL ECOLOGY ASSESSMENT

TERRESTRIAL ECOLOGY DEPARTMENT
OF ENVIRONMENT HABITAT MAPPING

Project No. 12563972
Revision No. -
Date Jun 2, 2023

FIGURE 5

Q:\GIS\PROJECTS\12563000s\12563972\Layouts\TerrestrialEcology\12563972_TerrestrialEcology_GIS005.mxd
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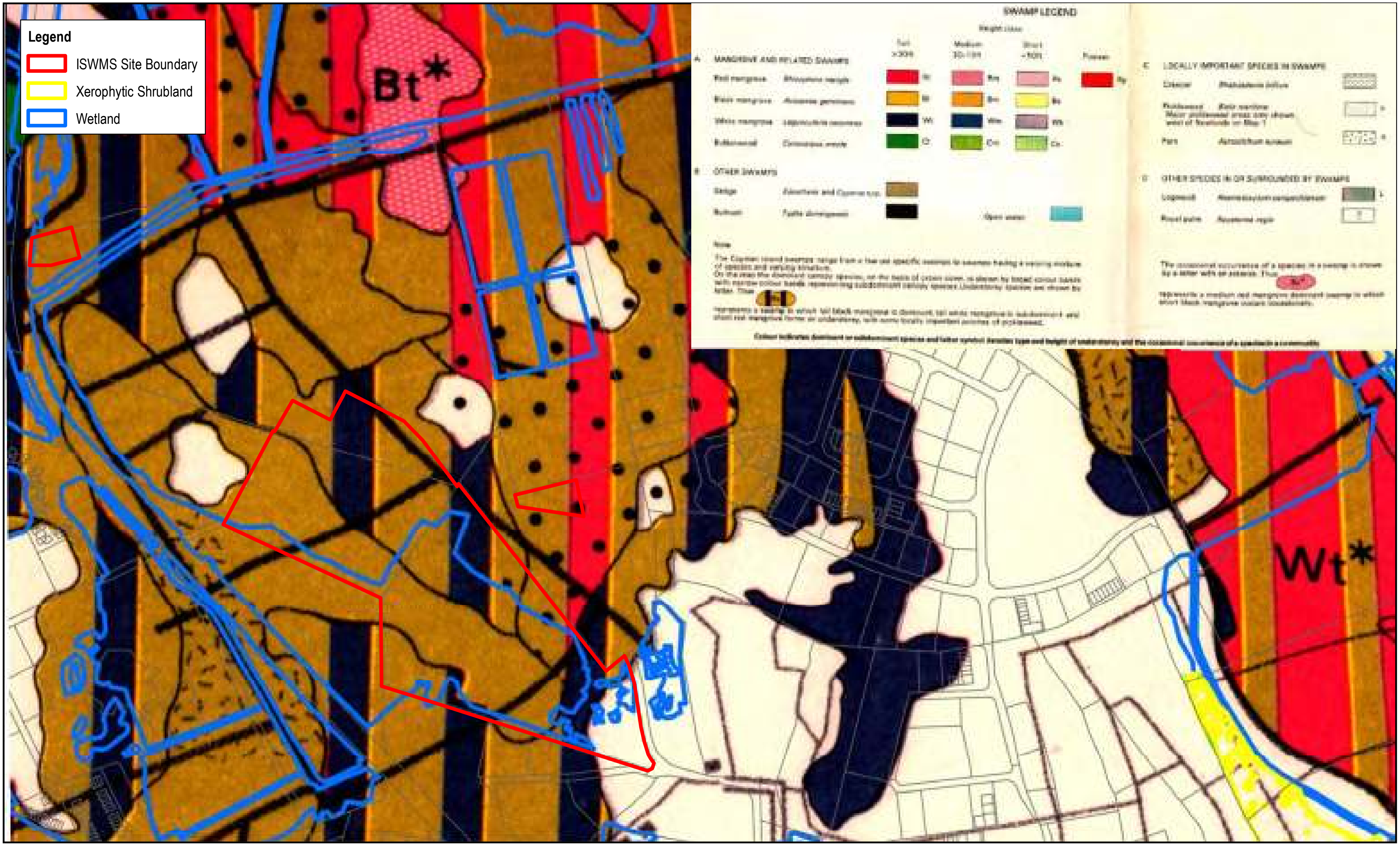
Data source: ESRI, GEBCO, NOAA, National Geographic, Garmin, HERE, Geonames.org, NGDC. Grand Cayman Department of Environment, 2021.



Paper Size ANSI A

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Meters

N

Map Projection: Lambert Conformal Conic
Horizontal Datum: Cayman Islands Geodetic Datum 2011
Grid: Cayman Islands National Grid 2011

GRAND CAYMAN, CAYMAN ISLANDS
INTEGRATED SOLID WASTE MANAGEMENT
SYSTEM FOR THE CAYMAN ISLANDS
- TERRESTRIAL ECOLOGY ASSESSMENT

TERRESTRIAL ECOLOGY
HISTORICAL VEGETATION MAPPING

Project No. **12563972**
Revision No. **-**
Date **Jun 2, 2023**

FIGURE 6

Q:\GIS\PROJECTS\12563000s\12563972\Layouts\TerrestrialEcology\12563972_TerrestrialEcology_GIS006.mxd
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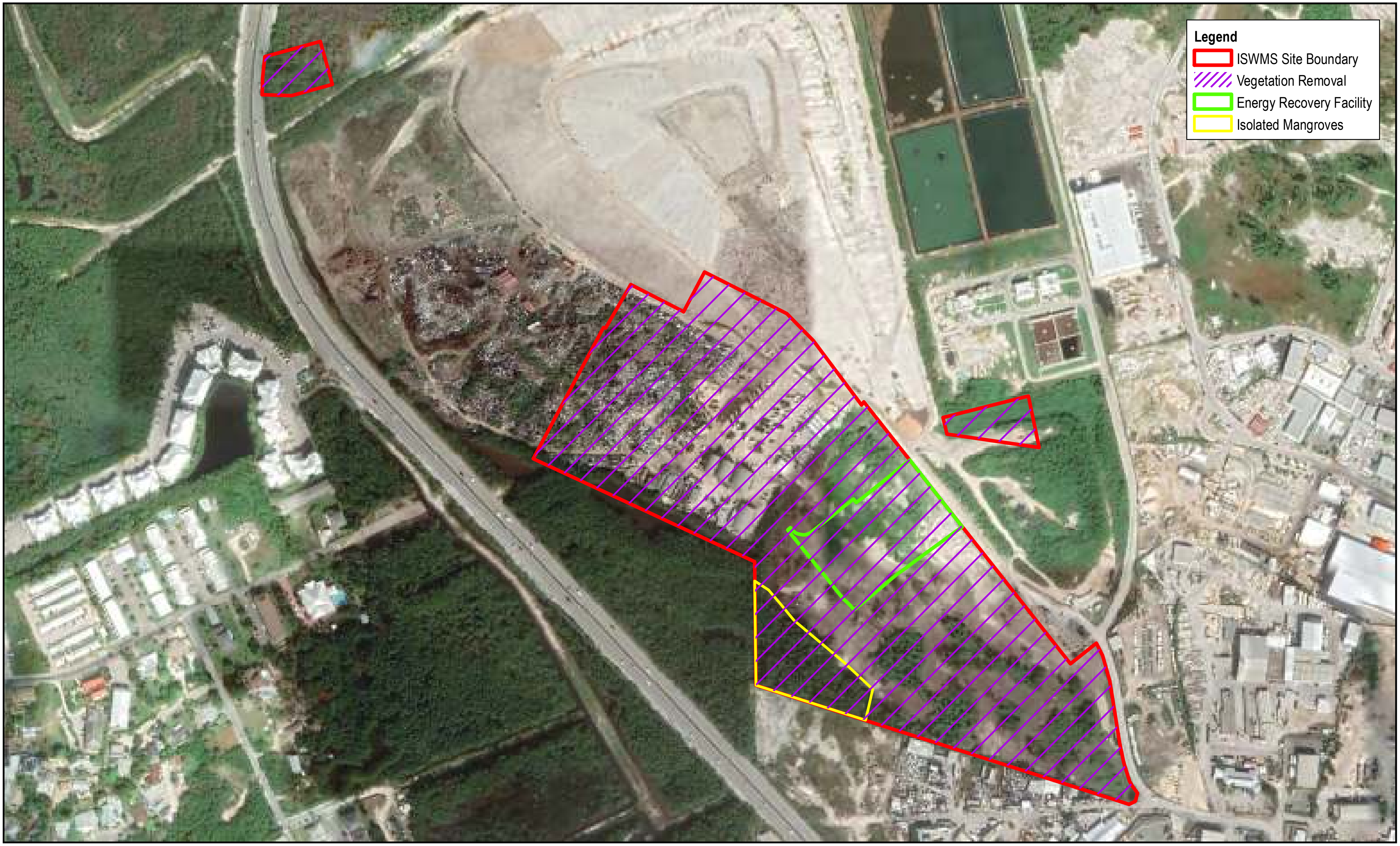

Paper Size ANSI A

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Meters

Map Projection: Lambert Conformal Conic
Horizontal Datum: Cayman Islands Geodetic Datum 2011
Grid: Cayman Islands National Grid 2011

N

GRAND CAYMAN, CAYMAN ISLANDS
INTEGRATED SOLID WASTE MANAGEMENT
SYSTEM FOR THE CAYMAN ISLANDS
- TERRESTRIAL ECOLOGY ASSESSMENT

TERRESTRIAL ECOLOGY IMPACT ASSESSMENT

Project No. **12563972**
Revision No. **-**
Date **Jun 2, 2023**

FIGURE 7

Q:\GIS\PROJECTS\12563000s\12563972\Layouts\TerrestrialEcology\12563972_TerrestrialEcology_GIS007.mxd
Print date: 02 Jun 2023 - 08:47

Data source: Google Earth, Image © 2023 Maxar Technologies, Imagery Date 7/11/2022

Appendices

Appendix A

Agency Correspondence

Amy Douglas

From: Dombowsky, Lauren <Lauren.Dombowsky@gov.ky>
Sent: Tuesday, November 29, 2022 2:13 PM
To: Amy Douglas
Cc: Katrina Greenfield; Olynik, Jeremy; Richard McAree; Ebanks-Petrie, Gina
Subject: RE: Grand Cayman - Terrestrial Ecology Information Request

Hi Amy,

Thank you, please find a link to download our terrestrial and marine data here:

Kind regards,

Lauren Dombowsky, CEnv | Manager, Environmental Management Unit
Department of Environment | Cayman Islands Government
Environmental Centre | 580 North Sound Road
Box 10202| Grand Cayman KY1-1002
CAYMAN ISLANDS | Tel: (345) 244-5932

From: Amy Douglas [mailto:Amy.Douglas@ghd.com]
Sent: 29 November 2022 09:43
To: Dombowsky, Lauren <Lauren.Dombowsky@gov.ky>
Cc: Katrina Greenfield <Katrina.Greenfield@ghd.com>; Olynik, Jeremy <Jeremy.Olynik@gov.ky>; Richard McAree <Richard.McAree@dart.ky>; Ebanks-Petrie, Gina <Gina.Ebanks-Petrie@gov.ky>
Subject: [EXTERNAL] RE: Grand Cayman - Terrestrial Ecology Information Request

Hi Lauren,

Signed agreement attached. Thanks for your help on this. Much appreciated!

Amy Douglas
[she/her]

M.Sc.
Ecologist

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Connect

Please consider the environment before printing this email

From: Dombowsky, Lauren <Lauren.Dombowsky@gov.ky>
Sent: Monday, November 28, 2022 11:03 AM
To: Amy Douglas <Amy.Douglas@ghd.com>

Cc: Katrina Greenfield <Katrina.Greenfield@ghd.com>; Olynik, Jeremy <Jeremy.Olynik@gov.ky>; Richard McAree <Richard.McAree@dart.ky>
Subject: RE: Grand Cayman - Terrestrial Ecology Information Request

Hi Amy,

Please see the attached spatial data sharing agreement. Once you sign, we will release the data we have. Some of the questions below refer to matters which have already been settled as part of the ToR, so it is vital that this is followed.

Kind regards,

Lauren Dombowsky, CEnv | Manager, Environmental Management Unit
Department of Environment | Cayman Islands Government
Environmental Centre | 580 North Sound Road
Box 10202| Grand Cayman KY1-1002
CAYMAN ISLANDS | Tel: (345) 244-5932

From: Amy Douglas [mailto:Amy.Douglas@ghd.com]
Sent: 18 November 2022 15:06
To: Dombowsky, Lauren <Lauren.Dombowsky@gov.ky>
Cc: Katrina Greenfield <Katrina.Greenfield@ghd.com>; Olynik, Jeremy <Jeremy.Olynik@gov.ky>
Subject: [EXTERNAL] RE: Grand Cayman - Terrestrial Ecology Information Request

Hi Lauren,
Thanks back to you for also being so speedy!
Correct, we are following the final Terms of Reference dated October 4, 2021.

We are also looking to contact:
- National Trust for the Cayman Islands
- National Conservation Council
- Birdlife International
- Central Caribbean Marine Institute
- Shark Conservation Cayman

If you have any other recommendations, I would be grateful for the local input.

As for useful information, ideally were looking for any habitat mapping you may have, any designated areas within the study area, and if there are any protected species that we have missed off our list.

Thanks,

Amy Douglas
[she/her]

M.Sc.
Ecologist

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Please consider the environment before printing this email

From: Dombowsky, Lauren <Lauren.Dombowsky@gov.ky>
Sent: Friday, November 18, 2022 2:49 PM
To: Amy Douglas <Amy.Douglas@ghd.com>
Cc: Katrina Greenfield <Katrina.Greenfield@ghd.com>; Olynik, Jeremy <Jeremy.Olynik@gov.ky>
Subject: RE: Grand Cayman - Terrestrial Ecology Information Request

Hi Amy,

Thanks for getting back to me so quickly. I will ask our Senior GIS Officer (cc'd) to clip our habitat mapping extent to 2 km from the terrestrial study area site.

Could I please check that you are following the scope outlined in the final Terms of Reference? It outlined what kind of information was available and should be used for the assessment.

With respect to your final questions, could you clarify what kind of additional information would be useful?

Kind regards,

Lauren Dombowsky | Manager, Environmental Management Unit
Department of Environment | Cayman Islands Government
Environmental Centre | 580 North Sound Road
Box 10202| Grand Cayman KY1-1002
CAYMAN ISLANDS | Tel: (345) 244-5932

From: Amy Douglas [mailto:Amy.Douglas@ghd.com]
Sent: Friday, November 18, 2022 2:18 PM
To: Dombowsky, Lauren <Lauren.Dombowsky@gov.ky>
Cc: Katrina Greenfield <Katrina.Greenfield@ghd.com>
Subject: [EXTERNAL] RE: Grand Cayman - Terrestrial Ecology Information Request

Hi Lauren,

The terrestrial study area extends 2 km from the site boundary, apologies, I should have included that on the snips.

Our marine study area extends 12 nautical miles from site.

Amy Douglas
[she/her]

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Ecologist

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Please consider the environment before printing this email

From: Dombowsky, Lauren <Lauren.Dombowsky@gov.ky>
Sent: Friday, November 18, 2022 2:12 PM
To: Amy Douglas <Amy.Douglas@ghd.com>
Cc: Katrina Greenfield <Katrina.Greenfield@ghd.com>
Subject: RE: Grand Cayman - Terrestrial Ecology Information Request

Hi Amy,

Could you confirm the study area? Is it restricted to the site or do you have an extent beyond that?

Kind regards,

Lauren Dombowsky, CEnv | Manager, Environmental Management Unit
Department of Environment | Cayman Islands Government
Environmental Centre | 580 North Sound Road
Box 10202| Grand Cayman KY1-1002
CAYMAN ISLANDS | Tel: (345) 244-5932

From: Amy Douglas [mailto:Amy.Douglas@ghd.com]
Sent: Friday, November 18, 2022 2:04 PM
To: Dombowsky, Lauren <Lauren.Dombowsky@gov.ky>
Cc: Katrina Greenfield <Katrina.Greenfield@ghd.com>
Subject: [EXTERNAL] Grand Cayman - Terrestrial Ecology Information Request

Hi Lauren,
Sharing the terrestrial ecology request this time. Please share with the appropriate team, thanks.

GHD Limited (GHD) was retained by DECCO Limited to determine the existing conditions of the terrestrial environment in the vicinity of the proposed Integrated Solid Waste Management System (ISWMS) site. The proposed site for the ISWMS is located to the north of central George Town towards the western coast of Grand Cayman, immediately south-west of the existing George Town Land Fill. The proposed ISWMS development consists of various new waste management facilities.

Please find mapping of the proposed site below.


West Bay
Rum Point
Old Man Bay
Grand Cayman
Breakers
George Town
Bodden Town

GHD's ecologists have completed background information reviews to characterize the associated terrestrial environment, with a focus on habitats, wildlife, protected species, and significant natural areas. Through the background review it was found that several species use the terrestrial habitats of the study area. A complete list of these species is attached.

We are seeking any additional natural environment assessments and protected species information for the listed location, and in particular any information about the mangroves east of the Esterly Tibbetts Highway.

Please let me know if you have any questions or require further information. We look forward to your response to our request.

Thank you,

Amy Douglas
[she/her]

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Connect

Amy Douglas

From: Amy Douglas
Sent: Wednesday, November 23, 2022 1:39 PM
To: info@nationaltrust.org.ky
Cc: Katrina Greenfield
Subject: Marine and Terrestrial Information for Grand Cayman
Attachments: Terrestrial Protected Species.pdf

Good afternoon,

GHD Limited (GHD) was retained by DECCO Limited to determine the existing conditions of the marine and terrestrial environment in the vicinity of the proposed Integrated Solid Waste Management System (ISWMS) site. The proposed site for the ISWMS is located to the north of central George Town towards the western coast of Grand Cayman, immediately south-west of the existing George Town Land Fill. The proposed ISWMS development consists of various new waste management facilities. We have contacted the Department of Environment and are also reaching out to The National Trust for the Cayman Islands to ensure our information is complete.

Please find mapping of the proposed site below.

GHD's ecologists have completed background information reviews to characterize the associated marine and terrestrial environments, with a focus on marine, coastal and terrestrial habitats, wildlife, protected species, and significant natural areas.

Marine Ecology

Through the background review it was found that the following are found within a 5-kilometre radius of the site:

- Marine Reserve Zones: George Town and Seven Mile Beach are approximately 1.5 km west of the Site. South Sound West and South Sound East are approximately 5 km south of the Site
- Line Fishing Zone: Jackson Point is approximately 4.5 km south of the Site
- Shore Line Fishing Zone: George Town approximately 1 km west of the Site
- No-Diving Overlay Zone: South Sound is approximately 5 km south of the Site
- Spawning Aggregation Overlay Zone: Southwest zone is approximately 5 km southwest of the Site off the shore of South Sound Beach.

As well, the following protected species were reported to use the seagrass bed and mangrove habitats of the Study Area (i.e., the Site including a 12 nautical mile buffer):

- All birds (mangroves)
- Bats (mangroves)
- Manatees (seagrass beds)
- Whales and dolphins (seagrass beds)
- Turtles (both)
- American and Cuban crocodile (mangroves)
- Sharks and rays (seagrass beds)
- All bony fish (both)

Terrestrial Ecology

Through the background review it was found that several species use the terrestrial habitats of the Study Area (i.e., the Site including a 2 kilometre buffer). A complete list of these species is attached.

We are seeking any additional natural environment assessments and protected species information for the listed location, and in particular any information about the mangroves east of the Esterly Tibbetts Highway. Please let us know if you have any questions or require further information. We look forward to your response to our request.

Thank you,

Amy Douglas
[she/her]

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Contact Us

Cayman Islands Environmental Centre

580 North Sound Road

George Town, Grand Cayman

Postal Address:

National Conservation Council

PO Box 10202, KY1-1002

Grand Cayman, Cayman Islands

Telephone: (345) 949-8469

Name

Amy Douglas

Email

amy.douglas@ghd.com

Message

Good afternoon,

GHD Limited (GHD) was retained by DECCO Limited to determine the existing conditions of the terrestrial environment in the vicinity of the proposed Integrated Solid Waste Management System (ISWMS) site. The proposed site for the ISWMS is located to the north of central George Town towards the western coast of Grand Cayman, immediately south-west of the existing George Town Land Fill. The proposed ISWMS development consists of various new waste management facilities. We have contacted the Department of Environment and are also reaching out to National Conservation Council to ensure our information is complete.

GHD's ecologists have completed background information reviews to characterize the associated terrestrial environments, with a focus on terrestrial habitats, wildlife, protected species, and significant natural areas.

Through the background review it was found that several species use the terrestrial habitats of the Study Area (i.e., the Site including a 2 kilometre buffer). A complete list of these species and a figure of the Study Area can be sent via email.

We are seeking any additional natural environment assessments and protected species information for the listed location, and in particular any information about the mangroves east of the Esterly Tibbetts Highway.
Please let us know if you have any questions or require further information. We look forward to your response to our request.

Thank you,
Amy

Send

From: Amy Douglas
To: americas@birdlife.org
Cc: Katrina Greenfield
Subject: RE: Terrestrial Information for Grand Cayman
Date: Thursday, April 27, 2023 3:36:21 PM
Attachments: Terrestrial Protected Species.pdf
image003.png
image004.png
image005.png
image006.png
image007.png
image008.png
image009.png

Good afternoon,
Please see the below request for information sent late last year.
We are hoping to receive a response to comprehensively complete our terrestrial assessment of the proposed site.

Thanks in advance for your help.
Kind regards,

Amy

Amy Douglas
[she/her]

M.Sc.
Ecologist

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GHD FIRST Emergency Spill Hotline: +1 800 679 9082

The Power of Commitment

Connect

From: Amy Douglas
Sent: Wednesday, November 23, 2022 2:07 PM
To: americas@birdlife.org
Cc: Katrina Greenfield <Katrina.Greenfield@ghd.com>
Subject: Terrestrial Information for Grand Cayman

Good afternoon,

GHD Limited (GHD) was retained by DECCO Limited to determine the existing conditions of the marine and terrestrial environment in the vicinity of the proposed Integrated Solid Waste Management System (ISWMS) site. The proposed site for the ISWMS is located to the north of central George Town towards the western coast of Grand Cayman, immediately south-

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Attachments: Terrestrial Protected Species.pdf

Good afternoon,

GHD Limited (GHD) was retained by DECCO Limited to determine the existing conditions of the marine and terrestrial environment in the vicinity of the proposed Integrated Solid Waste Management System (ISWMS) site. The proposed site for the ISWMS is located to the north of central George Town towards the western coast of Grand Cayman, immediately south-west of the existing George Town Land Fill. The proposed ISWMS development consists of various new waste management facilities. We have contacted the Department of Environment and are also reaching out to Birdlife International to ensure our information is complete.

Please find mapping of the proposed site below.

GHD's ecologists have completed background information reviews to characterize the associated terrestrial environments, with a focus on terrestrial habitats, wildlife, protected species, and significant natural areas.

Through the background review it was found that several species use the terrestrial habitats of the Study Area (i.e., the Site including a 2 kilometre buffer). A complete list of these species is attached.

We are seeking any additional natural environment assessments and protected species information for the listed location, and in particular any information about the mangroves east of the Esterly Tibbetts Highway. Please let us know if you have any questions or require further information. We look forward to your response to our request.

Thank you,

Amy Douglas
[she/her]

M.Sc.
Ecologist

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Appendix B

Preliminary Plant List

Appendix B

Preliminary Plant List
Cayman Islands Terrestrial Ecology Assessment

PTERIDOPHYTES	FERNS & ALLIES	Protected Species
Pteridaceae	**Brake Family**	
Acrostichum aureum	Golden leather fern	
Nephrolepidaceae	**Sword Fern Family**	
Nephrolepis exaltata	Southern sword fern	
DICOTYLEDONS	**DICOTS**	
Caracaceae	**Papaya family**	
Caraca papaya	Papaya	
Clusiaceae	**Attorney Tree Family**	
Clusia rosea	Autograph tree	
Aracaceae	**Palms**	
Thrinax radiata	Florida thatch palm	
Convolvulaceae	**Bindweed Family**	
Ipomoea alba	Moonflower	
Ipomoea triloba	Littlebell	
Fabaceae	**Legume Family**	
Leucaena leucocephala	White leadtree	
Parkinsonia aculeata	Retama	
Delonix regia	Flamboyant	
Phyllanthaceae	**Leaf-Flower Family**	
Phyllanthus urinaria	Chamberbitter	
Malvaceae	**Mallow and Hibiscus Family**	
Thespesia pupulnea	Portia Tree	
Rhizophraceae	**Mangroves**	
Rhizophora mangle	Red Mangrove	
Polygonaceae	**Buckwheat Faimly**	
Antigonon leptosus	Coral bells	
Combretaceae	**Bushwillow Family**	
Terminalia catappa	Sea almond	
Conocarpus erectus var. erectus	Silver buttonwood	
Rubiaceae	**Madder Family**	
Spermacoce verticillata	Shrubby false buttonweed	
Asteraceae	**Aster Family**	
Avicennia germinans	Black mangrove	**Y**
Tridax procumbens	Tridax daisy	
Euphorbiaceae	**Spurge Family**	
Ricinus communis	Castor Bean	
MONOCOTYLEDONS	**MONOCOTS**	
Cyperaceae	**Sedges**	
Cyperus ligularis	Swamp flatsedge	
Poaceae	**Grass Family**	
Bromus sp.	Brome grass species	
Melinis repens	Natal grass	
Dactyloctenium aegyptium	Durban crowfoot	

Total = 24 species

Appendix C

Bat Detector Results

Appendix C

Bat Detector Results
Cayman Islands Terrestrial Ecology Assessment

Number of Nightly Passes for Bat Detector 1 and 2				
Date	Pallas's Mastiff Bat		Brazilian Free-tailed Bat	
	Bat 1	Bat 2	Bat 1	Bat 2
27-Oct-2021	0	250	0	5
28-Oct-2021	0	236	0	2
29-Oct-2021	0	248	0	2
30-Oct-2021	0	282	1	0
31-Oct-2021	0	79	0	2
1-Nov-2021	4	83	3	0
2-Nov-2021	0	392	0	3
3-Nov-2021	0	165	0	5
4-Nov-2021	0	0	0	0
5-Nov-2021	52	286	0	3
6-Nov-2021	0	6	0	39
7-Nov-2021	0	28	0	9
8-Nov-2021	109	218	3	4
9-Nov-2021	37	131	4	10
10-Nov-2021	81	242	1	3
11-Nov-2021	0	89	0	6
12-Nov-2021	0	0	0	0
13-Nov-2021	0	0	0	0
14-Nov-2021	0	0	0	0
15-Nov-2021	0	0	0	0
16-Nov-2021	0	0	0	0
17-Nov-2021	0	0	0	0
18-Nov-2021	98	248	18	20
19-Nov-2021	82	180	13	3
20-Nov-2021	163	258	14	7
21-Nov-2021	70	188	1	6
22-Nov-2021	0	208	0	3
23-Nov-2021	0	3	0	6
24-Nov-2021	0	9	0	12
25-Nov-2021	0	142	0	1
26-Nov-2021	0	234	0	15
27-Nov-2021	0	166	0	5
28-Nov-2021	0	187	0	5
29-Nov-2021	0	141	0	8
30-Nov-2021	0	176	0	5
1-Dec-2021	0	217	0	4
2-Dec-2021	74	N/A	2	N/A
3-Dec-2021	106	N/A	5	N/A
4-Dec-2021	147	N/A	4	N/A

Appendix C

Bat Detector Results
Cayman Islands Terrestrial Ecology Assessment

Number of Nightly Passes for Bat Detector 1 and 2				
Date	Pallas's Mastiff Bat		Brazilian Free-tailed Bat	
	Bat 1	Bat 2	Bat 1	Bat 2
5-Dec-2021	205	N/A	3	N/A
6-Dec-2021	154	N/A	5	N/A
7-Dec-2021	261	N/A	16	N/A
8-Dec-2021	116	N/A	10	N/A
9-Dec-2021	71	N/A	10	N/A
10-Dec-2021	66	N/A	1	N/A
11-Dec-2021	N/A	N/A	N/A	N/A
12-Dec-2021	N/A	N/A	N/A	N/A
13-Dec-2021	N/A	N/A	N/A	N/A
14-Dec-2021	N/A	N/A	N/A	N/A
15-Dec-2021	N/A	N/A	N/A	N/A
16-Dec-2021	N/A	N/A	N/A	N/A
17-Dec-2021	N/A	N/A	N/A	N/A
18-Dec-2021	N/A	N/A	N/A	N/A
19-Dec-2021	N/A	N/A	N/A	N/A
20-Dec-2021	N/A	N/A	N/A	N/A
21-Dec-2021	N/A	N/A	N/A	N/A
22-Dec-2021	N/A	N/A	N/A	N/A
23-Dec-2021	N/A	N/A	N/A	N/A
24-Dec-2021	N/A	N/A	N/A	N/A
25-Dec-2021	N/A	N/A	N/A	N/A
26-Dec-2021	N/A	N/A	N/A	N/A
27-Dec-2021	N/A	N/A	N/A	N/A
28-Dec-2021	N/A	N/A	N/A	N/A
29-Dec-2021	N/A	N/A	N/A	N/A
30-Dec-2021	N/A	N/A	N/A	N/A
31-Dec-2021	N/A	N/A	N/A	N/A
1-Jan-2022	N/A	N/A	N/A	N/A
2-Jan-2022	N/A	N/A	N/A	N/A
3-Jan-2022	N/A	N/A	N/A	N/A
4-Jan-2022	N/A	N/A	N/A	N/A
5-Jan-2022	N/A	N/A	N/A	N/A
6-Jan-2022	N/A	N/A	N/A	N/A
7-Jan-2022	N/A	N/A	N/A	N/A
8-Jan-2022	N/A	N/A	N/A	N/A
9-Jan-2022	N/A	N/A	N/A	N/A
10-Jan-2022	N/A	N/A	N/A	N/A
11-Jan-2022	N/A	N/A	N/A	N/A
12-Jan-2022	N/A	N/A	N/A	N/A

Appendix C

Bat Detector Results
Cayman Islands Terrestrial Ecology Assessment

Number of Nightly Passes for Bat Detector 1 and 2				
Date	**Pallas's Mastiff Bat**		**Brazilian Free-tailed Bat**	
	Bat 1	**Bat 2**	**Bat 1**	**Bat 2**
13-Jan-2022	N/A	N/A	N/A	N/A
14-Jan-2022	N/A	162	N/A	16
15-Jan-2022	N/A	198	N/A	2
16-Jan-2022	N/A	176	N/A	6
17-Jan-2022	N/A	85	N/A	0
18-Jan-2022	N/A	126	N/A	6
19-Jan-2022	N/A	662	N/A	37
20-Jan-2022	N/A	746	N/A	61
21-Jan-2022	N/A	752	N/A	222
22-Jan-2022	N/A	59	N/A	4
23-Jan-2022	N/A	107	N/A	87
24-Jan-2022	N/A	153	N/A	5
25-Jan-2022	N/A	306	N/A	43
26-Jan-2022	N/A	93	N/A	0
27-Jan-2022	N/A	0	N/A	0
28-Jan-2022	N/A	0	N/A	0
29-Jan-2022	N/A	2	N/A	216
30-Jan-2022	N/A	2	N/A	0
31-Jan-2022	N/A	37	N/A	122
1-Feb-2022	N/A	358	N/A	72
2-Feb-2022	N/A	0	N/A	0
3-Feb-2022	N/A	0	N/A	0
4-Feb-2022	N/A	0	N/A	0
5-Feb-2022	N/A	0	N/A	0
6-Feb-2022	N/A	0	N/A	0
7-Feb-2022	N/A	0	N/A	0
8-Feb-2022	N/A	0	N/A	0
9-Feb-2022	N/A	135	N/A	78
10-Feb-2022	N/A	646	N/A	5
11-Feb-2022	N/A	669	N/A	7
12-Feb-2022	N/A	403	N/A	6
13-Feb-2022	N/A	175	N/A	11
14-Feb-2022	N/A	7	N/A	1
15-Feb-2022	N/A	22	N/A	0
Total number of nightly passes	**1896**	**11173**	**114**	**1200**
Note				
Due to technical issues, non-recording nights are listed as not applicable (N/A)				

Appendix C

Bat Detector Results
Cayman Islands Terrestrial Ecology Assessment

Appendix C-1 – Bat Detector 1 Charts

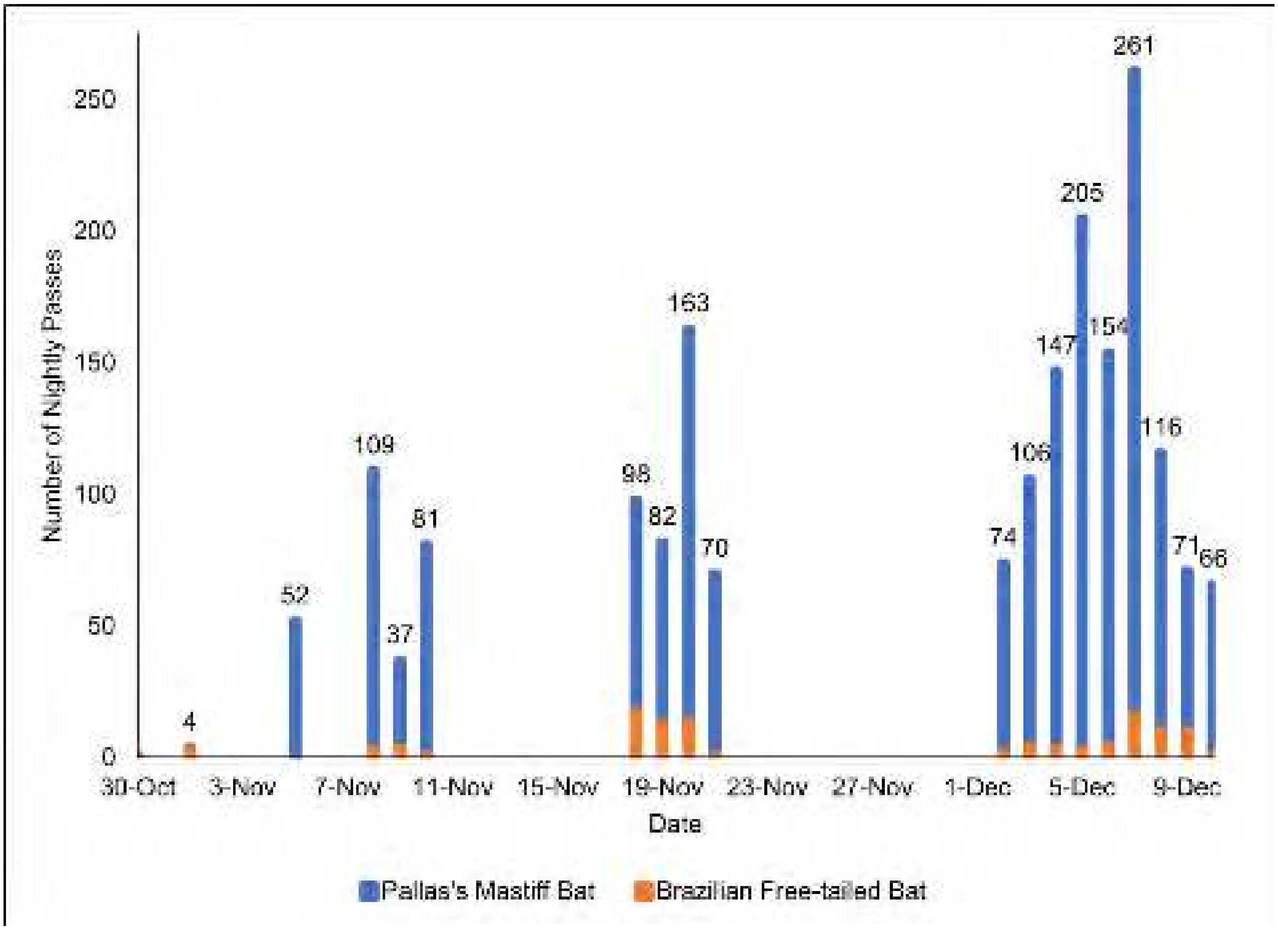


Figure 1 *Total Number of Nightly Passes at Bat Detector 1*

Appendix C

Bat Detector Results
Cayman Islands Terrestrial Ecology Assessment

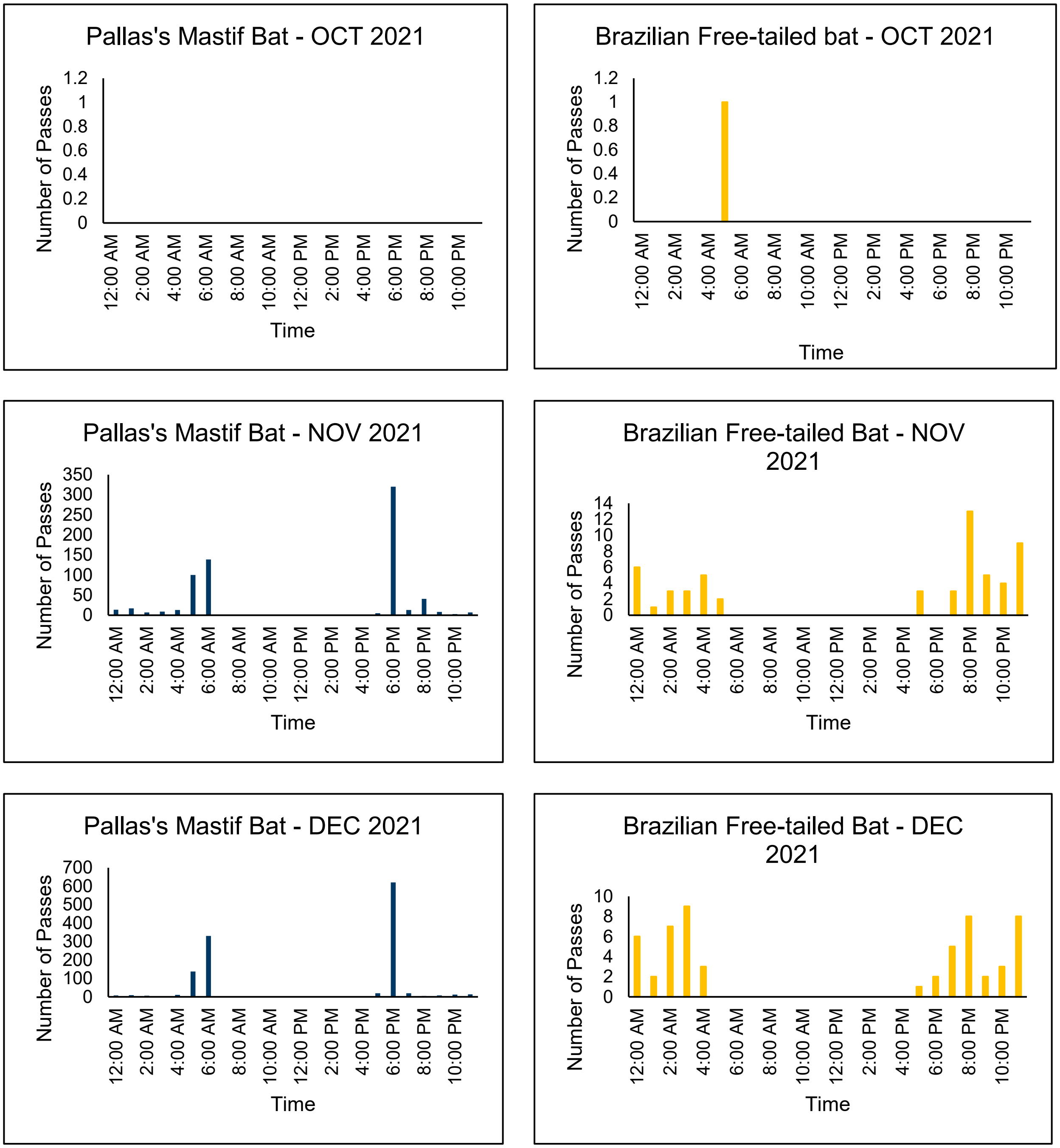


Figure 2 *Timeline for Nightly Bat Activity at Detector 1*

Appendix C

Bat Detector Results
Cayman Islands Terrestrial Ecology Assessment

Appendix C-2 – Bat Detector 2 Charts

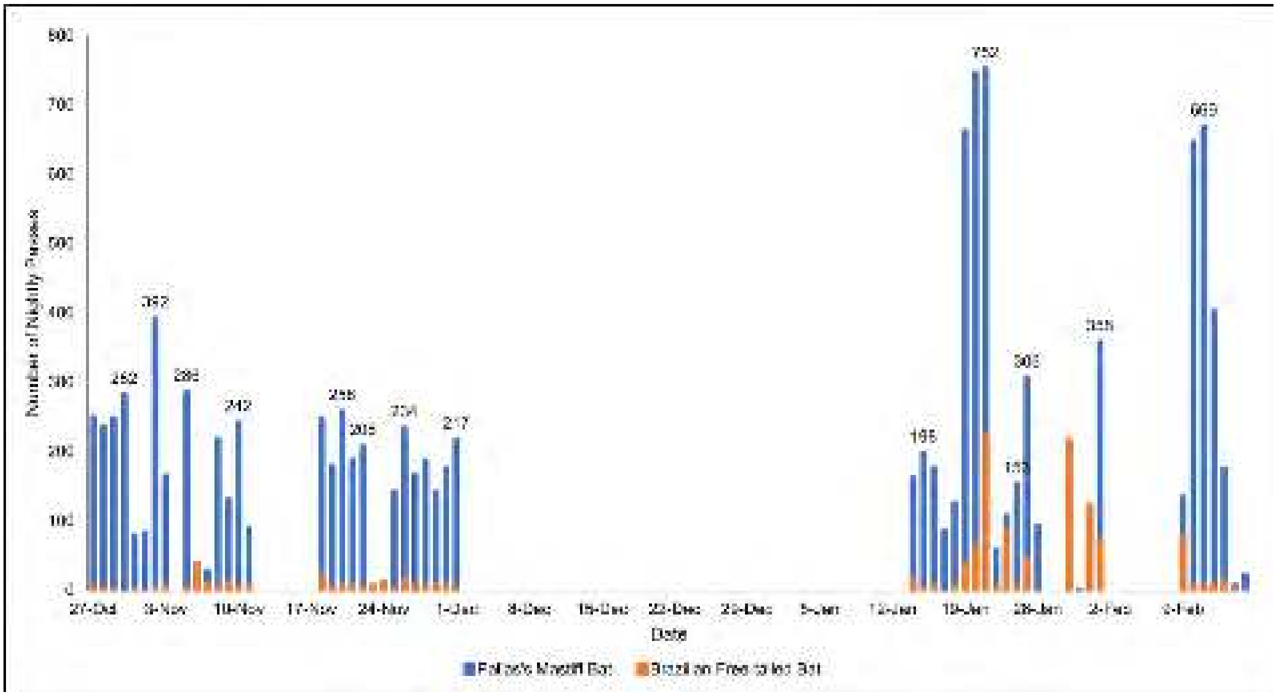
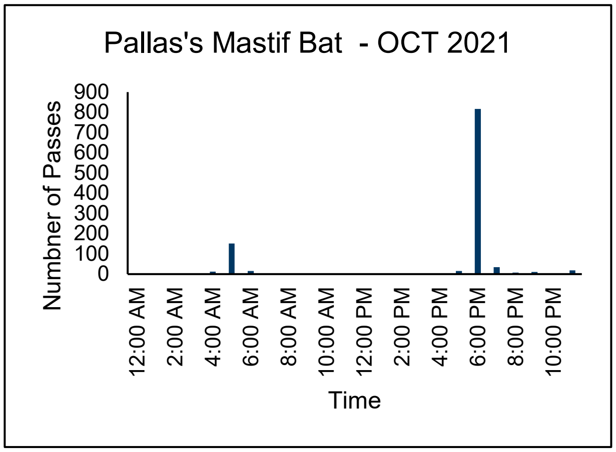
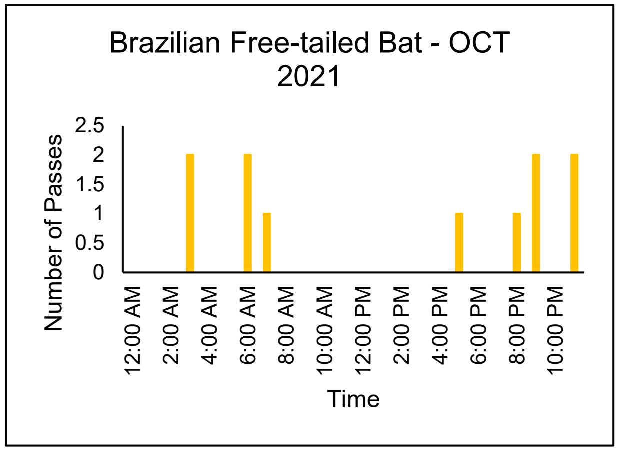


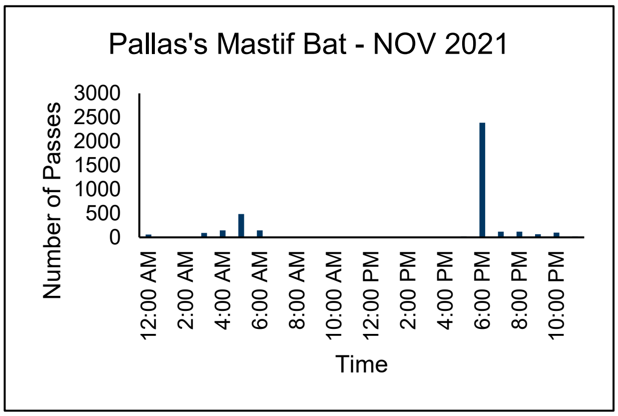
Figure 3 *Total Number of Nightly Passes at Bat Detector 2*

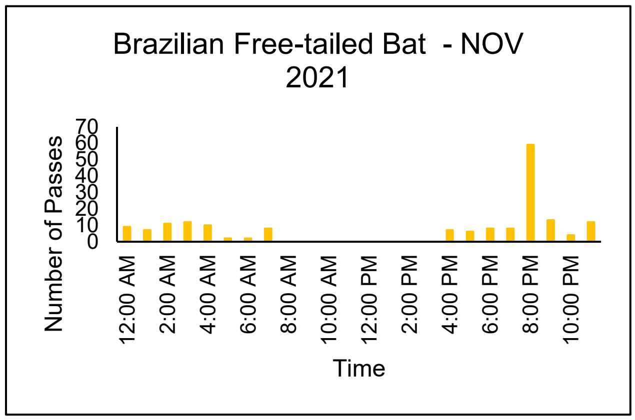
Appendix C

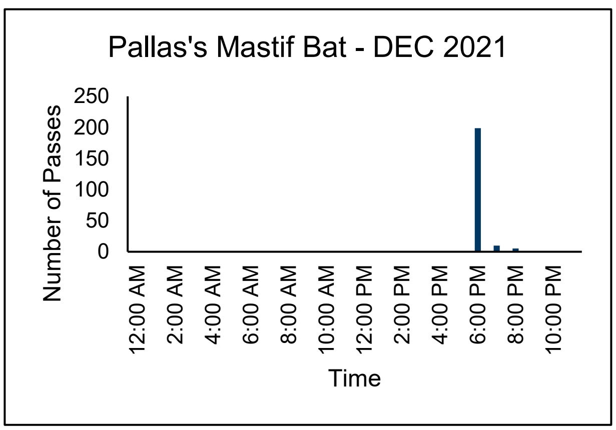
Bat Detector Results
Cayman Islands Terrestrial Ecology Assessment

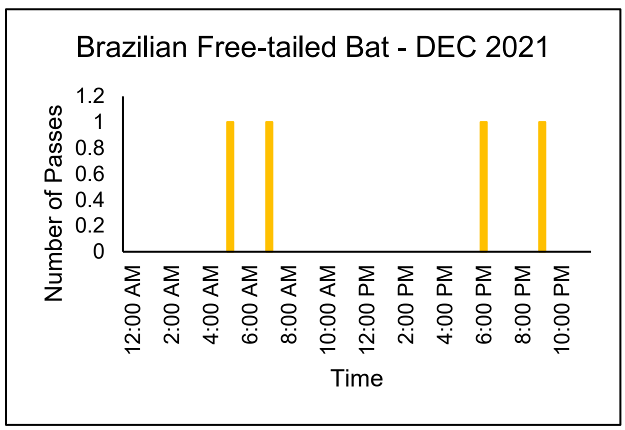












Appendix C

Bat Detector Results
Cayman Islands Terrestrial Ecology Assessment

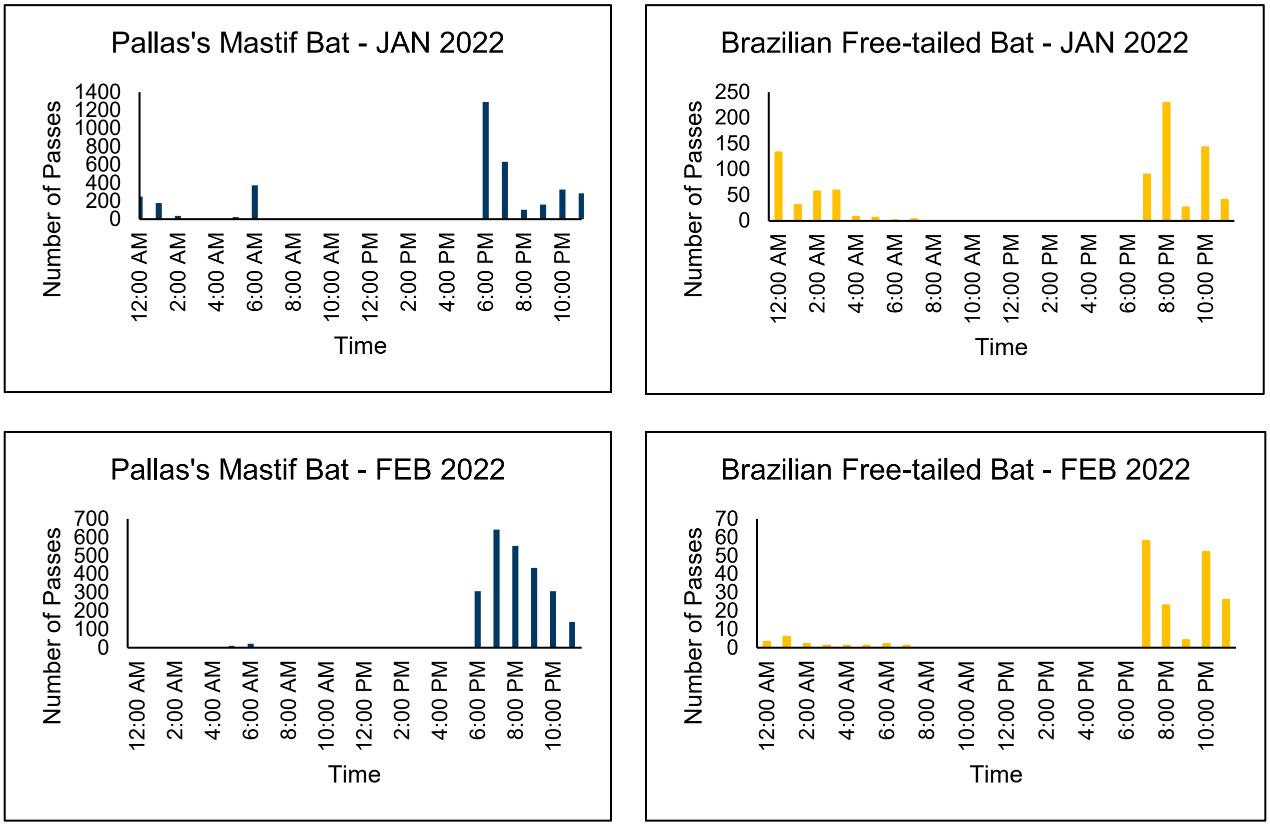


Figure 4 ***Timeline of Nightly Bat Activity for Bat Detector 2***

Appendix D

Audiofauna Monitoring Results

Appendix D

Audiofauna Monitoring Results
Cayman Islands Terrestrial Ecology Assessment

Common name	Scientific Name	Date observed
Amphibians		
Cuban Treefrog	*Osteopilus septentrionalis*	October 2021 - January 2022
Eastern Narrowmouth Toad	*Gastrophryne carolinensis*	November 31, 2021
Greenhouse Frog	*Eleutherodactylus planirostris*	October 2021 - January 2022
Birds		
Bananaquit	*Coereba flaveola*	October 2021 - November 2021
Black and White Warbler	*Mniotilta varia*	October 2021 - January 2022
Black-Crowned Night Heron	*Nycticorax nycticorax*	October 2021 - January 2022
Blue Grosbeak	*Passerina caerulea*	October 28, 2021
Bunting sp.	*Passerina sp.*	October 1, 2021
Common Gallinule	*Gallinula galeata*	November 19, 2021
Common Yellowthroat	*Geothlypis trichas*	October 30, 2021
Gray Catbird	*Dumetella carolinensis*	November 30, 2021
Greater Antillean Grackle	*Quiscalus niger*	November 3, 2021
Greater Yellowlegs	*Tringa melanoleuca*	October 30, 2021
House Sparrow	*Passer domesticus*	October 2021 - January 2022
Killdeer	*Charadrius vociferous*	October 31, 2021
Nashville Warbler	*Leiothlypis ruficapilla*	October 29, 2021
Northern Flicker	*Colaptes auratus*	November 19, 2021
Northern Mockingbird	*Mimos polyglottos*	October 2021 - January 2022
Northern Parula	*Setophaga americana*	Novermber 1, 2021
Red Junglefowl	*Gallus gallus*	October 2021 - January 2022
Smooth-billed Ani	*Crotophaga ani*	October 2021 - January 2022
White-crowned Sparrow	*Zonotrichla leucophrys*	October 29, 2021
Yellow Warbler	*Setophaga petechia*	November 20, 2021
Mammals		
Agouti	*Dasyprocta punctata*	October 31, 2021
Notes		
Bolded species denotes species protected under Schedule 1 of the National Conservation Law (2013).		

Appendix E

Wildlife Camera Monitoring Results

Appendix E

Wildlife Camera Monitoring Results
Cayman Islands Terrestrial Ecology Assessment

Common Name	Scientific Name	Location	Date Observed
Arthropods			
Unidentified butterfly	*Heliconius sp.*	Camera 3	January 2022
Unidentified butterfly	*Sulphur sp.*	Camera 3	November 2021, December 2021, January 2022
Unidentified butterfly	N/A	Camera 3	December 2021
Unidentified dragonfly	N/A	Camera 3	December 2021
Birds			
Bananaquit	***Coereba flaveola***	Camera 4	November 2021
Black-crowned Night Heron	***Nycticorax nycticorax***	Camera 3	November, December 2021, January 2022
Common Gallinule	***Gallinula galeata***	Camera 2, 3	November, December 2021
Cayman Parrot	***Amazona leucocephala***	Camera 3	December 2021
Great Blue Heron	***Ardea herodias***	Camera 3	November 2021
Great Egret	***Ardea aalba***	Camera 3	January 2022
Greater Anterior Grackle	***Quiscalus niger***	Camera 2	January 18, 2022
Green Heron	***Butorides virescens***	Camera 3	November, December 2021
Northern Mockingbird	***Mimus polyglottos***	Camera 2, 3	January 14, 2021
Red Junglefowl	*Gallus gallus*	Camera 2, 3	November 2021, December 2021, January 2022
Ruby Throated Hummingbird	***Archilochus colubris***	Camera 3	December 2021
Smooth-billed Ani	***Crotophaga ani***	Camera 3	December 2021
Snowy Egret	***Egretta thula***	Camera 2, 3	December 2021, January 2022
Tricolored Heron	***Egretta tricolor***	Camera 3	November 2021, January 2022
Yellow-crownded Night Heron	***Nyctonassa violacea***	Camera 3	December 2021
Mammals			
Dog	*Canis familiaris*	Camera 2, 3	December 2021, January 2022
Reptiles			
Unidentified iguana	*Cyclura sp.*	Camera 3	November 2021
Unidentified lizard	N/A	Camera 3	November 2021
Unidentified snake	N/A	Camera 3	November 2021
Notes			
Bolded species denotes species protected under Schedule 1 of the National Conservation Law (2013).			

Appendix F

Protected Species List

Appendix F

Protected Species List
Cayman Islands Terrestrial Ecology Assessment

Species	Habitat use within the Study Area[1]	Legal protection under Schedule I of the National Conservation Law (2013)	Method of species confirmation on Site	Location on Site
Birds				
All birds (Aves all species)*	Dry Shrubland, Dry Forest, Caves, Farms and Grassland and Urban man-modified areas	All birds are protected under Part 1 of the NCL, except those listed in Part 2	Wildlife cameras, Songmeter	Camera 2, 3, 4, Songmeter
Brown booby (*Sula leucogaster*)^	Caves	Protected under Part 1 of the NCL	N/A	N/A
Cayman parrot / Cuban parrot / Rose-throated parrot (*Amazona leucocephala)*^~	Dry Shrubland	Protected under Part 1 of the NCL	Wildlife camera	Camera 3
Red-footed booby (*Sula sula)*^	Dry Shrubland and Forest and Woodland	Protected under Part 1 of the NCL	N/A	N/A
Vitelline warbler (*Dendroica vitellina)*	Dry Shrubland	Protected under Part 1 of the NCL	N/A	N/A
West Indian Whistling-duck (Whistler) (*Dendrocygna arborea)*^	Farm and Grassland	Protected under Part 1 of the NCL	N/A	N/A
White-tailed tropicbird (Boatswain bird) (*Phaethon lepturus)*^	Caves	Protected under Part 1 of the NCL	N/A	N/A
Mammals				
Antillean Nectar Bat (*Brachyphylla nana nana*)*^	Caves	Protected under Part 1 of the NCL	N/A	N/A
Big Brown Bat (*Eptesicus fuscus mino*)*^	Dry Forest, Caves, Farms and Grassland and Urban man-modified areas	Protected under Part 1 of the NCL	N/A	N/A
Brazilian Free-tailed Bat (*Tadarida brasiliensis muscala*)*^~	Dry Shrubland, Dry Forest, Caves, Farms and Grassland and Urban man-modified areas	Protected under Part 1 of the NCL	Bat detector	Bat detector 1 and 2
Buffy Flower Bat (*Erophylla sezekorni*)*^	Dry Forest and Caves	Protected under Part 1 of the NCL	N/A	N/A
Jamaican Fruit Bat (*Artibeus jamaicensis parvipes*)*^	Dry Shrubland, Dry Forest, Caves, Farms and Grassland and Urban man-modified areas	Protected under Part 1 of the NCL	N/A	N/A
Pallas' Mastiff Bat (*Molossus molossus*)*^~	Dry Shrubland, Dry Forest, Caves, Farms and Grassland and Urban man-modified areas	Protected under Part 1 of the NCL	Bat detector	Bat detector 1 and 2
Red Bat (*Lasiurus borealis*)*^	Dry Shrubland, Dry Forest, Farms and Grassland and Urban man-modified areas	Protected under Part 1 of the NCL	N/A	N/A
Waterhouse's Leaf-nosed Bat (*Macrotus waterhousii minor*)*^	Dry Shrubland, Caves, Farms and Grassland and Urban man-modified areas	Protected under Part 1 of the NCL	N/A	N/A
White-shouldered Bat (*Phyllops falcatus*)*^	Dry Shrubland, Dry Forest and Urban man-modified areas	Protected under Part 1 of the NCL	N/A	N/A
Reptiles				
Grand Cayman Water snake (*Tretanorhinus variabilis lewisi)**	Ponds and Mangroves	Regulated under Part 2 of the NCL	N/A	N/A
Grand Cayman Blue iguana (*Cyclura lewisi)**^~	Dry Shrubland, Farm and Grassland	Protected under Part 1 of the NCL	Wildlife camera (potential observation)	Camera 3
Sister Islands Rock iguana (*Cyclura nubila caymanensis)**^	Dry Shrubland, Farm and Grassland	Protected under Part 1 of the NCL	N/A	N/A
Grand Cayman Blue-throated anole (*Anolis conspersus)**	Dry Shrubland	Regulated under Part 2 of the NCL	N/A	N/A
Wood slave gecko (*Aristelliger praesignis praesignis)**	Dry Shrubland	Regulated under Part 2 of the NCL	N/A	N/A
Grand Cayman Ground boa (*Tropodophis caymanensis)**	Dry Shrubland	Regulated under Part 2 of the NCL	N/A	N/A
Cayman racer (*Alsophis cantherigerus)**	Dry Shrubland	Regulated under Part 2 of the NCL	N/A	N/A

Appendix F

Protected Species List
Cayman Islands Terrestrial Ecology Assessment

Species	Habitat use within the Study Area[1]	Legal protection under Schedule I of the National Conservation Law (2013)	Method of species confirmation on Site	Location on Site
Grand Cayman racer (*Alsophis cantherigerus caymanus),* Cayman Brac racer (*Alsophis cantherigerus fuscicauda)* & Little Cayman racer (*Alsophis cantherigerus ruttyi)**	Urban and Man-Modified Areas	Regulated under Part 2 of the NCL	N/A	N/A
Little Cayman Green anole (*Anolis maynardi)*^*	Dry Shrubland, Forest and Woodland	Regulated under Part 2 of the NCL	N/A	N/A
Grand Cayman Blue-throated anole (*Anolis conspersus)**	Dry Shrubland	Regulated under Part 2 of the NCL	N/A	N/A
Western Grand Cayman Blue-throated anole (*Anolis conspersus conspersus)**	Forest and Woodland	Regulated under Part 2 of the NCL	N/A	N/A
Eastern Grand Cayman Blue-throated anole (*Anolis conspersus lewisi*)*	Forest and Woodland	Regulated under Part 2 of the NCL	N/A	N/A
Yellow galliwasp (*Celestus crusculus maculatus)**	Forest and Woodland	Regulated under Part 2 of the NCL	N/A	N/A
Grand Cayman Ground boa (Lazy snake) (*Tropidophis caymanensis caymanensis)**	Urban and Man-Modified Areas	Regulated under Part 2 of the NCL	N/A	N/A
Little Cayman Ground boa (Wood snake) (*Tropidophis caymanensis parkeri)**	Urban and Man-Modified Areas	Regulated under Part 2 of the NCL	N/A	N/A
Cayman Brac Ground boa (Lazy snake) (*Tropidophis caymanensis schwartzi)**	Urban and Man-Modified Areas	Regulated under Part 2 of the NCL	N/A	N/A
Cayman Brac Blind snake (*Typhlops biminiensis epactia)**	Urban and Man-Modified Areas	Regulated under Part 2 of the NCL	N/A	N/A
Grand Cayman Blind snake (*Typhlops caymanensis)**	Urban and Man-Modified Areas	Regulated under Part 2 of the NCL	N/A	N/A
Lesser Cayman Islands iguana (*Cyclura nubila caymanensis)**	Roads	Protected under Part 1 of the NCL	N/A	N/A
Invertebrates				
Cayman Brac cicada (*Diceroprocta ovata*)*	Dry Shrubland	Regulated under Part 2 of the NCL	N/A	N/A
Cayman Brown Leaf butterfly (*Memphis vericordia danielana)**	Forest and Woodland	Protected under Part 1 of the NCL	N/A	N/A
Cayman Zoe julia (*Dryas iulia zoe)**	Forest and Woodland	Protected under Part 1 of the NCL	N/A	N/A
Centipede (*Leptophilus caribeanus)**	Dry Shrubland	Regulated under Part 2 of the NCL	N/A	N/A
Grand Cayman cicada (*Diceroprocta cleaves)**	Dry Shrubland	Regulated under Part 2 of the NCL	N/A	N/A
Isopod (*Anopsilana crenata*)*	Ponds and Mangroves	Regulated under Part 2 of the NCL	N/A	N/A
Little Cayman cicada (*Diceroprocta caymanensis)**	Dry Shrubland	Regulated under Part 2 of the NCL	N/A	N/A
Little Cayman cicada (*Diceroprocta caymanensis)**	Forest and Woodland	Regulated under Part 2 of the NCL	N/A	N/A
Little Cayman snail (*Cerion nanus)*^*	Dry Shrubland	Protected under Part 1 of the NCL	N/A	N/A
Pygmy Blue butterfly (*Brephidium exilis thompsoni*)*^	Salt-tolerant succulents, Ponds and Mangroves	Protected under Part 1 of the NCL	N/A	N/A
Soldier crab (Hermit) *Coenobita clypeatus**	Forest and Woodland	Protected under Part 1 of the NCL	N/A	N/A
Swallowtail butterfly (endemic) (*Heraclides andraemon tailori)* *	Forest and Woodland	Protected under Part 1 of the NCL	N/A	N/A
White Land crab (*Cardisoma guanhumi)*^*	Roads	Regulated under Part 2 of the NCL	N/A	N/A
Plants				
Aegiphila caymanensis^*	Forest and Woodland	Protected under Part 1 of the NCL	N/A	N/A
*Agalinis kingsii**	Farm and Grassland	Protected under Part 1 of the NCL	N/A	N/A
*Allophylus cominia var. caymanensis**	Dry Shrubland	Regulated under Part 2 of the NCL	N/A	N/A

Appendix F

Protected Species List
Cayman Islands Terrestrial Ecology Assessment

Species	Habitat use within the Study Area[1]	Legal protection under Schedule I of the National Conservation Law (2013)	Method of species confirmation on Site	Location on Site
Banana orchid (*Myrmecophila thomsoniana*)*^	Dry Shrubland	Regulated under Part 2 of the NCL	N/A	N/A
Banara caymanensis*^	Dry Shrubland	Protected under Part 1 of the NCL	N/A	N/A
*Beloglottis costaricensis**	Forest and Woodland	Regulated under Part 2 of the NCL	N/A	N/A
Black mangrove (*Avicennia germinans* [= *nitida*])*~	Mangroves	Regulated under Part 2 of the NCL	Preliminary site surveys	Southern portion of the Site
Broadleaf (*Cordia sebestena caymanensis)**	Dry Shrubland	Regulated under Part 2 of the NCL	N/A	N/A
Bull rush *Zamia integrifolia**	Forest and Woodland	Regulated under Part 2 of the NCL	N/A	N/A
*Buxus bahamensis**	Dry Shrubland	Regulated under Part 2 of the NCL	N/A	N/A
*Casearia staffordiae**	Forest and Woodland	Protected under Part 1 of the NCL	N/A	N/A
Cayman sage (*Salvia caymanensis*)*^	Dry Shrubland, Urban and Man-Modified Areas and Roads	Protected under Part 1 of the NCL	N/A	N/A
Cayman Silverbush (*Argythamnia proctorii)* *	Forest and Woodland	Regulated under Part 2 of the NCL	N/A	N/A
Cedar (*Cedrela odorata*)*^	Forest and Woodland	Regulated under Part 2 of the NCL	N/A	N/A
*Celtis trinervia**	Forest and Woodland	Regulated under Part 2 of the NCL	N/A	N/A
Century plant / Agave (Agave caymanensis)*^	Dry Shrubland	Regulated under Part 2 of the NCL	N/A	N/A
Clamcherry *(Cordia laevigata)**	Forest and Woodland	Regulated under Part 2 of the NCL	N/A	N/A
*Colubrina arborescens**	Forest and Woodland	Regulated under Part 2 of the NCL	N/A	N/A
Consolea millspaughii caymanensis *^	Dry Shrubland, Forest and Woodland	Protected under Part 1 of the NCL	N/A	N/A
*Crossopetalum caymanense**	Forest and Woodland	Regulated under Part 2 of the NCL	N/A	N/A
*Daphnopsis americana**	Forest and Woodland	Regulated under Part 2 of the NCL	N/A	N/A
*Dendropanax arboreus**	Forest and Woodland	Regulated under Part 2 of the NCL	N/A	N/A
Dendropemon caymanensis *^	Dry Shrubland, Forest and Woodland	Regulated under Part 2 of the NCL	N/A	N/A
Drypetes sp.*^	Forest and Woodland	Regulated under Part 2 of the NCL	N/A	N/A
*Encyclia kingsii**	Forest and Woodland	Protected under Part 1 of the NCL	N/A	N/A
*Epiphyllum phyllanthus plattsii**^	Forest and Woodland	Protected under Part 1 of the NCL	N/A	N/A
*Euphorbia cassythoides**	Dry Shrubland	Regulated under Part 2 of the NCL	N/A	N/A
*Evolvulus squamosus**	Dry Shrubland	Regulated under Part 2 of the NCL	N/A	N/A
*Faramea occidentalis**	Forest and Woodland	Regulated under Part 2 of the NCL	N/A	N/A
Ghost orchid (Dendrophylax fawcettii)*^	Forest and Woodland	Protected under Part 1 of the NCL	N/A	N/A
Glassworts (*Salicornia* species)*	Salt-tolerant succulents	Regulated under Part 2 of the NCL	N/A	N/A
Ironwood (Chionanthus caymanensis)*^	Dry Shrubland	Regulated under Part 2 of the NCL	N/A	N/A
*Jatropha divaricate**	Forest and Woodland	Regulated under Part 2 of the NCL	N/A	N/A
*Licaria triandra**	Forest and Woodland	Regulated under Part 2 of the NCL	N/A	N/A
Lignum vitae (*Lignum vitae)**	Forest and Woodland	Regulated under Part 2 of the NCL	N/A	N/A
*Margaritaria nobilis**	Forest and Woodland	Regulated under Part 2 of the NCL	N/A	N/A
*Oeceoclades maculate**	Forest and Woodland	Regulated under Part 2 of the NCL	N/A	N/A
Old George (*Hohenbergia caymanensis*)*^	Forest and Woodland	Protected under Part 1 of the NCL	N/A	N/A
*Phyllanthus caymanensis**	Dry Shrubland	Regulated under Part 2 of the NCL	N/A	N/A
*Pilostyles globosa caymanensis**	Dry Shrubland	Regulated under Part 2 of the NCL	N/A	N/A
*Pisonia margaretae**^	Forest and Woodland	Protected under Part 1 of the NCL	N/A	N/A
*Pleurothallis caymanensis**	Dry Shrubland	Protected under Part 1 of the NCL	N/A	N/A
*Prosthechea cochleate**	Forest and Woodland	Regulated under Part 2 of the NCL	N/A	N/A
*Rauvolfia nitida**	Forest and Woodland	Regulated under Part 2 of the NCL	N/A	N/A
*Ruppia maritima**	Ponds and Mangroves	Regulated under Part 2 of the NCL	N/A	N/A
Satinwood *(Zanthoxylum flavum)**	Dry Shrubland	Regulated under Part 2 of the NCL	N/A	N/A
*Scolosanthus roulstonii**	Dry Shrubland	Regulated under Part 2 of the NCL	N/A	N/A
Silver Thatch palm (Coccothrinax proctorii)*^	Dry Shrubland, Forest and Woodland	Regulated under Part 2 of the NCL	N/A	N/A
Smokewood (*Erythroxylum confusum)**	Forest and Woodland	Regulated under Part 2 of the NCL	N/A	N/A
Tea banker (*Pectis caymanensis var. robusta)**	Urban and Man-Modified Areas	Protected under Part 1 of the NCL	N/A	N/A
*Terminalia eriostachya margaretiae**	Forest and Woodland	Protected under Part 1 of the NCL	N/A	N/A

Appendix F

Protected Species List
Cayman Islands Terrestrial Ecology Assessment

Species	Habitat use within the Study Area[1]	Legal protection under Schedule I of the National Conservation Law (2013)	Method of species confirmation on Site	Location on Site
*Tillandsia festucoides**	Forest and Woodland	Regulated under Part 2 of the NCL	N/A	N/A
*Tolumnia (= Oncidium) calochilum**	Forest and Woodland	Protected under Part 1 of the NCL	N/A	N/A
*Tolumnia (= Oncidium) variegate**	Forest and Woodland	Protected under Part 1 of the NCL	N/A	N/A
*Trichilia havanensis**	Forest and Woodland	Regulated under Part 2 of the NCL	N/A	N/A
*Turnera triglandulosa**	Roads	Regulated under Part 2 of the NCL	N/A	N/A
Verbesina caymanensis^	Dry Shrubland	Protected under Part 1 of the NCL	N/A	N/A
Yoke wood *(Catalpa longissimi)**	Forest and Woodland	Regulated under Part 2 of the NCL	N/A	N/A

Notes

[1] Habitats identified within the broad Study Area (per Figure 2) in the Cayman Islands National Biodiversity Action Plan (NBAP; DaCosta-Cottam et al. 2009)
* Denotes species listed within a Habitat Action Plan of the NBAP
^ Denotes species with own Species Action Plan detailed in the NBAP
~ Denotes species that were detected on Site
N/A - Not applicable

Appendix 8.A
Hydrology and Hydrogeology Assessment

Executive summary

This Hydrology and Hydrogeology Assessment presents the baseline hydrological and hydrogeological conditions at the Site and an impact assessment to assess any relevant issues that may affect the proposed development, in accordance with the requirements of the Final Terms of Reference (ToR) written by Wood (2021).

The report indicates that the Site area is low-lying and affected by extreme weather events and is subsequently at risk of flood events.

Groundwater within the vicinity of the Site area is hydraulically connected to the ocean and other surface waters (such as the nearby mosquito control channels). This infers a tidal influence on the groundwater, and results in a considerable degree of mixing of saltwater and freshwater at the transition zone, which is anticipated to be present beneath the Site. As a result the groundwater is of high salinity and considered to be of 'low quality', and is therefore unsuitable for potable use without treatment. This is typical for groundwater on Grand Cayman, with the exception of some freshwater lenses located on the eastern side of the island.. Groundwater sampling within the Site area indicates that quality has been affected, presumed to be caused by emissions from the adjacent George Town Landfill (GTLF).

Surface water sampling at the Site and nearby mosquito control channels and North Sound also appear to be contaminated, presumably associated with GTLF emissions. Based on current trends, it is anticipated that concentrations of these contaminants may increase in the near future without influence from the proposed development at the Site.

Available information allowed for a qualitative impact assessment of the potential risks relating to hydrology and hydrogeology. Based on the current proposed design, a variety of potential environmental impacts associated with all relevant phases of the ISWMS have been identified. A number of these impacts have been assessed as Potentially Significant Impacts.

Appropriate mitigation measures for these Potentially Significant Impacts have been recommended, including a surface runoff management plan, a flood risk assessment (FRA), storm water management plan, and other strategies and measures to address the effects of water quality deterioration, groundwater yield reduction, and degradation of subsurface infrastructure.

Overall, due to the current unsustainable design and practices at the GTLF and resulting impacts to groundwater quality, it is likely that the construction of the ISWMS will result in net environmental benefits in the long-term. This is due to improved waste management practices and facilities replacing the current practices at the GTLF (unlined landfill) that are currently impacting groundwater and surface water quality.

A residual significant risk relates to potential flooding occurring at the site that exceeds the criteria adopted in the site design and impacts site infrastructure.

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1. Introduction

1.1 Purpose of this report

GHD Limited (GHD) was retained by ReGen and the Cayman Islands Government (CIG) as approved by the Environmental Assessment Board (EAB) to undertake a hydrology and hydrogeology assessment as part of the Environmental Impact Assessment (EIA) for the proposed Integrated Solid Waste Management System (ISWMS, Project). This hydrology and hydrogeology assessment in part overlaps with matters considered in other assessments within the EIA. In particular, as highlighted within the ToR, Marine Ecology, Terrestrial Ecology, and Land Quality.

1.2 Overview of the Proposed Development

An Integrated Solid Waste Management System (ISWMS) is to be developed north of central Georgetown, Grand Cayman.

1.3 Study Areas

1.3.1 Spatial scope

The proposed Integrated Solid Waste Management System (ISWMS) is described in detail in Chapter 4 - Proposed Project & Overview.

The ISWMS will be located to the north of central George Town towards the western coast of Grand Cayman (the “Site”). The proposed boundary and layout of the ISWMS is shown in Figure 1.

The Study Area considered within this report encompasses the entire footprint of the ISWMS and some of its environs within the 2 km buffer zone, as outlined in the ToR (Wood, 2021). The ISWMS will include the following elements:

- Energy Recovery Facility (ERF)
- Non-Energy Recovery Facilities:
  - Site weighbridges
  - Green Waste Processing Facility (GWPF)
  - Construction and Demolition Waste Processing Facility (C&DWPF)
  - Bottom Ash Processing Facility (BAPF)
  - Abandoned and End of Life / Scrap Metal Processing Facility (ELV/SMPF)
  - Medical Waste Facility
  - Materials Recycling Facility
  - Household Waste Recycling Centre
  - Landfill Gas Facility (LGF)
  - Residual Waste Landfill (RWL)
- Ancillary Facilities:
  - Admin Building
  - Maintenance Building
  - CUC Substation

For the avoidance of doubt, this hydrology and hydrogeology assessment excludes:

- Potential contamination effects to, or from, soils, which are assessed separately elsewhere.
- Potential effects resulting from the subsequent closure of the existing landfills on each of the three islands including the Georgetown Landfill (GTLF).

As referenced in the ToR (Wood, 2021), the construction and operation of the proposed facilities on the Sister Islands will be managed by the DEH, and so will lie outside the scope of this EIA. Furthermore, with respect to the landfill closures on each of the three islands, it is understood that such activities will be subject to risk-based assessments that will be conducted outside the EIA.

1.3.2 Temporal scope

The temporal scope considered within this report covers the construction, operation, and decommissioning of the ISWMS. GHD understands that the design life of the new facilities is 25 years.

Figure 1 *Hydrology and hydrogeology study area*

2. Methodology

2.1 Relationship with other Sections of the EIA

This Hydrology and Hydrogeology Assessment in part overlaps with matters considered in other assessments within the EIA. In particular, as highlighted within the ToR (Wood, 2021), Marine Ecology, Terrestrial Ecology, and Land Quality. The land quality chapter of the EIA is being prepared by GHD and due regard has been given to coordinate these chapters.

2.2 Potential receptors

The main potential water receptors and flood risk that could be affected by, or impact, the proposed development at the Site are summarised in Table 1, as identified in the ToR (Wood, 2021). It is important to note that this assessment examines potential changes of the Site on the water environment supporting designated conservation sites and potential undesignated groundwater-dependent terrestrial ecosystems (GWDTEs), not the habitats themselves, which are considered in the marine ecology and terrestrial ecology assessment reports.

Table 1 Potential hydrology (including flood risk) and hydrogeology receptors identified in the ToR (Table 5.13 in Wood, 2021).

Receptor	Location
Water Environment	
Ironshore Formation aquifer (limestone and marl bands up to 7.6 m thick)	Beneath the proposed development Site (0 to -25 ft / 0 to -7.6 m below mean sea level)
Bluff Group aquifer (Pedro Castle Formation aquifer, Cayman Formation and Brac Formation; dolomite, limestone and dolostone)	Beneath the proposed development Site (<-25 ft /-7.6 m below mean sea level)
North Sound (contains Replenishment and Environmental Zone which are marine protected areas)	2,460 ft (750 m) northeast of the Site
Water Use	
Groundwater abstraction for geothermal cooling system and potable water supply for use on the development site	At the proposed development Site
Groundwater abstraction for reverse osmosis plant for Laundry Facility	0.2 miles (0.3 km) northeast of the proposed development Site
Groundwater abstraction for potable water supply following desalination at WAC's Red Gate Road Water Works (reverse osmosis plants)	0.6 miles (1 km) southeast of the proposed development Site
Groundwater abstraction for geothermal cooling purposes at the CUC electrical power generation facility	0.5 miles (0.75 km) southeast of the proposed development Site
Groundwater abstraction for geothermal cooling purposes undertaken by various other developments including Fosters warehouses and the Owen Roberts International Airport, with expectation of further future projects	0.7 miles (1.2 km) southeast (Fosters warehouse) and south (Airport) of the proposed development Site
Humans, properties, and infrastructure within areas prone to flooding	
Site infrastructure, staff, and visitors	Proposed development Site
Surrounding land infrastructure, users, and visitors	Surrounding land

2.3 Assessment methodology

The assessment methodology is based on that prescribed within the ToR (Wood, 2021).

2.3.1 Consistent terminology

To assist the reader, consistent terminology has been adopted within this Hydrology and Hydrogeology Assessment. In particular, the word 'effect' is used to describe the consequence of environmental changes that are caused by development-related activities. The word 'impact' has not been used other than in the phrase EIA or where it appears in references).

2.3.2 Review of existing conditions

Available secondary sources of information were collected and reviewed to characterize the existing hydrological and hydrogeological conditions at the Site. A number of documents were identified within the ToR (Wood, 2021) and, in preparing this Hydrology and Hydrogeology Assessment, GHD identified additional relevant documents. All documents referred to have been cited within the text and fully referenced in Section 7.

It should be noted that where data (*e.g.*, contaminant analysis results) required extraction from the electronic documents (*e.g.,* PDF) provided, this has been done on a 'best endeavours' basis. If necessary, scanned images have been converted using optical character recognition (OCR) technology. However, GHD cannot guarantee the accuracy of the original third party data, nor in the fidelity of any OCR or transcription, whether manual or digital.

The following sources of secondary information have been considered in relation to hydrology and hydrogeology:

- Google Earth – web-based aerial imagery.
- Online topographic map (http://en-gb.topographic-map.com/places/George-Town-133291).
- Cayman Islands Government (CIG), 1992. Environmental Assessment of Grand Cayman Sanitary Landfill, Grand Cayman Island, B.W.I.
- Wood, 2021. Terms of Reference.
- GHD, 2023. GTLF Environmental Risk Assessment.
- GHD, 2023. Flood Risk Assessment.
- Carbex Geological Services Ltd, 2023. ReGen Geological Report.
- GHD, 2023. ISWMS Works Delivery Plan.
- GHD, 2023. ISWMS Service Delivery Plan.
- R.C. Minning & Associates, Inc (2023). Hydrogeological Investigation ReGen Geothermal System. Grand Cayman Island, Grand Cayman.
- Intergovernmental Oceanography Commission Website (http://www.ioc-sealevelmonitoring.org/station.php).

2.3.3 Site visits, inspections, and investigations

Due to the limited timescales, it was not possible for GHD to undertake bespoke Site visits or surveys, nor undertake any additional Site investigations or monitoring during the preparation of this Hydrology and Hydrogeology Assessment. Consequently, the following assessments are based entirely on secondary sources, including pre-existing environmental investigation and assessment reports relating to the Site.

However, GHD is aware that groundwater sampling works have recently been undertaken in some areas at the Site by DEH. The results of this have been incorporated into this assessment where possible.

2.3.4 Hydrology (surface water) and hydrogeological (groundwater) assessment

Based on the information reviewed, the assessment of potential hydrological and hydrogeological effects involved:

– Describing baseline hydrological and hydrogeological conditions:
  - Outlining the local surface water and groundwater information (relating to quality and levels).
  - Identifying factors that may affect the future baseline.
– Assessing hydrological and hydrogeological risks to identify potentially significant effects:
  - Details of the method used to assess each risk (presented in Section 2.3.4.1).
  - Details of the method adopted to assess the significance of each effect (presented in Section 3.3.5).
– Consideration of the influence of any cumulative effects of different hydrological and hydrogeological issues.
– Presenting relevant mitigation measures for any significant effects following accepted engineering practice standards with clear confirmation that the proposed mitigative solutions are technically and environmentally sound.

2.3.4.1 Hydrological and hydrogeological risk assessment

As requested in the ToR (Wood, 2021), the assessment of hydrology and hydrogeology has been conducted, where possible, in line with the Directive for EIAs (2016) issued in accordance with The National Conservation Law (2013) and will take into account the Water Authority Act (2018 Revision). Section 19 of which states that groundwater vests in the name of the Crown and appoints the Water Authority Cayman (WAC) as the custodian of groundwater in the name of, and on behalf of, the Crown.

As there are no specific standards for water quality within the Cayman Islands, the assessment adopted Florida Clean up Standard target levels (CCTLs) where available. Given the brackish groundwater within the assessment area, and proximity to marine surface water features, target levels protective of both low yield/poor quality groundwater and marine surface water are considered appropriate for use at the Site. The CCTLs for such ground waters are generally higher (*i.e.* 10-times) than those for more sensitive groundwaters. According to Chapter 62-780 of the Florida Administrative Code (F.A.C) (State of Florida, 2005), 'Poor quality' means "*groundwater within the affected monitoring zone with background concentrations, as defined in subsection 62-780.200(3), F.A.C., that exceed any of Florida's Primary or Secondary Drinking Water Standards referenced in Chapter 62-550, F.A.C.*" and 'Low yield' means "*groundwater that is contained in an aquifer that has an average hydraulic conductivity of less than one foot per day, determined by performing slug tests or an equivalent method for determining hydraulic conductivity on a minimum of three monitoring wells in each affected monitoring zone; and a maximum yield of 80 gallons per day, determined by pumping a four-inch well screened across the cross-section of the plume, for a minimum of two hours*". The ToR (Wood, 2021) states that an aquifer with hydraulic connectivity between the centre of the landfill into the North Sound has an average of 12 feet per day. However, given the brackish nature of the groundwater beneath the Site and lack of any nearby abstractions, the use of these criteria at the Site is considered to be reasonable. Where relevant CCTLs are not available, alternative criteria have been sought from alternative sources, such as USEPA, European Water Framework Directive (WFD), and World Health Organisation (WHO).

2.3.5 Future Baseline

The future baseline considers the changes that would take place in the absence of the advancement of the ISWMS project, including natural occurrences and process that would alter the current baseline conditions during the anticipated lifetime of the project, or other changes occurring in the surrounding area which may positively or negatively effect environmental conditions.

In the event of unavoidable changes being identified in relation to hydrology and hydrogeology, these are reflected in suitable amendments to the current baselines in the relevant section of this report.

2.3.6 Significance evaluation

2.3.6.1 Value and Magnitude of Receptors

The significance of the effects resulting from the ISWMS project has primarily been determined by the value of the relevant hydrological features and the magnitude of change as a consequence of the ISWMS project. In terms of the hydrology and hydrogeology, the key types of effects relate to water levels, flow, and quality. Where appropriate, effects on surface water flows, effects on immediate and downstream morphology, sediment dynamics, and flood risk have also been considered.

Described below is the method and criteria which have been used to determine value, magnitude of change, and the significance of the effects.

The value of hydrological and hydrogeological water features scoped into the assessment has been associated with the importance of the surface water or groundwater features. Table 2 provides a summary of the criteria used in the valuation of water features and introduces the concept of receptor type (a collection of receptors whose value is assessed using the same set of criteria). Professional judgement has been applied to the assessment due to the semi-quantitative nature of the criteria.

The magnitude of change on water receptors considered independently from the value of the receptor. Its assessment - both potential, taking into account any inherent integral mitigation to the proposed ISWMS, alongside residual, following the implementation of additional mitigation measures – is also semi-quantitative and therefore professional judgement has also been applied to the assessment. Table 2 provides examples of how various levels of change can be determined with respect to water features.

Table 2 Summary of value definition of hydrology (including flood risk) and hydrogeology receptors. [Source: Wood, 2021]

Value	Criteria	Receptor type*	Examples
High	Features with a high yield, quality or rarity with little potential for substitution	Aquatic environment	Conditions supporting a site with an international conservation designation, where the designation is based specifically on aquatic features. High status (quantity and/or quality) watercourse, also any associated upstream unclassified watercourse. Principal aquifer (high permeability, able to support water supply and/or watercourse baseflow on a strategic scale).
	Water use supporting human health and economic activity at a regional scale	Water use	Regionally important public surface water or groundwater supply (and associated catchment) or permitted discharge.
	Features with a high vulnerability to flooding	Flood risk	Land use type considered as 'Essential Infrastructure' (i.e., critical national infrastructure, such as essential transport and utility infrastructure) and 'Highly Vulnerable' (e.g. police/ambulance stations that are required to operate during flooding, mobile homes intended for permanent residential use).
Medium	Features with a medium yield, quality or rarity, with a limited potential for substitution	Aquatic environment	Conditions supporting a site with a national conservation designation, where the designation is based specifically on aquatic features. Good status (quantity and/or quality) watercourse, also any associated upstream unclassified watercourse. Secondary aquifer (permeable, able to support water supply and/or watercourse baseflow on a local scale).

Value	Criteria	Receptor type*	Examples
	Water use supporting human health and economic activity at a local scale	Water use	Local public surface water and groundwater supply (and associated catchment) or permitted discharge. Licensed non-public surface water and groundwater supply abstraction (and associated groundwater catchment) which is relatively large relative to available resource, or where raw water quality is a critical issue, e.g., industrial process water, or permitted discharge.
	Features with a medium vulnerability to flooding	Flood risk	Land use type considered as 'More Vulnerable' (e.g., most types of residential development, hostels and hotels, landfill and waste management facilities).
Low	Features with a low yield, quality or rarity, with some potential for substitution	Aquatic environment	Conditions supporting a site with a local conservation designation, where the designation is based specifically on aquatic features, or an undesignated but highly/moderately water-dependent ecosystem. Lower status (quantity and/or quality) watercourse, also any associated upstream unclassified watercourse. Secondary aquifer (lower permeability, limited yield).
	Water use supporting human health and economic activity at household/individual business scale	Water use	Licensed non-public surface water and groundwater supply abstraction (and associated catchment), which is small relative to available resource, or where raw water quality is not critical, e.g., cooling water, spray irrigation, mineral washing or permitted discharge. Unlicensed potable surface water and groundwater abstraction (and associated catchment) e.g., private domestic water supply, well, spring or permitted discharge.
	Features with a low vulnerability to flooding	Flood risk	Land use type considered as 'Less Vulnerable' (e.g., most types of business premises).
Very Low	Commonplace features with very low yield or quality with good potential for substitution	Aquatic environment	Conditions supporting an undesignated and low water-dependent ecosystem. Unclassified watercourse. Non-aquifer (low permeability, minimal yield)
	Water use does not support human health, and of only limited economic benefit	Water use	Unlicensed non-potable surface water and groundwater abstraction (and associated catchment) e.g., livestock supply.
	Features that are resilient to flooding	Flood risk	Land use type considered as 'Water-compatible use' (e.g., appropriately designed flood control infrastructure; water transmission infrastructure).

Notes:
* Receptor types map onto receptors such as those identified in Table 2 as follows:
- Aquatic environment – aquifers, watercourses, conditions supporting GWDTEs and designated conservation sites
- Water use – springs, abstractions
- Flood risk – humans, properties and infrastructure.

Table 3 Summary of hydrology (including flood risk) and hydrogeology magnitude of change definition [Source: Wood, 2021

Magnitude	Criteria	Receptor type	Example
High	Results in major change to feature, of sufficient magnitude to affect its use/integrity.	Aquatic environment	Deterioration in river flow regime, morphology or water quality, leading to sustained, permanent or long-term breach of relevant conservation objectives (COs) or non-temporary downgrading (deterioration) of watercourse status (quantity and/or quality) or dependent receptors. Deterioration in groundwater levels, flows or water quality, leading to non-temporary downgrading of status (quantity and/or quality) of aquifer or dependent receptors.
		Water use	Complete or severely reduced water availability and/or quality, compromising the ability of water users to abstract.
		Flood risk	Change in flood risk resulting in potential loss of life or major damage to property or infrastructure.
Medium	Results in noticeable change to feature, of sufficient magnitude to affect its use/integrity in some circumstances.	Aquatic environment	Deterioration in river flow regime, morphology or water quality, leading to periodic, short-term and reversible breaches of relevant COs, or potential temporary downgrading of watercourse status (quantity and/or quality) or dependent receptors. Deterioration in groundwater levels, flows or water quality, leading to potential temporary downgrading of status (quantity and/or quality) of aquifer or dependent receptors.
		Water use	Moderate reduction in water availability and/or quality, which may compromise the ability of the water user to abstract on a temporary basis or for limited periods, with no longer-term effect on the purpose for which the water is used.
		Flood risk	Change in flood risk resulting in potential for moderate damage to property or infrastructure.
Low	Results in minor change to feature, with insufficient magnitude to affect its use/integrity in most circumstances.	Aquatic environment	Slight change in river flow regime, morphology or water quality, but remaining generally within COs, and with no short-term or permanent change to watercourse status (quantity and/or quality) or dependent receptors. Slight deterioration in groundwater levels, flows or water quality, but with no short-term or permanent downgrading of status (quantity and/or quality) of aquifer or dependent receptors.
		Water use	Minor reduction in water availability and/or quality, but unlikely to affect the ability of a water user to abstract.
		Flood risk	Change in flood risk resulting in potential for minor damage to property or infrastructure.

Magnitude	Criteria	Receptor type	Example
Very Low	Results in little change to feature, with insufficient magnitude to affect its use/integrity	Aquatic environment	Very slight change in river flow regime or water quality, and no consequences in terms of COs or watercourse status (quantity and/or quality) or dependent receptors. Very slight change in groundwater levels or quality, and no consequences in terms of status (quantity and/or quality) of aquifer or dependent receptors.
		Water use	Very slight change in water availability or quality and no change in ability of the water user to exercise licensed rights or continue with small private abstraction.
		Flood risk	Increased frequency of flood flows, but which does not pose an increased risk to property or infrastructure.

2.3.6.2 Significance of Effects

As outlined in the ToR (Wood, 2021) both the value of the water feature and the magnitude of change are used to derive the overall significance of the water-based effects. In the case of this assessment, the effects are assessed as being significant, probably significant or not significant as per the matrix in Table 4, with 'Major' effects taken to be 'Significant' and 'Moderate' effects, in the majority of cases, the significance can be determined as 'Beneficial', 'Adverse' or 'Neutral'.

Table 4 Significance evaluation matrix relating to the water environment. [Source: Wood, 2021]

		Magnitude of change			
		High	**Medium**	**Low**	**Very Low**
Value	**High**	Major (Significant)	Major (Significant)	Moderate (Probably significant)	Minor (Not significant)
	Medium	Major (Significant)	Moderate (Probably significant)	Minor (Not significant)	Negligible (Not significant)
	Low	Moderate (Probably significant)	Minor (Not significant)	Negligible (Not significant)	Negligible (Not significant)
	Very Low	Minor (Not significant)	Negligible (Not significant)	Negligible (Not significant)	Negligible (Not significant)

Note: 'Significant' effects are those identified as 'Major'. 'Moderate' effects would normally be deemed to be 'significant'. However, there may be some exceptions, depending on the environmental topic and the application of professional judgment.

Residual effects remaining as 'Significant' following the implementation of additional mitigation measures will be identified. It is possible that there are no additional mitigation measures required, or that there are no residual effects following the application of mitigation measures.

2.4 Cumulative effects

The ToR (Wood, 2021) identified two potential future developments in the vicinity; the Planned Area Development for Camana Bay; and the proposed Cruise Berthing Facility.

Due to the limited radius of influence of the hydrology and hydrogeology effects, cumulative effects in relation to these, or any other future developments, are unlikely. If cumulative effects are identified during the hydrological and hydrogeological assessments, their significance will be assessed in the relevant section of this report.

2.5 Consultation

Consultation with Water Authority Cayman (WAC) has occurred throughout the EIA process.

3. Current baseline: hydrology and hydrogeology

3.1 Topography

According to the ToR (Wood, 2021):

– Site elevation ranges approximately between 7 and 20 ft (2.13 to 6.10 m) above mean sea level.
– The surrounding land is mainly flat and low lying and, where developed, is formed of reclaimed former mangrove swamp.

3.2 Climate

The following meteorological conditions for Grand Cayman are summarised in The climate for Cayman Islands is tropical marine, including warm, rainy summers from May to October, with average temperatures approximately 80 to 85°F (27 to 29°C). The maximum average monthly temperature in July at 83.9°F (28.8°C), and winters are only slightly cooler on average, from November to April, with the lowest average monthly temperatures in February at 77.2°F (25.1°C). The heaviest rainfall typically occurs in October. Tropical low-pressure systems affect Grand Cayman during the summer months, and can comprise tropical waves, depressions, tropical storms, and hurricanes (with sustained winds at times exceeding speeds of 74 mph (119 kmph)). Hurricanes that periodically affect the island typically range from Category I through Category V on the Saffir Simpson scale. The hurricane season for this region is June 1 to November 30. Throughout the winter period, the Cayman Islands can experience 'Nor'wester' storms which can result in cooler temperatures and strong northwest winds across the islands.

Table 5 (Cardno ENTRIX, 2013), as outlined in the ToR (Wood, 2021).

Average monthly rainfall in Grand Cayman varies from just under 1 inch (25 mm) per month, to over 20 inches (508 mm) per month. Average annual rainfall varies significantly, depending on individual storm events. The long-term annual average rainfall is 64.3 inches (1.63 m).

The climate for Cayman Islands is tropical marine, including warm, rainy summers from May to October, with average temperatures approximately 80 to 85°F (27 to 29°C). The maximum average monthly temperature in July at 83.9°F (28.8°C), and winters are only slightly cooler on average, from November to April, with the lowest average monthly temperatures in February at 77.2°F (25.1°C). The heaviest rainfall typically occurs in October. Tropical low-pressure systems affect Grand Cayman during the summer months, and can comprise tropical waves, depressions, tropical storms, and hurricanes (with sustained winds at times exceeding speeds of 74 mph (119 kmph)). Hurricanes that periodically affect the island typically range from Category I through Category V on the Saffir Simpson scale. The hurricane season for this region is June 1 to November 30. Throughout the winter period, the Cayman Islands can experience 'Nor'wester' storms which can result in cooler temperatures and strong northwest winds across the islands.

Table 5 Meteorological summary for Grand Cayman. [Source: Wood, 2021]

Month	Average Rainfall (inches)[a]	Average Wind Speed (mph)[b]	Average Wind Direction[c]	Average Temperature (°F)
January	1.68	11.3	ENE	77.3
February	2.88	9.6	ENE	77.2
March	7.42	9.9	ENE	78.4
April	20.36	10.2	ENE	80.0
May	3.56	8.6	E	81.7
June	1.69	8.9	E	83.3
July	11.51	8.8	E	83.9
August	5.35	8.4	E	83.6
September	3.85	6.7	E	83.1
October	0.71	9.8	ENE	81.8
November	1.97	11.4	ENE	80.7
December	3.36	9.7	ENE	78.7

Notes: Data sources:
[a] CIG National Weather Service 30-year average for George Town, Grand Cayman Island.
[b] CIG National Weather Service 21-year average for George Town, Grand Cayman Island.
[c] CIG www.caymanislands-guide/weather/wind

3.3 Geology

The geology in the vicinity of the proposed development is described in CIG (1992), WAC (2001), Jones (1994), and Carbex Geological Services Ltd (2023) (Appendix 3) and summarised in Table 6, sourced from the ToR (Wood, 2021).

The Cayman Islands are outcrops of an undersea mountain range, known as the Cayman Ridge, within a tectonically active region. Elevated above the general level of the Cayman Ridge, the islands are formed from a separate fault block. The islands have a granodiorite base, capped with basalt and approximately 1,300 m of Tertiary carbonates – limestones and dolostones. The Tertiary Period geological succession consists of the Pleistocene Ironshore Formation unconformably overlying the Bluff Group. At surface level across much of Grand Cayman is peat (formed within the low-lying wetlands), alongside some areas of imported fill.

The Ironshore Formation comprises coralline limestones (from soft to hard) with hard lenses interspersed throughout, alongside coral ledge and pockets of calcareous sand. The underlying Bluff Group comprises the following formations; Pedro Castle Formation, Cayman Formation, and Brac Formation. The Cayman Formation exhibits a number of geological features including joints, fractures, and (primarily in-filled) sinkholes and solution cavities. The Cayman Formation is divided into the upper ’cap rock‘ (5.5 to 65 ft (1.7 to 19.8 m) below ground level (bgl)), and the lower part of the Cayman Formation which extends to depths below 250 ft (76 m) deep. ’cap rock‘ (5.5 to 65 ft (1.7 to 19.8 m) below ground level (bgl)) and the lower part of the Cayman Formation that extends to depths below 250 ft (76 m) deep. The ’cap rock’ is formed of hard dolostones that have low porosities and low permeabilities, and the lower unit of the Cayman Formation is formed of relatively friable dolostones with high porosities and high permeabilities.

Investigation of the geology of the Site area by Carbex Geological Services Ltd (2023) confirms that the geological makeup noted above is consistent with the geology beneath the Site. Data based upon three wells installed at the Site in December 2022, concludes that the Site is underlain by the following strata, from youngest to oldest; Ironshore Formation, Pedro Castle Formation, Cayman Formation, and Brac Formation. The characteristics of which correspond to those identified in other wells within the vicinity of the Site. Porosity and permeability values were obtained for twenty-five samples from various parts of the succession in each well on site, with all formations ranging from 10.1 to 39.7%.

Table 6 Geology summary for the Cayman Islands. [Source: Wood, 2021]

Period	Series	Formation	Elevation (ft/m above mean sea level)	Thickness (ft / m)
Made ground	Made ground	Imported fill	+1.5 to +4.0 ft +0.45 to +1.2 m	2.5 ft/ 0.75 m
Quaternary	Holocene	Peat (swamp deposits)	0 to +1.5 ft 0 to +0.45 m	1.5 ft/ 0.45 m (4-10 ft/ 1.2-3.0 m below wastewater treatment lagoons to the west of the proposed development)
Quaternary	Pleistocene	Ironshore Formation (calcareous marl)	0 to -3.0 ft 0 to -0.9 m	3.0 ft/ 0.9 m
Quaternary	Pleistocene	Ironshore Formation (very soft friable limestone)	-3.0 to -7.5 ft -0.9 to -2.3 m	4.5 ft/ 1.4 m
Quaternary	Pleistocene	Ironshore Formation (soft friable limestone and marl bands)	-7.5 to -25 ft -2.3 to -7.6 m	17.5ft/ 5.3 m
Tertiary	Pliocene	Bluff Group- Pedro Castle Formation (hard dolomite and limestone)	-25 to -45 ft -7.6 to -13.7 m	20ft/ 6.1 m
Tertiary	Miocene	Bluff Group- Cayman Formation (dolostone)	-45 to >-300 ft -13.7 to >-91.4 m	>250ft/ >76 m
Tertiary	Oligocene	Bluff Group- Brac Formation (limestone and sucrosic dolostone)	>-300 ft >-91.4 m	-

Notes: Based on information reported in CIG (1992), WAC (2001) and Jones (1992). Thickness of Brac Formation not reported.

3.4 Potential sources of ground and surface water contamination

Potential soil contamination at the Site, which may represent sources of groundwater and surface water contamination, is discussed in detail within the Land Quality Assessment of this EIA. This includes information regarding:

– The adjacent Georgetown Landfill (GTLF) including:
  - Its boundary and layout.
  - Its historical development.
  - Results of leachate sampling.
  - Plans for its closure, remediation, and restoration.

– Other known or potential sources of contamination within the proposed ISWMS footprint including:
  - The old scrap and tyre stockpile area (OSTSA).
  - The arsenic containment cell.
  - The equipment storage area (including the oil, hazardous waste storage area, and area of suspected bund overtopping in 2004).
  - Evidence of earlier waste disposal activities outside of the GTLF.

Based on the available information, groundwater and surface water contamination within the proposed ISWMS footprint is most likely to result from current and historical waste disposal activities at the GTLF, which is understood to be owned by CIG. Management of the known environmental impacts of the GTLF is one of the drivers of the development of the ISWMS.

Overall, due to the current design and practices at the GTLF and potential resulting impacts to groundwater and surface water quality, it is likely that the construction of the ISWMS and its practices will result in net environmental benefits in the long-term.

3.5 Hydrogeology

The groundwater beneath the Site is reportedly tidally influenced, with a hydraulic gradient towards the North Sound to the east (CIG, 1992). Observation boreholes (OBHs) located around the GTLF have been used for groundwater level monitoring and assessment in relation to tidal cycles. An OBH within the central part of the landfill exhibited a head difference of between 0.45 ft (0.14 m) and 0.68 ft (0.2 m) (mean 0.56 ft (0.17 m)) above the corresponding tidal level within North Sound, with the groundwater levels indicating a tidal lag. The amplitude of the tidal fluctuations in North Sound were 1.2 times that of the OBH. Assuming a net mean hydraulic head of 0.56 ft (0.17 m), and an average distance from a central point in the landfill to North South of 3000 feet (914 m) and using an aquifer permeability of 0.00188 ft (0.00057 m) per minute (constant head permeability test measurement), alongside a porosity of 15%, the groundwater flow has been calculated at a rate of 12 ft (3.6 m) per day.

According to the ToR, assuming a net mean hydraulic head of 0.56 ft (0.17 m), and an average distance from a central point in the landfill to North South of 3,000 feet (914 m) and using an aquifer permeability of 0.00188 feet (0.00057 m) per minute (constant head permeability test measurement), alongside a porosity of 15%, the groundwater flow was calculated at a rate of 12 ft (3.6 m) per day[1].

More recent groundwater monitoring undertaken by Amec Foster Wheeler (2016) at 10 boreholes within and around the GTLF, on the western edge of the Site, is indicative of groundwater levels ranging from 1.87 ft (0.57 m) and 11.4 ft (3.47 m) bgl and subject to tidal variation (0.59 to 0.62 ft (0.18 to 0.19 m) across a 24 hour timeframe.

The tidal influence of the groundwater indicates hydraulic connectivity between the groundwater and ocean (Figure 2). This reportedly results in considerable mixing of saltwater from the ocean and freshwater, causing a transition zone of brackish water (Amec Foster Wheeler, 2016). This mixing zone was anticipated to be present beneath the Site. Although Amec Foster Wheeler did not determine groundwater flow direction, they did confirm that groundwater is considered to be in continuity with surface waters. GHD (2021) suggested that "*It can be assumed that the groundwater at the Site is flowing towards the canals and North Sound due to their closer proximity and proven tidal influence*".

Interpretation of the hydrogeological conditions on-Site, by R.C. Minning & Associates Inc (2023), details that the groundwater flow system directly in contact with both the North Sound and the Caribbean Sea with the water table elevation fluctuating (with a slight lag) in response to local tidal cycles.

The groundwater is also assumed to be in hydraulic connectivity with the various mosquito-control canals, including the 'northern channel' on the northern boundary of the Site (Section 3.6).

[1] Ibid

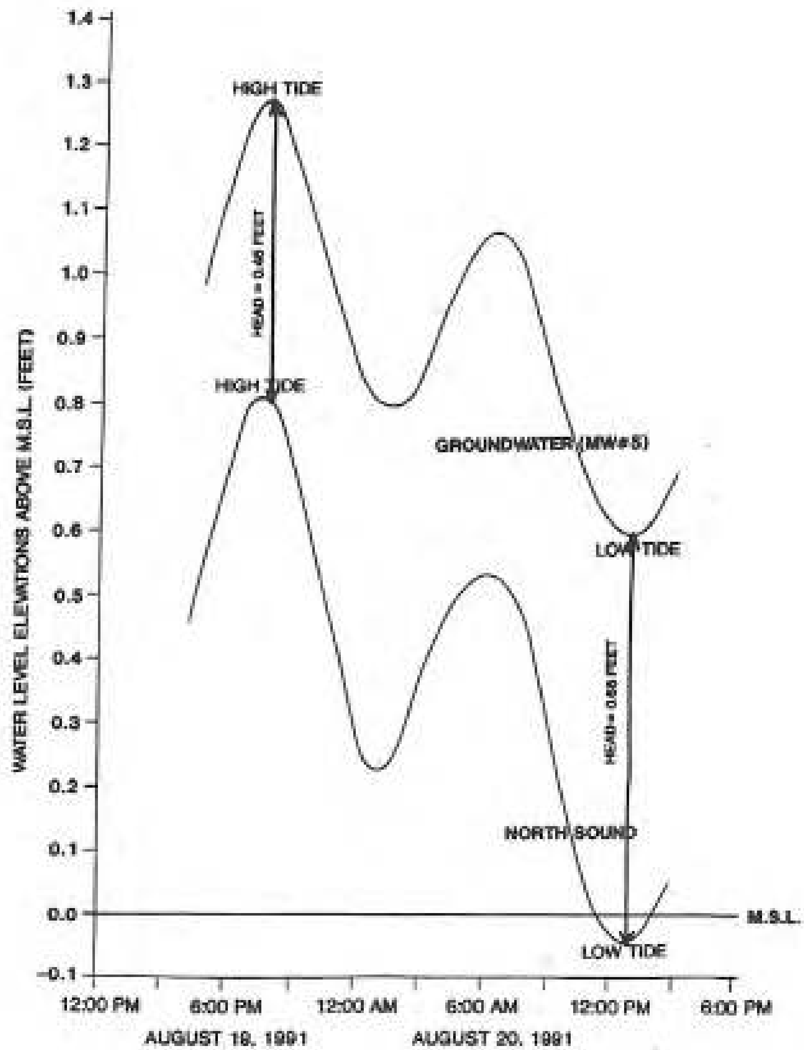

Figure 2 ***Net hydraulic head difference between groundwater levels at OBH within the central part of GTLF and water levels in the North Sound [Source: Wood, 2021]***

3.5.1 Available monitoring data

Quantitative water quality analysis data (surface water and groundwater) for the period of 2006 to December 2022 was provided by DART on 19 April 2023. GHD has relied upon this data and assumed that it is accurate and representative of the conditions at the Site during this period.

DART provided data as a spreadsheet of collated data for 2006 to June/July 2022 and as laboratory certificates and digital data for the 2022 analysis.

GHD has relied on the data within the spreadsheet and manually added the December 2022 data to it. However, in undertaking our assessment we note that:

– Some of the sampling locations within the spreadsheet do not correspond with sampling locations provided on the plan that GHD was issued, including: MW1, SW1, SW7, SWA1, SWA2, SWA4, SWA6, Drain.
– Some of the sampling locations have limited data points and variable sampling periods between locations, resulting in challenges in identifying data trends and allowing comparison between sampling locations.
– There are inconsistencies in the values presented in the spreadsheet compared to the equivalent values in the certificates of analysis. In undertaking this assessment, GHD has relied on the values within the spreadsheet.

- The spreadsheet contained a substantial number of “numbers stored as text” and other discrepancies (e.g. spaces and other non-visible data). GHD has resolved these in order to allow the data to be queried and statistical analysis applied.
- In assessing the data GHD has assumed that any concentrations reported as being below the relevant Limit of Detection (LoD) has been assumed to be at that LoD. This is a highly precautionary assumption.
- For several samples and substances the LoD exceeded the respective CCTL, resulting in the data being inconclusive as to whether or not they exceed the CCTLs. As a highly precautionary assumption, these data points have been assumed to exceed the CCTLs.
- As discussed below, for several contaminants, apparent exceedances of the CCTLs were noted. However, examination of the data appears to indicate that many of these are due to 1000-fold discrepancies between concentrations and LoDs between different monitoring rounds. This is potentially indicative of the data either being subjected to laboratory dilutions, or variations in reporting units (e.g. µg/kg and mg/kg), rather than true exceedances.

3.5.2 Groundwater quality

Groundwater quality to the north of the Site, in and around the GTLF, has been monitored by DEH between 2006 and December 2022. The monitoring locations are shown in Figure 3 and the full dataset is provided in Appendix A. Groundwater samples were analysed for a wide suite of contaminants and the concentrations compared to applicable assessment criteria, predominantly CCTLs. A summary of these results is provided in Table 7.

In general, elevated concentrations of organic contaminants were not reported:

- Polychlorinated Biphenyls (PCBs) were not detected above the relevant LoD in any of the 41 samples tested.
- The concentrations of Volatile Organic Compounds (VOCs) were below relevant LoDs. However, Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX), acetone, carbon disulfide, chlorobenzene, 1,4-dichlorobenzene, and cis-1,2-dichloroethene were detected in one or more samples but not at concentrations above the CCTL.
- Diesel Range Organics (DRO C10-C28) were detected in all 20 samples tested but Gasoline Range Organics (GRO C6-C10) were only detected in 5% of these samples. No assessment criteria are available for these contaminants.

Table 7 Summary of groundwater contamination within the Site between 2006 and December 2022. [Source: Appendix A]

Substance	Unit	Florida Clean Up Standard Target Levels (CCTLs)	Samples With Data (No.)	Samples Below LoD (%)	Samples Exceeding CCTLs (%)	Concentration		
						Minimum	Maximum	Mean
"Ammonia or total Nitrogen"*	mg/L	28	78	0	21	0.073	330	36.31
Total Dissolved Solids (TDS)	mg/L	5000	85	0	71	330	27000	8756.82
1,2-Dibromoethane	µg/L	0.2	49	100	100	0.25	1	0.81
Dibromomethane	µg/L	0.2	55	100	100	0.34	1	0.77
1,2,3-Trichloropropa ne	µg/L	0.2	55	100	100	0.39	1	0.82
Antimony	mg/L	0.06	71	62	4	0.0005	0.68	0.03
Arsenic	mg/L	0.1	74	43	4	0.0018	8.5	0.18
Barium	mg/L	20	75	5	3	0.0056	290	5.03
Beryllium	mg/L	0.04	69	88	6	0.00017	0.2	0.01
Cadmium	mg/L	0.05	69	83	4	0.000078	0.15	0.01

Chromium	mg/L	1	75	37	4	0.00036	4.7	0.17
Copper	mg/L	10	71	55	1	0.0009	13	0.26
Iron	mg/L	3	50	28	28	0.031	5700	123.05
Lead	mg/L	0.15	69	58	4	0.00034	12	0.27
Nickel	mg/L	1	74	59	4	0.0018	7.3	0.17
Selenium	mg/L	1	73	84	5	0.001	1.2	0.07
Thallium	mg/L	0.02	69	99	67	0.00049	0.49	0.05
Mercury	mg/L	0.02	66	94	11	0.00008	0.08	0.01
Aldrin	µg/L	0.02	29	100	38	0.0012	0.95	0.09
Alpha-BHC	µg/L	0.06	29	100	21	0.00098	0.95	0.9
Beta-BHC	µg/L	0.02	29	100	10	0.0012	0.95	0.10
Dieldrin	µg/L	0.02	29	100	38	0.0012	0.95	0.09

Notes: * This term is used in the data relied on by GHD, but these are different determinands so the meaning of this data is not clear. For the purpose of this assessment GHD has assumed that these values can be compared to the CCTL for ammonia.

Cells shaded red indicate an exceedance of the CCTL, cells shaded orange indicate exceedances where the LoD exceeds the CCTL, cells shaded green indicate that concentrations fall below the CCTL.

Consistent CCTL exceedances of ammonia or total nitrogen have been recorded in the north of the Site, alongside several isolated exceedances across the rest of the Site, but there does not appear to be any increasing or decreasing trend in concentrations over time. This may relate to the bund overtopping from the GTLF.

Exceedances of CCTL for Total Dissolved Solids (TDS) were identified across the majority of the Site, except for areas in the far south-east. These exceedances of TDS have been recorded since the earliest monitoring round in 2006 and appear to be significantly fluctuating over time with no obvious trend aside from generally exceeding the CCTL consistently. These fluctuations may potentially be explained by the location of the Site within the transition zone where considerable mixing of groundwater and saltwater occurs, together with any dissolved solids that either water body is transporting.

Exceedances of CCTL for both arsenic and antimony have been recorded in MW19 (south-east of the Site) and MW20 (south-west of the Site) in recent monitoring rounds, potentially indicating a potential relationship in their source and pathway into the groundwater. This may either be associated with the arsenic containment cell detailed within the Land Quality Assessment of the EIA, which is located in the centre/south of the Site, or the data may have been reported in the incorrect unit. The latter explanation may justify the high variability, inconsistency, and lack of apparent trend in these concentrations.

Historically, iron concentrations have been identified above the CCTL in MW1 (east, on Seymour Road, exact location not known), MW5 (Site centre, exact location not known), and MW8 (north-eastern corner). However, no data has been obtained from these locations since 2015, and therefore it is not possible to assess this trend over time or current status. In the more recent monitoring rounds, substantial exceedances of iron have also been found in MW19 (south-east of the Site) and MW20 (south-west of the Site). It is possible that these increases in iron concentrations may be related to the increases in arsenic and antimony that were identified within the same time frame and potentially sharing the same source, or the data may have also been reported in an incorrect unit.

Metals barium, beryllium, cadmium, chromium, copper, lead, nickel, selenium, thallium, and mercury also exceed their respective CCTLs and also exhibit highly fluctuating results with no trend. While this is potentially indicative of the groundwater being impacted by a wide range of metals, potentially associated with the GTLF, the results may also be caused by data discrepancies between monitoring rounds.

VOCs 1,2-dibromoethane, dibromomethane, and 1,2,3-trichloropropane also exceeded their respected CCTLs in all 55 samples; however, all 55 samples were also recorded below the LoD. As a result, the analysis of the data remains inconclusive.

Several CCTL exceedances of pesticides aldrin, alpha-BHC, beta-BHC, and dieldrin were also noted in several samples. As all sample data falls below the LoD, analysis of the exceeding data also remains inconclusive.

While no assessment criteria is available for DROs, concentrations have been identified above the LoD in MW-15A and MW16 within the area of suspected overtopping of the bund within the equipment storage area in 2004 in the south of the Site. Out of the three results obtained for this area (MW-15A in 2015 and 2016, MW16 in 2013) the maximum detected concentration is 1.7 mg/L in MW16 in 2013. It is possible that this concentration is related to the overtopped bund incident, however, as no earlier or more recent data has been obtained it is not possible to comment on any potential trends. It should also be noted that the concentrations within this area are consistent with other concentrations detected across the rest of the Site. The highest concentration recorded on Site is 26 mg/L in MW21 in 2016, on the northern boundary of the Site.

Figure 3 *Surface water and groundwater monitoring location plan*

3.5.3 Groundwater abstractions

The ToR identified three groundwater abstractions within 2 km of the proposed development site as presented in Table 8. It is noted that the nearest abstraction is 0.5 miles (0.75 km) northeast of the proposed development Site.

Table 8 Potential groundwater abstraction receptors identified in the ToR

Receptor	Location
Groundwater abstraction for reverse osmosis plant for Laundry Facility	0.2 miles (0.3 km) northeast of the proposed development Site
Groundwater abstraction for potable water supply following desalination at WAC's Red Gate Road Water Works (reverse osmosis plants)	0.6 miles (1 km) east of the proposed development Site
Groundwater abstraction for geothermal cooling purposes at the CUC electrical power generation facility	0.5 miles (0.75 km) northeast of the proposed development Site
Groundwater abstraction for geothermal cooling purposes undertaken by various other developments including Fosters warehouses and the Owen Roberts International Airport, with expectation of further future projects	0.7 miles (1.2 km) northwest (Fosters warehouse) and south (Airport) of the proposed development Site

Due to the general high salinity of groundwater and lack of significant freshwater resources on Grand Cayman, potable water is reportedly supplied from desalinisation plants by reverse osmosis. Water is reportedly sourced from wells drilled deep into the limestone bedrock beneath the Island and is treated to drinking water quality standard (Wood, 2021, Cayman Water 2023). This abstraction occurs from wells with response zones exceeding 100 ft (30 m) deep (GHD, 2021). Abstractions for the WAC's Red Gate Road Water Works are reportedly sourced from a depth of approximately 100 feet (R. C. Minning & Associates, Inc 2023).

Although freshwater lenses are present in several isolated areas of Grand Cayman (Wood, 2021), these are not used as a primary source of drinking water for the Island. The Site is not considered to be in close proximity to any major freshwater lenses, with the nearest freshwater lens approximately 4.9 miles (8 km) southeast of the site.

The two non-potable abstractions listed in Table 8 are reportedly for cooling purposes therefore the requirements for water quality for this purpose is potentially limited to consideration of physico-chemical properties (such as total suspended solids, pH, temperature, or similar), so that the abstracted water does not block or damage equipment associated with or inhibit the functionality of the cooling systems.

3.6 Hydrology

The ToR (Wood, 2021) details that the porous nature of the limestone bedrock and the flat topography of the Grand Cayman results in a lack rivers or streams across the island. Constructed mosquito-control channels transverse the local area and discharge into North Sound approximately 2,460 ft (750 m) northeast of the Site. The closest channel ('northern channel') runs west to east along the northern boundary of the proposed development. The northern channel is fringed with mangroves and is culverted below Esterly Tibbetts Highway to the west of the Site. Other channels are present around the GTLF to the west of the Site and discharge into the 'northern channel'.

The ToR (Wood, 2021) also states that the water level in the channels and the North Sound fluctuate with the tide. The tidal variation in the North Sound recorded by CIG (1992) was in the order of 0.8 ft (0.24 m). Data from an Intergovernmental Oceanography Commission (IOC) sea level monitoring station at George Town indicates the tidal variation in North Sound at the time of water sampling on 14 April 2015 was approximately 1 ft (0.3 m). The depth of the canals is such that they will likely be in hydraulic conductivity with groundwater.

3.6.1 Surface water quality

The ToR (Wood, 2021) states that surface water quality in the 'northern channel' and the North Sound near the Site has been monitored by DEH between 2006 and 2013 and by Amec Foster Wheeler in 2015. The data is provided in full in Amec Foster Wheeler (2016) and summarised in Table 9. The data shows that the 'northern channel' is potentially affected by leachate from GTLF, which acts as a source of contaminants, including ammonia, orthophosphate, Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD), entering the North Sound. A review of available data indicates that there is apparently a relatively rapid dilution/dispersion of the discharge within North Sound.

Table 9 Summary of general surface water quality surrounding the Site. [Source: Wood, 2021]

Substance	Unit	Northern Channel			North Sound		
		Min	Mean	Max	Min	Mean	Max
Ammonia	mg/l	0.32	4.26	13	0.51	0.81	1.1
Orthophosphate	mg/l	0.03	0.13	0.44	<0.015	0.039	0.052
COD	mg/l	23	1,902	11,000	200	200	200
pH	-	7.34	7.56	8.25	n.m.	n.m.	n.m.
Specific Conductance	umhos/cm	15,000	52,000	130,000	n.m.	n.m.	n.m.
BOD	mg/l	2.5	11	36	<2.0	-	3
Diesel Range Organics [C10-C28]	mg/l	0.046	0.119	0.33	-	-	0.048
GRO-C6-C10	mg/l	<0.047	-	-	n.m.	n.m.	n.m.

In addition to the groundwater data (Section 3.5.1), DART also provided GHD with surface water quality data, whereby concentrations of a suite of contaminants have also been analysed throughout the sampling period. Their locations are shown in Figure 3. The most recent round of sampling was conducted by DEH as per their monitoring schedule/plan. Table 10 summarises the concentrations of contaminants detected across the Site and surrounding area in comparison with relevant CCTLs. The data discrepancies detailed in Section 3.5.1 apply to this data set and are considered in the interpretation of data.

Table 10 Summary of surface water contamination surrounding the Site between 2006 and December 2022. [Source: Appendix A]

Substance	Unit	Florida Clean Up Standard Target Levels (CCTLs)	Samples With Data (No.)	Samples Below LoD (%)	Samples Exceeding CCTLs (%)	Concentration		
						Minimum	Maximum	Mean
Turbidity	NTU	29	91	1	31	0.23	320	36.109
Acrylonitrile	µg/L	0.2	50	92	85	0.001	20	15.228
1,2,3-Trichloropropane	µg/L	0.2	52	93	85	0.00048	1	0.803
Vinyl Chloride	µg/L	2.4	52	91	2	0.00048	10	0.979*
Arsenic	mg/L	0.05	84	34	7	0.0015	4.9	0.129
Beryllium	mg/L	0.00013	76	93	95	0.00017	0.2	0.010*
Cadmium	mg/L	0.009	77	94	4	0.000078	0.078	0.0055
Chromium (Hexavalent)	mg/L	0.05	77	44	9	0.0016	7.4	0.237
Copper	mg/L	0.004	76	88	50	0.0004	0.9	0.051*
Iron	mg/L	0.3	30	32	16	0.037	310	20.124
Lead	mg/L	0.0085	65	64	49	0.00034	3.6	0.235

Substance	Unit	Florida Clean Up Standard Target Levels (CCTLs)	Samples With Data (No.)	Samples Below LoD (%)	Samples Exceeding CCTLs (%)	Concentration		
						Minimum	Maximum	Mean
Nickel	mg/L	0.008	77	90	48	0.0018	2.4	0.099
Silver	mg/L	0.0004	79	95	52	0.0001	0.39	0.020
Thallium	mg/L	0.0063	77	99	49	0.00026	0.26	0.023*
Zinc	mg/L	0.086	79	77	8	0.00049	10	0.439*
Mercury	mg/L	0.000025	57	97	99	0.00008	0.08	0.004
4,4'-DDD	µg/L	0.0003	25	100	86	0.00012	1	0.114
4,4'-DDE	µg/L	0.0002	25	100	86	0.00012	1	0.113
Alpha-BHC	µg/L	0.005	25	100	71	0.000007	1	0.114

Notes: * Predominantly due to LoD exceeding CCTL, however some actual exceedances have been recorded in samples where the LoDs are lower.

Cells shaded red indicate an exceedance of the CCTL, cells shaded orange indicate exceedances where the LoD exceeds the CCTL, cells shaded green indicate that concentrations fall below the CCTL.

Site-wide CCTL exceedances in turbidity have been identified, being particularly consistent in the north and northwest of the Site, which may be explained by the location of the Site being within the transition zone where considerable mixing of groundwater and saltwater occur.

VOCs acrylonitrile, and 1,2,3-trichloropropane were found to exceed their respective CCTLs. In many samples it is suspected that this is caused by data reporting in a different unit, and in other samples it may potentially be due to the LoD exceeding the CCTL.

Vinyl chloride was identified above the CCTL in SW12 toward the south of the Site, also exhibiting a sharply rising pattern within the three data points obtained for leachate between July 2020 and December 2022. Due to the assumed north/north-easterly groundwater flow from the Site to the Northern Channel and North Sound, it is unlikely that these exceedances are related. However, these results, in particular those associated with the December 2022 monitoring round, may be caused by data reporting in a different unit.

Arsenic concentrations were noted to be consistent within the western area of the Site. A significant increase in concentration of arsenic was identified in this location during the December 2022 round of sampling, which is consistent with increases in chromium (hexavalent), magnesium, and zinc in the same locations. This may indicate a potential relationship between the substances and their potential source. The exceedances of arsenic and chromium (hexavalent) may potentially be associated with the arsenic containment cell (detailed within the Land Quality Assessment of this EIA), located in the centre/south of the Site since circa 2005, due to presence of timber treated with chromated copper arsenate (CCA) preservatives. However, it is considered more likely that many of these exceedances, in particular those associated with the December 2022 monitoring round, may be caused by data reporting in a different unit. This may also explain many of the exceedances for other substances including antimony, cadmium, copper, iron, lead, nickel, silver, thallium, and mercury.

Consistent exceedances of lead were identified in SW7 (north of the Site) alongside some isolated exceedances across the wider Site area during the older sampling periods between 2006 and 2013. Zinc concentrations were also found to exceed the CCTLs in samples obtained from the Site drains.

Several exceedances of pesticides 4,4'-DDD, 4,4'-DDE, and alpha-BHC were also noted in several samples. Whilst this could have been associated with treated timber within the arsenic containment cell, all sample data falls below the LoD, therefore analysis of the exceeding data remains inconclusive.

GHD undertook a flood risk assessment for the proposed development, which included calibration to the measurements taken during Hurricane Ivan, then simulating Category 2, 3 and 5 cyclone events. The results of the assessment show that the most severe storm surge conditions occur in the interior of the north bay, corresponding with previous models. Category 5 conditions result in the largest storm surges, peaking at 9.5 ft (2.9 m) within the North Bay, and Category 2 and 3 conditions produce similar peak water surface elevations of approximately 5.6 and 5.9 ft (1.7 and 1.8 m) respectively. The severity of the surges on the shoreline are reduced due to the generally steep bathymetry surrounding the majority of Grand Cayman, however, the North Bay area is susceptible to significant surge effects due to shallow bathymetry and semi-enclosed geometry within this region. In the event of an extreme rainfall event occurring in combination with a coastal storm surge, flooding is likely to be exacerbated.

3.7 Flood risk

As stated in the ToR (Wood, 2021), surface water flooding occurs as a result of rainfall intensity exceeding the capacity of local drainage and infiltration, causing water to flow overland. This is considered a potential hazard following heavy rainfall events. In the Cayman Islands, heavy rainfall typically only takes place for several hours, which, at worst, reportedly causes moderate flooding in some low-lying regions of the islands. This is due to the rapid infiltration of water enabled by the island's surface, which mostly comprises a limestone outcrop or very thin and porous limestone soils. However, if a tropical depression settles over the island, it can rain for a period of several days with surface water flooding resulting in severe problems.

The Cayman Islands has experienced a total of 74 tropical storms and hurricanes over the period of 1852 to 2008 (156 years), with nine major storms of Category three or higher. In September 2004, Hurricane Ivan reportedly caused sustained winds of up to 155 mph (249 km/h), producing storm surges of 9.5 ft (2.9 m) and wave heights of greater than 26 ft (7.9 m) that flooded large coastal areas and deposited large amounts of sediment onshore (Wood, 2021).

No delineated floodplain mapping was found for the Cayman Islands. However, the Site, like much of Grand Cayman, is low-lying which indicates that tidal flooding and hurricane/tropical storm-associated flooding are significant potential hazards. The flood zones resulting from hurricanes according to hurricane categories on the Saffir-Simpson Scale are shown on Figure 4, as detailed in the ToR (Wood, 2021). Exposure scores for flood hazards were determined by Novelo-Casanova and Suarez based on a) flood distribution areas during Hurricane Ivan, and b) topographic elevation and potential for flooding, as follows:

– Level 5 (very high exposure score) as shown on Figure 4, 'a' was assigned to zones where coastal flooding and wave action are the highest during Category 1 and 2 hurricanes which, on average, hit the Cayman Islands every 2.33 years.
– Level 4 (high exposure) was applied to Category 3 flood areas (Figure 4 'b') with hurricanes of this magnitude typically hitting the islands once every 9.1 years).
– Level 3 (moderate exposure) given to flood areas associated with hurricane Categories 4 and 5 (Figure 4 'c') that take place approximately every 100 years.

This shows that the Site is within an area of very high exposure to hurricanes and associated flooding and storm surge. Storm surges combined with wave action are responsible for much of the damage usually caused by hurricanes, especially in large, low-lying coastal settlements. In addition to causing flooding and damage to coastal structures, storm surges may also cause flooding further inland through the blockage of the outfalls of drainage systems.

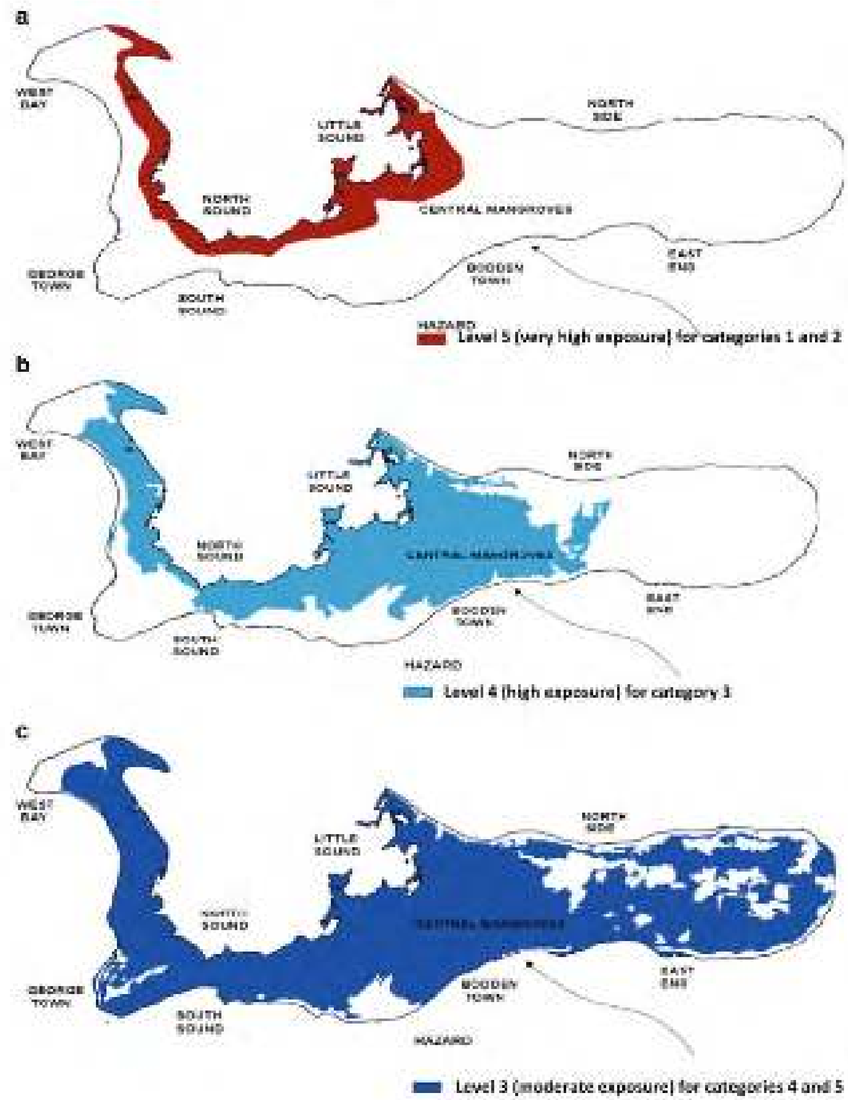

Figure 4 ***Level of exposure to due to flooding from hurricanes: a) Hurricane categories 1 and 2, b) Hurricane category 3, c) Hurricane categories 4 and 5. The arrow indicates the direction of approach of the hurricane. [Source: Novelo-Casanova and Suarez, 2010; Wood, 2021]***

GHD undertook a flood risk assessment for the proposed development, which included calibration to the measurements taken during Hurricane Ivan, then simulating Category 2, 3 and 5 cyclone events. The results of the assessment show that the most severe storm surge conditions occur in the interior of the north bay, corresponding with previous models. Category 5 conditions result in the largest storm surges, peaking at 9.5 ft (2.9 m) within the North Bay, and Category 2 and 3 conditions produce similar peak water surface elevations of approximately 5.6 and 5.9 ft (1.7 and 1.8 m) respectively. The severity of the surges on the shoreline are reduced due to the generally steep bathymetry surrounding the majority of Grand Cayman, however, the North Bay area is susceptible to significant surge effects due to shallow bathymetry and semi-enclosed geometry within this region. In the event of an extreme rainfall event occurring in combination with a coastal storm surge, flooding is likely to be exacerbated.

3.8 Protected areas

According to the ToR (Wood, 2021) the closest proposed international designated (proposed Ramsar) sites are located approximately 4.5 km (2.75 miles) to the east (Central Mangrove Wetland, Little Sound, Ponds and associated Marine Zones) and 7.5 km (4.75 miles) to the north (Barkers Wetland) of the Site. The Central Mangrove Wetland, Little Sound, Ponds and associated Marine Zones comprise pristine mangrove wetlands supporting important habitats, marine invertebrates and internationally important populations of migratory birds. Barkers Wetland is a continuum from coral reef to coastal forest and mangrove supporting endangered marine and terrestrial reptiles, breeding and migratory birds as well as important invertebrates and endemic fish.

The Cayman Islands has a network of marine protected areas. There are three categories of marine parks for Grand Cayman:

– Environmental zone: in which prohibited activities include the removal of any form of marine life, the use of anchors, entry into the water and exceeding a speed of five knots.
– Replenishment zone: where the removal of conch and lobster is prohibited, and fishing methods restricted.
– Marine park zone: in which marine life is protected and anchoring forbidden, except in certain circumstances.

The closest marine protected area to the Site is the Marine Reserve on the west coast which comprises the Seven Mile Beach. The North Sound to the east of the Site also contains marine protected areas (Replenishment and Environmental zones). The closest nationally important terrestrial areas to the Site include the Mangrove Buffer Zone near the west coast and three Terrestrial Protected Areas between 1.4 km (0.9 miles) and 2.5 km (1.5 miles) to the north.

3.9 Future Baseline

Land use changes, and particularly climate change, could affect baseline conditions at the Site in the future.

Climate change could affect the amount, intensity and duration of rainfall, temperature and evapotranspiration, occurrence of extreme weather (hurricanes) and amount and rate of sea level rise.

As outlined in the ToR (Wood, 2021), estimates of future sea-level rise within the Caribbean in the Model for the Assessment of Greenhouse-gas Induced Climate Change (MAGICC) indicates an increase of 12 cm (0.4 ft) to 80 cm (2.6 ft) in sea levels by 2100 from a 1990 baseline. This range encompasses the conservative estimates by the Intergovernmental Panel on Climate Change (IPCC) for global sea-level rise and represents a rise of approximately 0.14 cm to 0.91 cm (0.05 inch to 0.35 inch) per year. The Cayman Islands are amongst those islands showing regional variation in rainfall projections, with a decrease of between 10 and 50 mm in annual rainfall totals predicted between 2011 and 2099 (National Climate Change Committee, 2011). This could change the hydrological characteristics of the Site and wider catchment areas over time.

With respect to groundwater and surface water quality at the Site and the surrounding area, analysis of laboratory results using a highly precautionary approach (Section 3.5.1) suggest that groundwater and surface waters are already affected to some extent. These are believed to be primarily affected by emissions from GTLF, the closure of which is only possible if ISWMS proceeds at the Site providing an alternative waste disposal option. In the absence of ISWMS, it is likely that operation of the GTLF would be prolonged and, even if operational controls of leachate were improved, the associated emissions are likely to continue to impact groundwater and surface water quality over a prolonged period.

Local pollution incidents unrelated to the Site could also cause changes in the water quality within the proposed development Site and wider catchment.

4. Impact Assessment

4.1 Potential effects

The potential hydrology (including flood risk) and hydrogeology effects associated with the proposed development are summarised in Table 11. A number of these are sourced from the ToR (Wood, 2021).

When considering potential impacts the following design specifications for the proposed development were considered with regards to water supply and wastewater management which will require the necessary consents and permits from the relevant authority:

– Potable water supply will be sourced from the municipal water supply provided by the Cayman Water Authority.
– Cooling water for the Energy Recovery Facility (ERF) will be sourced from groundwater abstractions located within the Project Site, abstracted from approximate depth of 51 to 149 feet/130 (15.5 to 45.4 m).
– Following the ERF cooling cycle, cooling water will be discharged to the ground via discharge wells located within the Project Site, at discharge depth at circa 250 to 400 feet (76 to 121 m).
– Sewage and wastewater from toilet blocks will be disposed of either to mains sewer and the neighbouring wastewater treatment plant (subject to agreement for the Operator) or via septic tank to groundwater.

Table 11 Potential hydrology (including flood risk) and hydrogeology effects

Activity	Potential Effect	Receptor
Temporary dewatering associated with the excavation of the foundations for infrastructure	Localised and temporary decline in groundwater levels and baseflows, deterioration in groundwater quality via induced saline intrusion	• Aquifers • Surface waters (North Sound & Mosquito control canals) • Groundwater abstractions
Temporary storage/stockpiling of materials	Change surface water drainage patterns and locally increase flood risk	• Site infrastructure, staff, and visitors • Surface waters (North Sound & Mosquito control canals)
Soil compaction and introduction of areas of hardstanding	Reduce infiltration recharge and groundwater levels and baseflows	• Aquifers • Surface waters (North Sound & Mosquito control canals) • Groundwater abstractions
	Increase surface water runoff and sediment-loading	• Surface waters (North Sound & Mosquito control canals)
	Increase surface water runoff and flood risk	• Surrounding land infrastructure, staff, and visitors
Groundwater abstraction for on-Site non-potable supply for ERF cooling, compost irrigation and general Site maintenance)	Localised decline in groundwater levels and baseflows, further deterioration in groundwater quality via induced saline intrusion, increase in local groundwater temperature.	• Aquifers • Surface waters (North Sound & Mosquito control canals) • Groundwater abstractions
Disposal of wastewater generated at the Site (including potential sanitary effluent, facility wash water, Composting Area runoff and non-contact ERF cooling water)	Deterioration in groundwater and baseflow quality	• Aquifers • Surface waters (North Sound & Mosquito control canals) • Groundwater abstractions • Subsurface infrastructure

Activity	Potential Effect	Receptor
Disposal of landfill leachate from the RWL	Deterioration in groundwater and baseflow quality	• Aquifers • Surface waters (North Sound & Mosquito control canals) • Groundwater abstractions • Subsurface infrastructure
Disturbance of existing contamination (discussed in the Land Quality Assessment of this EIA)	Exposure (and potential spread) of contaminated soils at the Site surface and release of runoff, deteriorating water quality	• Aquifers • Surface waters (North Sound & Mosquito control canals) • Groundwater abstractions • Subsurface infrastructure
Potentially contaminative activities on-Site	Release of pollutants directly (e.g., spillages) or indirectly (via surface water runoff), leading to deterioration in surface water and groundwater quality	• Aquifers • Surface waters (North Sound & Mosquito control canals) • Groundwater abstractions • Subsurface infrastructure
Tidal flooding, surface water flooding and extreme weather and climate change-induced flood events	Multiple effects e.g., sediment-loading release of pollutants, flooding, mobilisation of contaminants off-Site by flood water	• Aquifers • Surface waters (North Sound & Mosquito control canals) • Groundwater abstractions • Site infrastructure, staff, and visitors
Failure of landfill cap or composite liner (*e.g.* due to flawed engineering, extreme weather events or sea-level rise)	Ingress of rainwater resulting in uncontrolled releases of leachate to the surrounding ground and groundwater	• Aquifers • Surface waters (North Sound & Mosquito control canals) • Groundwater abstractions • Subsurface infrastructure
Inappropriate disposal of additional wastes during emergency situations (*e.g.* hurricane or earthquake debris)	The composition of such wastes is unknown but may result in unsuitable materials being stockpiled that could result in unforeseen leachate issues that could affect surface waters and groundwater	• Aquifers • Surface waters (North Sound & Mosquito control canals) • Groundwater abstractions • Subsurface infrastructure

4.1.1 Groundwater abstractions

The cooling water for the proposed ERF will be sourced from groundwater using abstraction wells within the Project Site. Following the ERF cooling cycle, this groundwater (which will be warmer than ambient groundwater temperature) will be discharged to the ground via discharge wells located within the Project Site.

R. C. Minning & Associates Inc (2023) undertook a hydrogeological investigation and modelling to investigate the potential impacts of the proposed ERF 'cooling water' wells relative to each other (abstraction and discharge points) and existing groundwater users in proximity of the development. It incorporated site-specific geological and hydrogeological data as well as available geological and hydrogeological information for the region. Groundwater modeling was undertaken to simulate the groundwater flow system and to simulate future heat and groundwater transport scenarios associated with the installation and operation of the cooling water system.

The R. C. Minning & Associates Inc (2023) assessment was undertaken on the basis of an assumed groundwater abstraction rate for the geothermal cooling system of 11,000 gpm (gallons per minute) via four abstraction wells, each yielding 2, 750 gpm. The assumed abstraction well depth was ~51ft to ~149ft below ground surface with injection (discharge) via three wells to a depth of ~250ft to ~400ft below ground surface.

Modelling by R.C. Minning & Associates Inc (2023), alongside previous studies and operational history within the area, indicated that this abstraction is likely to be sustainable, with limited drawdown of groundwater levels anticipated once the system is in operation. The volumes of abstracted water were anticipated to be recharged via horizontal groundwater flow from the North Sound, alongside periodic discharge from on-Site stormwater drainage into the abstraction zone coupled with local precipitation. Recharge via horizontal groundwater flow from the North Sound indicates that saline intrusion could occur, however, the groundwater in the area is brackish to saline, with saline conditions (>10,000 mg/L TDS) occurring in proximity to the 'northern channel or North Sound (refer Section 8.4.5).

The findings of the hydrogeological investigation and modelling were as follows:

– Limited drawdown of the groundwater levels will occur when the ERF cooling water system is in operation.
– Limited warming of the groundwater (0.1°C to 0.6°C) in the cooling water system abstraction zone (at the site), due to the hydrogeological characteristics and the operation of the cooling water system, i.e., low vertical permeability and injection (discharge) at a significantly lower depth and geology (between ~-250 and ~-400 ft below ground surface).
– No impact on any adjacent groundwater abstractions associated with the proposed ERF cooling water system.
– None of the injected warm water from the ReGen facility reached the Caribbean Sea, North Sound, the residential canals or nearby water users in the modelled simulations.

The hydrogeological investigation also considered the potential for 'short-circuiting' by two pathways:

– Vertical migration from the injection zone upward into the abstraction zone via joint and fracture systems, i.e., high vertical permeabilities. This was considered unlikely due to:
  - the vertical difference in depths between injection and abstraction wells, as well as low permeability with fractures rarely evident in the strata above -350 feet.
  - groundwater flow is primarily horizontal via intra formational pathways such as bedding plains and solution channels.
  - Empirical support for minimal vertical hydraulic communication between these zones and operation of similar cooling water systems which indicate that the vertical permeability of the 150 – 200 ft BGS layer is sufficiently low to prevent short circuiting.
– inadequate well construction (particularly the injection wells).
  - To be mitigated through appropriate grouting in the annulus to create a between the well casing and the surrounding rock.

The R. C. Minning & Associates Inc (2023) is provided in **Appendix B.**

4.2 Embedded Measures

The currently proposed layout, design, and operation of the ISWMS is described in Chapter 4 of this EIA and includes consideration of potential hydrology and hydrogeology effects, explicitly or otherwise. Some of these proposed mitigation measures are outlined in more detail in the sections below.

4.2.1 Leachate management

According to Chapter 4, "*the Residual Waste Landfill will be an engineered facility with a composite liner, leachate containment, leachate treatment, environmental controls and monitoring*". It will be designed, constructed and/or operated in line with relevant modern US standards, which should include procedures to manage landfill by-products including leachate, dusts, odours, and landfill gas, such as:

- Resource Conservation and Recovery Act (RCRA) (Sub-Title D Non-Hazardous Rules and Sub-Title C Hazardous Rules)
- RCRA Subtitle D (258) Seismic Design Guidance for Municipal Solid Waste Landfill Facilities.
- 40 Code of Federal Regulations:
  - Part 258 – Criteria for Municipal Solid Waste Landfills
  - Part 264 – Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
  - Part 265 – Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, And Disposal Facilities
- Standards for the GTLF design (remediated as part of the ISWMS project):
  - Florida Administrative Code No. 62-701.500: Landfill Operation Requirements
  - Florida Administrative Code No. 62-701.600: Landfill Final Closure

The nature of the residual waste (principally post-combustion residues from the ERF) will limit its leachability and putrescibility but, if fully complied with, the standards stipulate requirements for leachate emissions to be mitigated appropriately. This would therefore reduce the likelihood of deterioration in surface water or groundwater quality via pollutant (leachate) release.

The Landfill Facility design will incorporate pollution control features (e.g., leachate extraction wells, transmission pipework and a sequencing batch reactor type leachate treatment plant) to collect and treat leachate produced within the landfill cell(s). The leachate will be treated on site and potential reuse of the effluent for dust suppression purposes will be considered. The effluent quality will be suitable for discharge from the Site in compliance with local environmental licence requirements.

Subject to the quality of the effluent from the leachate treatment plant, in addition to reuse on site, disposal mechanism could include to the off-site and adjacent wastewater treatment plant (subject to agreement with Water Authority Cayman) or disposed of on-site via deep well injection. The quality of the leachate post treatment will be assessed as part of the detailed design of the treatment plant.

The following features are proposed for the leachate management system:

- Leachate from the waste bunker will be pumped out in accordance with the expected composition of the waste, into a suitable containment system followed by treatment if necessary.
- A leachate drainage network will be installed, with all roads and operating areas to be instated and maintained to ensure that no damage occurs.
- Storm water will also be collected through the leachate collection system.
- Leachate that has been recirculated will be sprayed over the composting windrow, in the event that the moisture content must be raised. It will also be used for dust suppression purposes for the non-capped areas of the facility via tractor and bowser.
- Clean surface water from non-active areas will be prevented from making contact with the leachate in the active areas via temporary internal bunds and storm flaps to prevent contamination of this water.
- A leachate treatment plant will be developed to receive, treat, and dispose of leachate from the landfill facility, prior to the landfill facility becoming operational. The volume of generated leachate will determine the capacity of the leachate treatment plant and the ability to balance with the volumes of recirculated leachate required for dust suppression. Where volumes of recirculated leachate are insufficient for the demand, grey water shall be used instead.

4.2.2 Storage and material handling

According to Chapter 4, "*Facility designs include consideration of laydown areas which will be set aside for the storage of construction materials and waste management activities and located away from potential contaminant pathways.*". This would therefore reduce the likelihood of construction materials and wastes becoming a potential pollutant source within a potential contaminant pathway, reducing the likelihood of deterioration in surface water or groundwater quality via pollutant release.

This section in Chapter 4 however does not consider the effect of changes to surface water drainage patterns, and therefore could still potentially contribute to an increase in local flood risk.

4.2.3 Facility design standards

As noted in Chapter 4, each of the ISWMS facilities will be designed to a still water elevation of 8 ft above mean sea level (AMSL), based on Hurricane Ivan (a 1 in 100 year return period) records and US Federal Emergency Management Agency (FEMA) guidance has been used to arrive at Base Flood Elevation (BFE) of +12 ft (3.7 m) AMSL and Design Flood Elevation (DFE) of +13 ft (4.0 m) AMSL. Drainage systems will be designed to manage the impacts of extreme weather conditions and reduce risk of flooding and will comply with all applicable building design codes and regulations.

4.2.4 Stormwater management

A general site drainage system to manage surface water run-off from non-operational areas of the Site has been developed and is described in Chapter 4. The design of the Site's drainage system incorporates pollution control features and system divisions to isolate specific areas as appropriate.

4.3 Assessment of effects

The potential significance of the effects identified in Section 4.1 have been assessed in line with the methodology outlined in Section 2.3 in order to identify potentially significant effects in the absence of mitigation beyond that considered integral to the design (embedded measures) (see Table 12).

Table 12 Significance assessment of potential water-related effects in the absence of mitigation (except for embedded design measures)

Activity	Receptor	Value	Magnitude	Significance	Rationale
Temporary dewatering associated with the excavation of the foundations for infrastructure	Aquifer quality	Medium	Low	Minor	As aquifers on Grand Cayman are of high salinity and high yield, they are not considered to support human health without desalinisation and treatment to achieve drinking water quality standards. Therefore, a deterioration in quality due to saline intrusion is not considered a Significant Effect.
	Surface waters (North Sound & Mosquito control canals)	Medium	Low	Minor	While the North Sound surface waters support local economic activity and recreation, saline intrusion via hydraulic connectivity is not considered to significantly deteriorate quality. As groundwater flow acts as a baseline flow for surface waters, there may be a temporary slight decline in water levels, however this is not considered to be significant.
	Groundwater abstractions	Medium	Low	Minor	As dewatering works will be transient, and groundwater abstractions likely being unnecessary for the development at this stage, the effect on groundwater abstractions and therefore not considered to be significant. For off-Site abstractions identified, these are 0.6 miles (potable water supply) and 0.5 miles (cooling water) from the proposed development and likely abstract at significant depth (100 feet or 30.5 m depth for potable water, from 70 feet or 21 m depth for CUC cooling water) and therefore not likely to be impacted by the shallow and transient anticipated groundwater disturbance taking place during construction. This is not considered a Significant Effect.
Temporary storage/stockpiling of materials	Site infrastructure, staff, and visitors	Medium	Low	Minor	As described in Chapter 4, drainage systems will be designed to manage the impacts of extreme weather conditions and reduce risk of flooding and will comply with all applicable building design codes and regulations. Further a general site drainage system to manage surface water run-off from non-operational areas of the Site has been developed and is described in Chapter 4. This is not considered a Significant Effect.
	Surface waters (North Sound & Mosquito control canals)	Medium	Low	Minor	Localised flooding would be unlikely to cause significant effect to surface waters located off-site, due to likely low volumes of flood water alongside the effects being temporary.

Activity	Receptor	Value	Magnitude	Significance	Rationale
Soil compaction and introduction of areas of hardstanding	Aquifer quality	Medium	Low	Minor	As aquifers on Grand Cayman are of high salinity and low yield, they are not considered to support human health without desalinisation and treatment to achieve drinking water quality standards. A reduction in groundwater levels due to slight increase in hardstand surfaces at the site is considered unlikely to result in a significant effect to users. Surface water management measures may also enable infiltration in some areas of the Site, minimising the potential reduction in groundwater levels.
	Surface waters (North Sound & Mosquito control canals)	Medium	Very low	Minor	As described in Chapter 4, drainage systems will be designed to manage the impacts of extreme weather conditions and reduce risk of flooding and will comply with all applicable building design codes and regulations. Further a general site drainage system to manage surface water run-off from non-operational areas of the Site (as well as associated pollution management measures) has been developed and is described in Chapter 4. This is not considered a Significant Effect.
	Groundwater abstractions	Medium	Low	Minor	Reduced infiltration could locally result in a minor and localised change to groundwater recharge. However, it is considered unlikely to significantly affect water table levels outside of the site and, therefore, there is likely to be limited effect on groundwater abstractions identified within 1.2 miles of the proposed development. The proposed abstraction of water for on-site cooling purposes is also unlikely to be impacted due to the depth of the proposed abstraction (51 to 149 feet below ground surface). This is not considered a Significant Effect.
	Surrounding land infrastructure, staff, and visitors	High	Very low	Minor	As described in Chapter 4, drainage systems will be designed to manage the impacts of extreme weather conditions and reduce risk of flooding and will comply with all applicable building design codes and regulations. Further a general site drainage system to manage surface water run-off from non-operational areas of the Site has been developed and is described in Chapter 4. This is not considered a Significant Effect.

Activity	Receptor	Value	Magnitude	Significance	Rationale
Groundwater abstraction for on-Site non-potable supply for ERF cooling, compost irrigation and general Site maintenance)	Aquifer quality	Medium	Medium	Minor	As aquifers on Grand Cayman are of high salinity, they are not considered to support human health without desalinisation and treatment to achieve drinking water quality standards. Therefore, a deterioration in quality via potential saline intrusion associated with groundwater abstraction is not considered a Significant Effect on groundwater quality.
	Surface waters quality (North Sound & Mosquito control canals)	Medium	Low	Minor	While the North Sound surface waters support local economic activity and recreation, saline intrusion via hydraulic connectivity is not considered to significantly deteriorate quality in surface water (due to groundwater already being saline). Abstraction modelling by R.C. Minnings and Associates Inc (2023) indicates that the proposed abstraction rate of 11,000 gpm is unlikely to affect surface waters, due to the limited extent of drawdown identified from the groundwater.
	Groundwater abstractions	Medium	Low	Minor	An assessment of the impact of the proposed abstraction rate of 11,000 gpm for the proposed ERF cooling water suggests that there is limited drawdown, is unlikely to significantly affect water table levels and therefore there is likely to be limited effect on groundwater abstractions identified within 1.2 miles of the proposed development.
Disposal of wastewater generated at the Site (including potential sanitary effluent, facility wash water, Composting Area runoff and	Aquifer quality	Medium	Low	Minor	As aquifers on Grand Cayman are of high salinity and low yield, they are not considered to support human health or economic activity without desalinisation and treatment to achieve drinking water quality standards. The modelled groundwater discharge of cooling water by R.C. Minnings and Associates Inc (2023) suggests thatthere is limited impact to groundwater in terms of temperature increase. Therefore, a deterioration in quality is not considered a Significant Effect.

Activity	Receptor	Value	Magnitude	Significance	Rationale
non-contact ERF cooling water)	Surface waters (North Sound & Mosquito control canals)	**Medium**	**Medium**	**Moderate**	**The North Sound surface waters support local economic activity and recreation, and marine protected areas, therefore a deterioration in quality from potential contamination from discharge of wastewater to groundwater (or quality impacted groundwater in connectivity with surface waters) could negatively affect surface water users. The potential disposal of sanitary wastewater to shallow groundwater via septic tanks would be considered the potential source. This is considered a Potentially Significant Effect and depends on the potential contaminant properties and concentrations as to how much this could effect water quality. This also depends on whether the mains sewerage disposal route can be used for sanitary wastewater discharge.** The disposal of non-sanitary waste (e.g. cooling water) is of sufficient depth (circa 250-400 feet) to be considered to not impact surface water quality.
	Groundwater abstractions	Medium	Low	Minor	Groundwater abstractions (on-site and off-site) are likely to be deep in the limestone aquifer, at a depth considered unlikely to be impacted by either discharge from septic tanks (to shallow groundwater) or from the deeper (circa 250-400 feet) discharge of cooling water. Therefore, a deterioration in groundwater quality is not considered a Significant Effect on the off-site abstractions or proposed on-site abstractions (for cooling water purposes).
	Subsurface infrastructure at the site	**Medium**	**Medium**	**Moderate**	**Potential contamination of groundwater with elevated concentrations of contaminants, including sulphate, may compromise the structural integrity of concrete infrastructure (such as foundations) depending on the concrete grade used within the development. This could cause significant effect to the Site infrastructure.**
Disposal of landfill leachate from the RWL	Aquifer quality	Medium	Low	Minor	Assuming compliance with the leachate management procedures, any leachate emissions would be managed and mitigated appropriately and would therefore reduce the likelihood of water quality deterioration. Also, as aquifers on Grand Cayman are of high salinity and they are not considered to support human health without desalinisation and treatment to achieve drinking water quality standards. Therefore, a deterioration in quality is not considered a Significant Effect.

Activity	Receptor	Value	Magnitude	Significance	Rationale
	Surface waters quality (North Sound & Mosquito control canals)	Medium	Low	Minor	The North Sound surface waters support local economic activity and recreation, and marine protected areas, therefore a deterioration in quality from potential contamination from landfill leachates could negatively effect surface water users. However, leachate management procedures reduce the likelihood of this occurring. This is therefore considered not Significant.
	Groundwater abstractions	Medium	Low	Minor	Leachate management procedures reduce the likelihood of leachate reaching and impacting groundwater quality. In the event of an uncontrolled release of leachate to groundwater then this is considered unlikely to impact on-site or off-site groundwater abstractions due to a combination of depth of on-site abstraction (circa 51-149 feet), as well as depth of abstraction and distance to the off-site abstractions. Any uncontrolled release of leachate is likely to be limited in duration (i.e. temporally limited) due to mitigation measures that will be documented in the detailed design of the ISWMS facility and associated environmental management plans. This is therefore considered not Significant.
	Subsurface infrastructure	Medium	Low	Minor	Potential contamination of groundwater with elevated concentrations of sulphate may compromise the structural integrity of any concrete infrastructure (such as foundations) depending on the concrete grade used within the development. Any uncontrolled release of leachate is likely to be limited in duration (i.e. temporally limited) due to mitigation measures that will be documented in the detailed design of the ISWMS facility and associated environmental management plans. This is therefore considered not Significant.
Disturbance of existing contamination (discussed in the Land Quality Assessment of the EIA)	Aquifer quality	Medium	Medium	Moderate	**Despite desalinisation and treatment being required to achieve drinking water quality standards, groundwater within aquifers on Grand Cayman is abstracted to ultimately support human health as well as economic activity. Deterioration in quality is therefore considered a Potentially Significant Effect.**
	Surface waters quality (North Sound & Mosquito control canals)	**Medium**	**Medium**	**Moderate**	**While the North Sound surface waters support local economic activity and recreation, disturbance of contamination on-site has the potential to migrate via surface water runoff or shallow groundwater and subsequent discharge to surface water.**

Activity	Receptor	Value	Magnitude	Significance	Rationale
	Groundwater abstractions	Medium	Low	Minor	The disturbance of contaminated land is considered unlikely to impact on-site or off-site groundwater abstractions due to a combination of depth of on-site abstraction (circa 51-149 feet), as well as depth of abstraction and distance to the off-site abstractions. The potential effect is therefore not considered significant.
	Subsurface infrastructure	**Medium**	**Medium**	**Moderate**	**While potential contamination of groundwater is considered unlikely, and may not result in elevated sulphate concentrations, potential contamination of groundwater with elevated concentrations of Sulphate may compromise the structural integrity of any concrete infrastructure (such as foundations) depending on the concrete grade used within the development. This is a general consideration for the whole Site.**
Potentially contaminative activities on-Site	Aquifer quality	Low	Medium	Minor	As aquifers on Grand Cayman are of high salinity and low yield, they are not considered to support human health or economic activity without desalinisation and treatment to achieve drinking water quality standards. The groundwater quality is considered to potentially already be impacted by GTLF operations. Therefore a deterioration in quality is not considered a Significant Effect.
	Surface waters quality (North Sound & Mosquito control canals)	**Medium**	**Medium**	**Moderate**	**The North Sound surface waters support local economic activity and recreation, and marine protected areas, therefore a deterioration in quality from potential contamination from Site activity (from surface runoff or migration via groundwater) could negatively affect surface water users. This is considered a Potentially Significant Effect and depends on the potential contaminant properties within the leachate and other sources and their respective concentrations.**
	Groundwater abstractions	**Medium**	**Low**	**Minor**	Contaminating activities on site is considered unlikely to significantly impact on-site or off-site groundwater abstractions due to a combination of depth of on-site abstraction (circa 51-149 feet), as well as depth of abstraction and distance to the off-site abstractions. The potential effect is therefore not considered significant.

Activity	Receptor	Value	Magnitude	Significance	Rationale
	Subsurface infrastructure	**Medium**	**High**	**Moderate**	**Potential contamination of groundwater with elevated concentrations of sulphate may compromise the structural integrity of any concrete infrastructure (such as foundations) depending on the concrete grade used within the development. This could cause Significant effect to the Site infrastructure. This is a general consideration for the whole Site.**
Tidal flooding, surface water flooding and extreme weather and climate change-induced flood events	Aquifer quality	**Medium**	Medium	**Moderate**	**This relates to the potential mobilisation of contaminants (associated with waste material, fuel storage, etc) on site during a flood, with contaminants subsequently infiltrating to the underlying groundwater.** **As aquifers on Grand Cayman are of high salinity and they are not considered to support human health without desalinisation and treatment to achieve drinking water quality standards. The groundwater quality is considered to potentially already be impacted by GTLF operations. Due to the value of the receptor, this is considered a Potentially Significant Effect.**
	Surface waters (North Sound & Mosquito control canals)	**Medium**	**Medium**	**Moderate**	**This relates to the potential mobilisation of contaminants (associated with waste material, fuel storage, etc) on site during a flood, with contaminants subsequently discharging to the surface water or infiltrating to the underlying groundwater and then discharging to the surface water bodies.** **The North Sound surface waters support local economic activity and recreation, and marine protected areas, therefore a deterioration in quality from site related contamination migrating via floodwater could negatively affect surface water users. This is considered a Potentially Significant Effect and depends on the potential contaminant properties within the leachate and their respective concentrations.**

Activity	Receptor	Value	Magnitude	Significance	Rationale
	Groundwater abstractions	**Medium**	**Low**	**Minor**	This relates to the potential mobilisation of contaminants (associated with waste material, fuel storage, etc) on site during a flood, with contaminants subsequently infiltrating to the underlying groundwater. Contamination resulting from flooding on site is considered unlikely to significantly impact on-site or off-site groundwater abstractions due to a combination of the depth of on-site abstraction (circa 51-149 feet), as well as depth of abstraction and distance to the off-site abstractions. The potential effect is therefore not considered significant.
	Site infrastructure, staff, and visitors	**Medium**	**Medium**	**Moderate**	**Potential localised flooding has the potential to cause lasting effects on Site infrastructure sensitive to flood water inundation and users, potentially compromising the integrity of the system and posing a risk to life. Therefore, the effect is considered potentially Significant.**

4.4 Summary of findings

An assessment of the significance of each of the potential hydrological and hydrogeological effects identified with respect to the proposed development are presented in Table 12. This identified the following potentially significant (moderate or major) effects:

1. Deterioration in local water quality as a result of contamination associated with potential wastewater disposal (sanitary waste disposed via septic tank) may affect recreational users of surface waters, in particular for the North Sound. Subsurface concrete infrastructure could also be affected, depending on the contents of the wastewater and the grade of concrete used.
2. Deterioration in aquifer quality as a result of contamination associated with disturbance of existing known contamination may affect groundwater abstracted for drinking water use, despite being subject to treatment and desalination prior to use.
3. Deterioration of surface water quality resulting from contamination caused by disturbance of existing contamination on-site. Subsurface concrete infrastructure could also be affected, depending on the contaminants present and the grade of concrete used.
4. Deterioration in water quality resulting from potentially-contaminative activities on-Site could affect end users of groundwater abstractions. Subsurface concrete infrastructure could also be affected, depending on the contaminants present and the grade of concrete used.
5. Flooding from tidal sources and weather-induced events could affect surface waters and their suitability for use (both North Sound and mosquito control channels), through the potential mobilisation of contaminants (associated with waste material, fuel storage, etc.) on site. Flooding of surface waters could also cause detrimental effects to the Site's infrastructure, staff, and visitors, compromising the integrity of the ISWMS system and potentially risking life.
6. Flooding from tidal sources and weather-induced events could affect aquifer quality, in the event of a flood potentially causing mobilisation of contaminants which may subsequently infiltrate into the groundwater and impacting its quality.

5. Mitigation Measures

5.1 Localised flooding

A number of Potentially Significant Effects have been identified associated with localised flooding at the Site.

5.1.1 Stormwater management plan

A detailed stormwater management plan should also be prepared for the construction phase of the proposed development, which details all areas from which runoff can arise. This should also consider if or how this system interface with existing drainage systems e.g., the neighbouring GTLF The plan should then propose appropriate and adequate runoff collection and treatment options for the identified runoff, without compromising existing systems. It is recommended that, wherever possible, the principles of Sustainable Urban Drainage Systems[2] should be applied and associated pollution control measures.

[2] Woods Ballard B, Wilson S, Udale-Clarke H, Illman S, Scott S, Ashley R, & Kellagher R. *C753 - The SuDs Manual.* CIRIA: London, UK. 2015. Accessed from https://www.ciria.org/ItemDetail?iProductCode=C753&Category=BOOK&WebsiteKey=3f18c87a-d62b-4eca-8ef4-9b09309c1c91

5.1.2 Environmental management plan – flood risk measures

Environmental management plan (EMP) to include flood risk mitigation measures regarding minimising the risk of equipment sensitive to floodwater inundation, the siting of temporary stockpiles (or other potential sources of contamination) and measures to ensure safety of Site workers (e.g., evacuation plans).

5.2 Deterioration of water quality

A number of Potentially Significant Effects have been identified associated with deterioration of water quality for both surface water and within aquifers.

A detailed wastewater and sewerage plan should be prepared in order to minimise the risk of leaks and spills within the system. The plan should incorporate suitable treatment options for wastewater prior to discharge, in accordance with projected volumes and with the requirements of the regulatory authority.

The cap used to seal completed sections of the RWL remain effective and intact into the future, to prevent the escape of leachate or other waste material. Consideration of foreseeable changes to the local climate and sea level due to climate change must be included in the design. The RWL is intended to be constructed in a phased manner and capping of the first phase is not anticipated in the near future. Prior to any capping, additional contemporary studies should be undertaken to ensure that the current design is adequate in light of the latest climate data and modelling and procedures put in place to ensure that the ultimate construction is in line with the agreed design.

A robust strategy must be made and adhered to, preventing the disturbance of or managing existing known areas of contamination on the Site (as detailed in the Land Quality assessment). Disturbance of existing contamination is not proposed as part of the development construction or operation without a prior assessment of the contamination status of areas of potential concern and appropriate measures in place to manage risk to human health and the environment. All Site staff should have a thorough awareness of the locations of the existing contamination to reduce the likelihood of accidental disturbances or exposures.

Method statements should be prepared for all potentially-contaminative activities taking place on the Site. This must be inclusive of mitigation procedures to be used in the event of a spill or accident. It is recommended that potentially-contaminative activities are reduced where possible and take place in zoned areas whereby access to contaminant pathways and receptors are minimised as much as practicably possible. This should ideally be factored into the design and layout of the proposed development and operational management plans.

A waste management plan should be prepared inclusive of appropriate waste management for emergency situations, factoring in emergency response and flooding.

It is also recommended that groundwater is sampled and tested regularly to ensure that the abstracted water is of suitable quality for its intended use and the requirements would be documented in the environmental management plan. This would also contribute to monitoring of the groundwater to identify any potential changes in quality in response to abstraction or site operations over time.

5.3 Degradation of subsurface infrastructure

A number of Potentially Significant Effects have been identified associated with degradation of subsurface concrete infrastructure as a result of potential Sulphate or other contamination.

It is recommended that the design of the proposed development considers the use of an appropriate grade of concrete to prevent Sulphate attack in the event of groundwater contamination. It is recommended that soil and groundwater analysis is undertaken to inform a ground aggressivity assessment in order to determine a suitable design sulphate class (DS class) for the concrete structures proposed in the subsurface region.

5.4 Significance evaluation considering mitigation measures

The mitigation measures proposed in the subsections above have been applied to the assessment of potential hydrology and hydrogeology effects to reassess significance considering mitigation measures. Only those effects identified as “Potentially Significant” from Table 12 have been reassessed in consideration of mitigation in Table 12.

Table 13 Significance assessment of potential water related effects with the application of mitigation measures

Activity	Receptor	Value	Magnitude	Mitigation	Magnitude (considering mitigation)	Significance (considering mitigation)	Rationale
Disposal of wastewater generated at the Site (including potential sanitary effluent, facility wash water, Composting Area runoff and non-contact ERF cooling water)	Surface waters (North Sound & Mosquito control canals)	Medium	Medium	Prepare a detailed wastewater and sewerage plan to minimise the risk of leaks and spills within the system and incorporate suitable treatment options for wastewater prior to discharge. Detailed design to consider the feasibility of the option to connect to local wastewater network for disposal of sewerage to the local wastewater treatment works.	Low	Minor	Reduced potential for contamination from wastewater (or quality impacted groundwater in connectivity with surface waters) through the preparation and implementation of a detailed wastewater and sewerage plan, including suitable treatment options for wastewater prior to discharge and in line with the regulatory consent requirements. This is not considered a Significant Effect.
	Subsurface infrastructure	Medium	Medium	Prepare a detailed wastewater and sewerage plan to minimise the risk of leaks and spills within the system and incorporate suitable treatment options for wastewater prior to discharge. Construct using an appropriate grade of concrete to prevent Sulphate attack in the event of groundwater contamination.	Very low	Minor	The potential for contamination of groundwater with elevated concentrations of contaminants, including sulphate, is reduced through the preparation and implementation of a detailed wastewater and sewerage plan. Further, the potential for compromise to the structural integrity of concrete infrastructure (such as foundations) is reduced through use of appropriate concrete grade. This is not considered a Significant Effect.
Disturbance of existing contamination (discussed in Chapter 9 (Land Quality))	Aquifer quality	Medium	Medium	Implementation of a strategy to prevent or appropriately manage the disturbance of existing known areas of contamination on the Site (as detailed in Chapter 9 (Land Quality)).	Low	Minor	With the implementation of a strategy to prevent or appropriately manage the disturbance of existing known areas of contamination on the Site (as detailed in Chapter 9 (Land Quality), the effect of potential contamination is not considered a Significant Effect.
	Surface waters (North Sound & Mosquito	Medium	Medium	Implementation of a strategy to prevent the disturbance of or appropriately manage existing known areas of contamination on the Site (as	Low	Minor	With the implementation of a strategy to prevent the disturbance of or appropriately manage existing known areas of contamination on the Site (as detailed in Chapter 9

Activity	Receptor	Value	Magnitude	Mitigation	Magnitude (considering mitigation)	Significance (considering mitigation)	Rationale
	control canals)			detailed in the Land Quality Assessment).			(Land Quality), the effect of potential contamination is not considered a Significant Effect.
	Subsurface infrastructure	High	Low	Implementation of strategy to prevent the disturbance of existing known areas of contamination on the Site (as detailed in the Land Quality Assessment). Construct using an appropriate grade of concrete to prevent Sulphate attack in the event of groundwater contamination.	Very low	Minor	With the implementation of a strategy to prevent the disturbance of existing known areas of contamination on the Site (as detailed in Chapter 9 (Land Quality), the effect of potential contamination is not considered a Significant Effect. Further, the potential for compromise to the structural integrity of concrete infrastructure (such as foundations) is reduced through use of appropriate concrete grade. This is not considered a Significant Effect.
Potentially contaminative activities on-Site	Surface waters (North Sound & Mosquito control canals)	Medium	Medium	Include protocols for all potentially-contaminative on-Site activities in the Site EMP. Prepare a detailed wastewater and sewerage plan to minimise the risk of leaks and spills within the system and incorporate suitable treatment options for wastewater prior to discharge. Detailed design to consider the feasibility of the option to connect to local wastewater network for disposal of sewerage to the local wastewater treatment works	Very low	Minor	Reduced potential for contamination through protocols included in the EMP and the preparation and implementation of a detailed wastewater and sewerage plan, including suitable treatment options for wastewater prior to discharge. This is not considered a Significant Effect.
	Subsurface infrastructure	Medium	High	Include protocols for all potentially-contaminative on-Site activities in the Site EMP. Prepare a detailed wastewater and sewerage plan to minimise the risk of leaks and	Very low	Minor	The potential for contamination of groundwater with elevated concentrations of contaminants, including sulphate, is reduced through the inclusion of protocols for all potentially-contaminative on-Site activities in the Site EMP and the

Activity	Receptor	Value	Magnitude	Mitigation	Magnitude (considering mitigation)	Significance (considering mitigation)	Rationale
				spills within the system and incorporate suitable treatment options for wastewater prior to discharge. Detailed design to consider the feasibility of the option to connect to local wastewater network for disposal of sewerage to the local wastewater treatment works. Construct using an appropriate grade of concrete to prevent Sulphate attack in the event of groundwater contamination.			preparation and implementation of a detailed wastewater and sewerage plan. Further, the potential for compromise to the structural integrity of concrete infrastructure (such as foundations) is reduced through use of appropriate concrete grade. This is not considered a Significant Effect.
Tidal flooding, surface water flooding and extreme weather and climate change-induce d flood events	Aquifer quality	Medium	Medium	Include protocols for all potentially-contaminative on-Site activities in the Site EMP. A waste management plan should be prepared inclusive of appropriate waste management for emergency situations, factoring in emergency response and flooding.	Low	Minor	Due to the relatively low elevation of the proposed development, localised flooding could occur. Implementation of appropriate management of potentially contaminative activities and waste will minimise the risk of uncontrolled release of these materials if the site flooded.
	Surface waters (North Sound & Mosquito control canals)	Medium	Medium	Include protocols for all potentially-contaminative on-Site activities in the Site EMP. A waste management plan should be prepared inclusive of appropriate waste management for emergency situations, factoring in emergency response and flooding.	Low	Minor	Due to the relatively low elevation of the proposed development, localised flooding could occur. Implementation of appropriate management of potentially contaminative activities and waste will minimise the risk of uncontrolled release of these materials if the site flooded.
	Site infrastructure, staff, and visitors	Medium	Medium	The design should include consideration of the layout of the site (in terms of vulnerability/sensitivity to	Medium	Moderate	Flooding has the potential to cause lasting effects to site infrastructure potentially compromising the integrity of the system even with

Activity	Receptor	Value	Magnitude	Mitigation	Magnitude (considering mitigation)	Significance (considering mitigation)	Rationale
				flooding), establishing finished floor levels or raising equipment above anticipated flood water levels, topographic gradients of surfaces to direct floodwater away from sensitive infrastructure and evacuation routes or refuges. A hazard management plan for the site will document evacuation procedures in response to government issued warnings.			mitigation measures adopted (i.e. a flood event occurring that exceeds the design criteria). Therefore, the effect is considered Significant.

6. Conclusions

A review of the hydrology and hydrogeology indicates that the Site area is affected by extreme weather events, exposing the Site to potential tidal- and weather-related flood events, with the magnitude amplified by the low-lying nature of the Site.

Groundwater within the vicinity of the Site area is hydraulically connected to the ocean and other surface water bodies (such as the nearby mosquito control channels). This infers a tidal influence on the groundwater, and results in a considerable degree of mixing of saline water and fresher water at the transition zone, which is anticipated to be present beneath the Site. As a result, the groundwater is of high salinity and considered to be of 'low quality' and is therefore unsuitable for potable use without treatment. This is typical for groundwater on Grand Cayman, with the exception of some freshwater lenses located on the eastern side of the Island. A highly precautionary assessment of groundwater and surface water quality suggests that these waters may already be affected by contamination assumed to source from the GTLF. Based on current trends, it is anticipated that concentrations of these contaminants may increase in the near future without influence from the proposed development.

A qualitative assessment of the potential risks relating to hydrology and hydrogeology was undertaken. Based on the current proposed design (Chapter 4), a variety of potential environmental effects associated with the construction, operation and decommissioning of the ISWMS have been identified. A number of these effects have been assessed as Potentially Significant impacts.

Appropriate mitigation measures for these Potentially Significant Impacts have been recommended, many of which relate to the design of the proposed development and strategies to be adhered to throughout the construction, operation, and decommissioning phases of ISWMS.

However, it should be appreciated that, due to the current unsustainable design and practices at the GTLF and resulting impacts to groundwater quality, it is likely that the construction of the ISWMS will result in net environmental benefits in the long-term. This is due to improved waste management practices and facilities replacing the current practices at the GTLF (unlined landfill) that are currently impacting groundwater quality.

A residual significant risk relates to potential flooding occurring at the site that exceeds the criteria adopted in the site design and impacts site infrastructure.

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Appendices

Appendix A

Surface water and groundwater monitoring results

Paramater	Florida Clean up Standard Low Yield/ Poor Quality Criteria			Reporting Unit	MW1	MW1	MW1	MW5	MW5	MW5	MW5	MW8	MW8	MW8
					2007	2008	2011	2006	2007	2011	2013	2006	2007	2008
	MCL	Unit	Source		01/07/2007	01/07/2008	01/07/2011	01/07/2006	01/07/2007	01/07/2011	01/07/2013	01/07/2006	01/07/2007	01/07/2008
Ammonia or total Nitrogen	28	mg/l	GW Cleanup Target Levels	mg/L	1.3	0.073	0.66	30	20	11	22	-	14	14
Unionised Ammonia	-	mg/l	-	mg/l	-	-	-	-	-	-	-	-	-	-
Nitrogen, Kjeldahl	-	mg/L	-	-	1.8	1.4	-	-	23	-	-	17	17	14
Nitrate plus Nitrite, as N	110*	mg/l	10X Primary Standard	mg/L	<0.050	<2.5	0.83	<0.050	<0.050	<0.05	<0.05	-	0.18	0.15
Orthophosphate	-	-	-	mg/L	<0.050	<0.050	<0.05	-	0.15	<0.05	0.12	-	0.51	0.55
Phosphorus	-	-	-	mg/L	0.13	0.35	-	0.4	0.2	-	-	0.57	0.7	0.53
Chemical Oxygen Demand	-	-	-	mg/L	310	100	64	340	760	420	230	250	1100	250
pH	6-8.5	-	UK other surface water maximum allowable	-	7.66	7.44	7.64	7.06	7.2	7.34	7.4	7.39	7.33	7.27
Specific Conductance	-	-	-	umhos/cm	3000	2600	2700	12000	13000	7900	11000	20000	19000	18000
Total Dissolved Solids	5,000	mg/l	10X Second Standard	mg/L	4700	1600	1400	6300	7900	4800	6500	11000	9600	9100
Total Suspended Solids	-	-	-	mg/L	75	680	-	87	34	-	-	250	170	24
Turbidity	-	-	-	NTU	5.2	74	0.68	50	36	2200	130	220	67	8.9
Biochemical Oxygen Demand	-	-	-	mg/L	<2.0	<2.0	<2	4.4	12	7.8	14	-	18	18
8260B Volatile Organic Compounds by GC/MS	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acetone	63000	ug/L	GW Cleanup Target Levels	ug/L	<25	<25	<25	-	<25	<25	<25	-	<25	<25
Acrylonitrile	420	ug/L	GW Cleanup Target Levels	ug/L	<20	<20	<20	-	<20	<20	<20	-	<20	<20
Benzene	10	ug/L	10X Primary Standard	ug/L	<1	<1	<1	-	<1	<1	<1	-	<1	<1
Bromochloromethane	910	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<1	-	<1	<1	<1	-	<1	<1
Bromodichloromethane	6	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<1	-	<1	<1	<1	-	<1	<1
Bromoform	44	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<1	-	<1	<1	<1	-	<1	<1
Carbon disulfide	7000	ug/L	GW Cleanup Target Levels	ug/L	<2	<2	<2	-	<2	<2	<2	-	<2	<2
Carbon tetrachloride	30	ug/L	10X Primary Standard	ug/L	<1	<1	<1	-	<1	<1	<1	-	<1	<1
Chlorobenzene	1000	ug/L	10X Primary Standard	ug/L	<1	<1	<1	-	<1	<1	<1	-	<1	<1
Chloroethane	120	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<1	-	<1	<1	<1	-	<1	<1
Chloroform	700	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<1	-	<1	<1	<1	-	<1	<1
Dibromochloromethane	4	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<1	-	<1	<1	<1	-	<1	<1
1,2-Dibromo-3-Chloropropane	2	ug/L	10X Primary Standard	ug/L	<1	<1	<1	-	<1	<1	<1	-	<1	<1
1,2-Dibromoethane (EDB)	0.2	ug/L	10X Primary Standard	ug/L	<1	<1	<1	-	<1	<1	<1	-	<1	<1
1,2-Dichlorobenzene	6000	ug/L	10X Primary Standard	ug/L	<1	<1	<1	-	<1	<1	<1	-	<1	<1
1,4-Dichlorobenzene	750	ug/L	10X Primary Standard	ug/L	<1	<1	<1	-	<1	<1	<1	-	<1	<1
trans-1,4-Dichloro-2-butene	-	-	No Standard	ug/L	<2	<2	<2	-	<2	<2	<2	-	<2	<2
1,1-Dichloroethane	700	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<1	-	<1	<1	<1	-	<1	<1
1,2-Dichloroethane	30	ug/L	10X Primary Standard	ug/L	<1	<1	<1	-	<1	<1	<1	-	<1	<1
1,1-Dichloroethene	70	ug/l	10X Primary Standard	ug/L	<1	<1	<1	-	<1	<1	<1	-	<1	<1
cis-1,2-Dichloroethene	700	ug/l	10X Primary Standard	ug/L	<1	<1	<1	-	<1	<1	<1	-	1	<1
trans-1,2-Dichloroethene	1000	ug/l	10X Primary Standard	ug/L	<1	<1	<1	-	<1	<1	<1	-	<1	<1
1,2-Dichloropropane	50	ug/L	10X Primary Standard	ug/L	<1	<1	<1	-	<1	<1	<1	-	<1	<1
cis-1,3-Dichloropropene	4	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<1	-	<1	<1	<1	-	<1	<1
trans-1,3-Dichloropropene	4	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<1	-	<1	<1	<1	-	<1	<1
Ethylbenzene	300	ug/L	10X Second Standard	ug/L	<1	<1	<1	-	<1	<1	<1	-	<1	<1
2-Hexanone	2800	ug/L	GW Cleanup Target Levels	ug/L	<10	<10	<10	-	<10	<10	<10	-	<10	<10
Bromomethane	98	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<1	-	<1	<1	<1	-	<1	<1
Chloromethane (methyl chloride)	27	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<1	-	<1	<1	<1	-	<1	<1
Dibromomethane (EDB)	0.2	ug/l	10X Primary Standard	ug/L	<1	<1	<1	-	<1	<1	<1	-	<1	<1
Methylene Chloride	50	ugL	10X Primary Standard	ug/L	<5	<5	<5	-	<5	<5	<5	-	<5	<5
Methyl Ethyl Ketone	42000	ug/L	GW Cleanup Target Levels	ug/L	<10	<10	<10	-	<10	<10	<10	-	<10	<10
Iodomethane	-	-	No Standard	ug/L	<5	<5	<5	-	<5	<5	<5	-	<5	<5
methyl isobutyl ketone	5600	ug/L	GW Cleanup Target Levels	ug/L	<10	<10	<10	-	<10	<10	<10	-	<10	<10
Styrene	1000	ug/L	10X Primary Standard	ug/L	<1	<1	<1	-	<1	<1	<1	-	<1	<1
1,1,1,2-Tetrachloroethane	13	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<1	-	<1	<1	<1	-	<1	<1
1,1,2,2-Tetrachloroethane	2	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<1	-	<1	<1	<1	-	<1	<1
Tetrachloroethene	30	ug/L	10X Primary Standard	ug/L	<1	<1	<1	-	<1	<1	<1	-	<1	<1
Toluene	400	ug/L	10X Second Standard	ug/L	<1	<1	<1	-	<1	<1	<1	-	<1	<1
1,1,1-Trichloroethane	2000	ug/L	10X Primary Standard	ug/L	<1	<1	<1	-	<1	<1	<1	-	<1	<1

Paramater	Florida Clean up Standard Low Yield/ Poor Quality Criteria			Reporting Unit	MW1	MW1	MW1	MW5	MW5	MW5	MW5	MW8	MW8	MW8
					2007	2008	2011	2006	2007	2011	2013	2006	2007	2008
	MCL	Unit	Source		01/07/2007	01/07/2008	01/07/2011	01/07/2006	01/07/2007	01/07/2011	01/07/2013	01/07/2006	01/07/2007	01/07/2008
1,1,2-Trichloroethane	50	ug/L	10X Primary Standard	ug/L	<1	<1	<1	-	<1	<1	<1	-	<1	<1
Trichloroethene	30	ug/L	10X Primary Standard	ug/L	<1	<1	<1	-	<1	<1	<1	-	<1	<1
Trichlorofluoromethane	21000	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<1	-	<1	<1	<1	-	<1	<1
1,2,3-Trichloropropane	0.2	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<1	-	<1	<1	<1	-	<1	<1
8260B Volatile Organic Compounds	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vinyl acetate	880	ug/L	GW Cleanup Target Levels	ug/L	<2	<2	<2	-	<2	<2	<2	-	<2	<2
Vinyl chloride	10	ug/l	10X Primary Standard	ug/L	<1	<1	<1	-	<1	<1	<1	-	<1	<1
Xylenes, Total	200	ug/l	10X Second Standard	ug/L	<2	<2	<2	-	<2	<2	<2	-	<2	<2
6010B Inductively Coupled Plasma - Atomic Emission Spectometry - Total Recoverable	-		-	-	-	-	-	-	-	-	-	-	-	-
Antimony	0.06	mg/L	10X Primary Standard	mg/L	<0.0060	<0.0060	<0.02	<0.0060	<0.0060	<0.02	<0.02	<0.0060	<0.0060	<0.0060
Arsenic	0.1	mg/L	10X Primary Standard	mg/L	<0.010	<0.010	<0.02	<0.010	<0.010	<0.02	<0.02	0.019	<0.010	<0.010
Barium	20	mg/L	10X Primary Standard	mg/L	0.07		0.095	0.045	0.018	0.085	0.044	0.029	0.019	0.015
Beryllium	0.04	mg/L	10X Primary Standard	mg/L	<0.0030	<0.0030	<0.004	<0.0030	<0.0030	<0.004	<0.004	<0.0030	<0.0030	<0.0030
Cadmium	0.05	mg/L	10X Primary Standard	mg/L	<0.0050	<0.0050	<0.005	<0.0050	<0.0050	<0.005	<0.005	<0.0050	<0.0050	<0.0050
Chromium	1	mg/L	10X Primary Standard	mg/L	<0.010	<0.010	<0.01	0.012	<0.010	<0.01	<0.01	0.03	0.02	<0.010
Cobalt	1400	ug/L	GW Cleanup Target Levels	mg/L	<0.010	<0.010	<0.01	<0.010	<0.010	<0.01	<0.01	<0.010	<0.010	<0.010
Copper	10	mg/L	10X Second Standard	mg/L	0.033	0.083	<0.02	<0.020	<0.020	<0.02	<0.02	<0.020	<0.020	<0.020
Iron	3	mg/L	10X Second Standard	mg/L	0.7	3.4	<0.05	5.2	0.8	7.3	6.9	5.6	3.3	0.72
Lead	0.15	mg/L	10X Primary Standard	mg/L	0.014	0.05	<0.01	<0.0050	<0.0050	<0.01	<0.01	<0.0050	<0.0050	<0.0050
Magnesium	-	-	No Standard	mg/L	58	58	43	180	270	210	280	300	410	310
Nickel	1	mg/L	10X Primary Standard	mg/L	<0.040	<0.040	<0.04	<0.040	<0.040	<0.04	<0.04	<0.040	<0.040	<0.040
Selenium	0.5	mg/L	10X Primary Standard	mg/L	<0.010	<0.010	<0.02	<0.010	<0.010	<0.02	<0.04	<0.010	<0.010	<0.010
Silver	1	mg/L	10X Second Standard	mg/L	<0.010	<0.010	<0.01	<0.010	<0.010	<0.01	<0.01	<0.010	<0.010	<0.010
Thallium	0.02	mg/L	10X Primary Standard	mg/L	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Vanadium	490	ug/L	GW Cleanup Target Levels	mg/L	<0.010	<0.010	<0.01	0.011	0.011	<0.01	<0.01	0.025	0.021	0.011
Zinc	50	mg/L	10X Second Standard	mg/L	0.048	0.19	0.047	0.035	<0.020	<0.02	<0.02	0.027	0.067	0.027
7470A Mercury in Liquid Waste (Manual Cold Vapor Technique)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	0.02	mg/L	10X Primary Standard	mg/L	<0.00020	<0.00020	<0.0002	<0.00020	<0.00020	<0.0002	<0.0002	<0.00020	<0.00020	<0.00020
PCBs	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB-1016	***	ug/l	10X Primary Standard	ug/l	-	-	<1	-	-	<0.95	<0.96	-	-	-
PCB-1221	***	ug/l	10X Primary Standard	ug/l	-	-	<2	-	-	<1.9	<1.9	-	-	-
PCB-1232	***	ug/l	10X Primary Standard	ug/l	-	-	<1	-	-	<0.95	<0.96	-	-	-
PCB-1242	***	ug/l	10X Primary Standard	ug/l	-	-	<1	-	-	<0.95	<0.96	-	-	-
PCB-1248	***	ug/l	10X Primary Standard	ug/l	-	-	<1	-	-	<0.95	<0.96	-	-	-
PCB-1254	***	ug/l	10X Primary Standard	ug/l	-	-	<1	-	-	<0.95	<0.96	-	-	-
PCB-1260	***	ug/l	10X Primary Standard	ug/l	-	-	<1	-	-	<0.95	<0.96	-	-	-
Pesticides	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4,4'-DDD	1	ug/l	10X Primary Standard	ug/l	-	-	-	-	-	-	<0.048	-	-	-
4,4'-DDE	1	ug/l	10X Primary Standard	ug/l	-	-	-	-	-	-	<0.048	-	-	-
4,4'-DDT	1	ug/l	10X Primary Standard	ug/l	-	-	-	-	-	-	<0.048	-	-	-
Aldrin	0.02	ug/l	10X Primary Standard	ug/l	-	-	-	-	-	-	<0.048	-	-	-
alpha-BHC	0.06	ug/l	10X Primary Standard	ug/l	-	-	-	-	-	-	<0.048	-	-	-
beta-BHC	0.2	ug/l	10X Primary Standard	ug/l	-	-	-	-	-	-	<0.048	-	-	-
Chlordane (technical)	***	ug/l	10X Primary Standard	ug/l	-	-	-	-	-	-	<0.48	-	-	-
delta-BHC	21	ug/l	10X Primary Standard	ug/l	-	-	-	-	-	-	<0.048	-	-	-
Dieldrin	0.02	ug/l	10X Primary Standard	ug/l	-	-	-	-	-	-	<0.048	-	-	-
Endosulfan I	420	ug/l	10X Primary Standard	ug/l	-	-	-	-	-	-	<0.048	-	-	-
Endosulfan II	420	ug/l	10X Primary Standard	ug/l	-	-	-	-	-	-	<0.048	-	-	-
Endosulfan sulfate	420	ug/l	10X Primary Standard	ug/l	-	-	-	-	-	-	<0.048	-	-	-
Endrin	***	ug/l	10X Primary Standard	ug/l	-	-	-	-	-	-	<0.048	-	-	-
Endrin aldehyde	***	ug/l	10X Primary Standard	ug/l	-	-	-	-	-	-	<0.048	-	-	-
Endrin ketone	***	ug/l	10X Primary Standard	ug/l	-	-	-	-	-	-	<0.048	-	-	-
gamma-BHC (Lindane)	***	ug/l	10X Primary Standard	ug/l	-	-	-	-	-	-	<0.048	-	-	-

Paramater	Florida Clean up Standard Low Yield/ Poor Quality Criteria			Reporting Unit	MW1	MW1	MW1	MW5	MW5	MW5	MW5	MW8	MW8	MW8
					2007	2008	2011	2006	2007	2011	2013	2006	2007	2008
	MCL	Unit	Source		01/07/2007	01/07/2008	01/07/2011	01/07/2006	01/07/2007	01/07/2011	01/07/2013	01/07/2006	01/07/2007	01/07/2008
Heptachlor	***	ug/l	10X Primary Standard	ug/l	-	-	-	-	-	-	<0.048	-	-	-
Heptachlor epoxide	***	ug/l	10X Primary Standard	ug/l	-	-	-	-	-	-	<0.048	-	-	-
Methoxychlor	***	ug/l	10X Primary Standard	ug/l	-	-	-	-	-	-	<0.048	-	-	-
Toxaphene	***	ug/l	10X Primary Standard	ug/l	-	-	-	-	-	-	<4.8	-	-	-
Hydrocarbons	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diesel Range Organics [C10-C28]	-	-	No Standard	mg/l	-	-	-	-	-	-	-	-	-	-
Gasoline Range Organics (GRO)-C6-C10	-	-	No Standard	mg/l	-	-	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	14000	ug/l	10X Minimum criteria	mg/l	-	-	650	-	-	2700	2.5	-	-	-
Cyanide, Total	***	ug/l	10X Primary Standard	mg/l	-	-	<0.01	-	-	<0.01	<0.01	-	-	-
Sulphate	-	mg/l	-	mg/l	-	-	-	-	-	-	-	-	-	-
Chloride	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Paramater	Florida Clean up Standard Low Yield/ Poor Quality Criteria			Reporting Unit	MW8	MW8	MW8	MW8	MW8	MW8	MW8	MW9	MW9	MW9
					2010	2011	2013	2015	2016	2019	2020	2006	2007	2008
	MCL	Unit	Source		01/07/2010	01/07/2011	01/07/2013	15/04/2015	16/12/2016	28/08/2019	27/07/2020	01/07/2006	01/07/2007	01/07/2008
Ammonia or total Nitrogen	28	mg/l	GW Cleanup Target Levels	mg/L	21	35	35	28	17	16	18	-	6.4	6.6
Unionised Ammonia	-	mg/l	-	mg/l	-	-	-	-	-	-	0.14	-	-	-
Nitrogen, Kjeldahl	-	mg/L	-	-	2**	-	-	-	-	-	12	17	8.8	8.5
Nitrate plus Nitrite, as N	110*	mg/l	10X Primary Standard	mg/L	<0.050	0.69	<0.05	<0.018	<0.25	0.015	<0.010	<0.050	<0.050	<2.5
Orthophosphate	-	-	-	mg/L	0.76	0.63	0.48	0.47	0.37	0.44	0.15	-	0.071	0.069
Phosphorus	-	-	-	mg/L	0.28	-	-	-	-	-	0.24	<0.10	<0.10	<0.10
Chemical Oxygen Demand	-	-	-	mg/L	2100	800	320	250	230	190	180	240	640	1600
pH	6-8.5	-	UK other surface water maximum allowable	-	7.34	7.46	7.38	-	7.4	7.5	7.5	7.28	7.33	7.28
Specific Conductance	-	-	-	umhos/cm	25000	24000	12000	-	17000	33000	13000	20000	15000	17000
Total Dissolved Solids	5,000	mg/l	10X Second Standard	mg/L	9700	13000	7100	15000	14000	20000	7100	9600	7300	8500
Total Suspended Solids	-	-	-	mg/L	-	-	-	-	-	-	-	67	18	12
Turbidity	-	-	-	NTU	12	8.5	14	-	13	31	120	76	50	64
Biochemical Oxygen Demand	-	-	-	mg/L	11	19	38	<81.00	190	29	-	38	32	32
8260B Volatile Organic Compounds by GC/MS	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acetone	63000	ug/L	GW Cleanup Target Levels	ug/L	<25	<25	<25	-	-	-	<7.0	-	<25	<25
Acrylonitrile	420	ug/L	GW Cleanup Target Levels	ug/L	<20	<20	<20	-	-	-	<10	-	<20	<20
Benzene	10	ug/L	10X Primary Standard	ug/L	<1	<1	<1	<0.38	-	-	<0.43	-	<1	<1
Bromochloromethane	910	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<1	<0.52	-	-	<0.45	-	<1	<1
Bromodichloromethane	6	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<1	<0.50	-	-	<0.44	-	<1	<1
Bromoform	44	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<1	<0.71	-	-	<0.43	-	<1	<1
Carbon disulfide	7000	ug/L	GW Cleanup Target Levels	ug/L	<2	<2	<2	-	0.002	-	1.7	-	<2	<2
Carbon tetrachloride	30	ug/L	10X Primary Standard	ug/L	<1	<1	<1	<0.50	-	-	<0.33	-	<1	<1
Chlorobenzene	1000	ug/L	10X Primary Standard	ug/L	<1	<1	<1	<0.50	-	0.44	0.53	-	<1	<1
Chloroethane	120	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<1	<0.76	-	-	<2.5	-	<1	<1
Chloroform	700	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<1	<0.60	-	-	<0.50	-	<1	<1
Dibromochloromethane	4	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<1	<0.85	-	-	<0.32	-	<1	<1
1,2-Dibromo-3-Chloropropane	2	ug/L	10X Primary Standard	ug/L	<1	<1	<1	-	-	-	<1.1	-	<1	<1
1,2-Dibromoethane (EDB)	0.2	ug/L	10X Primary Standard	ug/L	<1	<1	<1	-	-	-	<0.44	-	<1	<1
1,2-Dichlorobenzene	6000	ug/L	10X Primary Standard	ug/L	<1	<1	<1	<0.50	-	-	<0.37	-	<1	<1
1,4-Dichlorobenzene	750	ug/L	10X Primary Standard	ug/L	<1	<1	<1	<0.64	-	-	<0.46	-	<1	<1
trans-1,4-Dichloro-2-butene	-	-	No Standard	ug/L	<2	<2	<2	-	-	-	<0.51	-	<2	<2
1,1-Dichloroethane	700	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<1	<0.50	-	-	<0.38	-	<1	<1
1,2-Dichloroethane	30	ug/L	10X Primary Standard	ug/L	<1	<1	<1	<0.50	-	-	<0.50	-	<1	<1
1,1-Dichloroethene	70	ug/l	10X Primary Standard	ug/L	<1	<1	<1	<0.50	-	-	<0.36	-	<1	<1
cis-1,2-Dichloroethene	700	ug/l	10X Primary Standard	ug/L	<1	<1	<1	<0.50	-	-	<0.41	-	<1	<1
trans-1,2-Dichloroethene	1000	ug/l	10X Primary Standard	ug/L	<1	<1	<1	<0.50	-	-	<0.37	-	<1	<1
1,2-Dichloropropane	50	ug/L	10X Primary Standard	ug/L	<1	<1	<1	<0.50	-	-	<0.67	-	<1	<1
cis-1,3-Dichloropropene	4	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<1	<0.50	-	-	<0.40	-	<1	<1
trans-1,3-Dichloropropene	4	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<1	<0.50	-	-	<0.42	-	<1	<1
Ethylbenzene	300	ug/L	10X Second Standard	ug/L	<1	<1	<1	<0.50	-	-	<0.33	-	<1	<1
2-Hexanone	2800	ug/L	GW Cleanup Target Levels	ug/L	<10	<10	<10	-	-	-	<2.0	-	<10	<10
Bromomethane	98	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<1	<0.98	-	-	<2.5	-	<1	<1
Chloromethane (methyl chloride)	27	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<1	<0.83	-	-	<0.40	-	<1	<1
Dibromomethane (EDB)	0.2	ug/l	10X Primary Standard	ug/L	<1	<1	<1	<0.59	-	-	<0.35	-	<1	<1
Methylene Chloride	50	ugL	10X Primary Standard	ug/L	<5	<5	<5	<3.0	-	-	<2.5	-	<5	<5
Methyl Ethyl Ketone	42000	ug/L	GW Cleanup Target Levels	ug/L	<10	<10	<10	-	-	-	-	-	<10	<10
Iodomethane	-	-	No Standard	ug/L	<5	<5	<5	-	-	-	<5.0	-	<5	<5
methyl isobutyl ketone	5600	ug/L	GW Cleanup Target Levels	ug/L	<10	<10	<10	-	-	-	-	-	<10	<10
Styrene	1000	ug/L	10X Primary Standard	ug/L	<1	<1	<1	<1.0	-	-	<0.27	-	<1	<1
1,1,1,2-Tetrachloroethane	13	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<1	<0.52	-	-	<0.37	-	<1	<1
1,1,2,2-Tetrachloroethane	2	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<1	<0.50	-	-	<0.62	-	<1	<1
Tetrachloroethene	30	ug/L	10X Primary Standard	ug/L	<1	<1	<1	<0.58	-	-	<0.74	-	<1	<1
Toluene	400	ug/L	10X Second Standard	ug/L	<1	<1	<1	<0.70	-	-	<0.48	-	<1	<1
1,1,1-Trichloroethane	2000	ug/L	10X Primary Standard	ug/L	<1	<1	<1	<0.50	-	-	<0.37	-	<1	<1

Paramater	Florida Clean up Standard Low Yield/ Poor Quality Criteria			Reporting Unit	MW8	MW8	MW8	MW8	MW8	MW8	MW8	MW9	MW9	MW9
					2010	2011	2013	2015	2016	2019	2020	2006	2007	2008
	MCL	Unit	Source		01/07/2010	01/07/2011	01/07/2013	15/04/2015	16/12/2016	28/08/2019	27/07/2020	01/07/2006	01/07/2007	01/07/2008
1,1,2-Trichloroethane	50	ug/L	10X Primary Standard	ug/L	<1	<1	<1	<0.50	-	-	<0.33	-	<1	<1
Trichloroethene	30	ug/L	10X Primary Standard	ug/L	<1	<1	<1	<0.50	-	-	<0.48	-	<1	<1
Trichlorofluoromethane	21000	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<1	<0.52	-	-	<0.42	-	<1	<1
1,2,3-Trichloropropane	0.2	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<1	<0.84	-	-	<0.39	-	<1	<1
8260B Volatile Organic Compounds	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vinyl acetate	880	ug/L	GW Cleanup Target Levels	ug/L	<2	<2	<2	-	-	-	<0.81	-	<2	<2
Vinyl chloride	10	ug/l	10X Primary Standard	ug/L	<1	<1	<1	<0.50	-	-	<0.50	-	<1	<1
Xylenes, Total	200	ug/l	10X Second Standard	ug/L	<2	<2	<2	-	-	-	<0.23	-	<2	<2
6010B Inductively Coupled Plasma - Atomic Emission Spectometry - Total Recoverable	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Antimony	0.06	mg/L	10X Primary Standard	mg/L	-	<0.02	<0.02	<0.010	0.00096	-	0.00099	<0.0060	<0.0060	<0.0060
Arsenic	0.1	mg/L	10X Primary Standard	mg/L	-	<0.02	<0.02	<0.070	0.008	0.0054	0.0047	0.013	0.011	<0.010
Barium	20	mg/L	10X Primary Standard	mg/L	-	0.015	<0.01	0.017	0.021	0.025	0.021	0.014	0.013	0.013
Beryllium	0.04	mg/L	10X Primary Standard	mg/L	-	<0.004	<0.004	<0.0010	0.00018	-	<0.00017	<0.0030	<0.0030	<0.0030
Cadmium	0.05	mg/L	10X Primary Standard	mg/L	-	<0.005	<0.005	<0.0010	0.00027	-	<0.00015	<0.0050	<0.0050	<0.0050
Chromium	1	mg/L	10X Primary Standard	mg/L	-	0.016	0.023	0.018	0.014	0.0076	0.01	0.012	<0.010	<0.010
Cobalt	1400	ug/L	GW Cleanup Target Levels	mg/L	-	<0.01	<0.01	<0.0030	0.0014	0.00031	0.00081	<0.010	<0.010	<0.010
Copper	10	mg/L	10X Second Standard	mg/L	-	<0.02	<0.02	0.0025	0.007	-	0.006	<0.020	<0.020	<0.020
Iron	3	mg/L	10X Second Standard	mg/L	-	<0.05	<0.05	-	-	-	0.24	0.16	0.051	0.096
Lead	0.15	mg/L	10X Primary Standard	mg/L	-	<0.01	<0.01	0.0058	0.0026	-	<0.00098	<0.0050	<0.0050	<0.0050
Magnesium	-	-	No Standard	mg/L	-	530	290	-	-	580	-	330	290	330
Nickel	1	mg/L	10X Primary Standard	mg/L	-	<0.04	<0.04	<0.0030	0.0059	-	0.0057	<0.040	<0.040	<0.040
Selenium	0.5	mg/L	10X Primary Standard	mg/L	-	<0.02	<0.04	<0.0040	0.0022	0.002	<0.001	<0.010	<0.010	<0.010
Silver	1	mg/L	10X Second Standard	mg/L	-	<0.01	<0.01	<0.0020	0.00016	-	0.00011	<0.010	<0.010	<0.010
Thallium	0.02	mg/L	10X Primary Standard	mg/L	-	<0.025	<0.025	<0.0040	<0.00049	-	<0.00049	<0.025	<0.025	<0.025
Vanadium	490	ug/L	GW Cleanup Target Levels	mg/L	-	0.019	0.016	0.013	0.014	0.008	0.0088	<0.010	<0.010	<0.010
Zinc	50	mg/L	10X Second Standard	mg/L	-	<0.02	<0.02	<0.0080	0.05	-	0.026	0.069	0.043	0.12
7470A Mercury in Liquid Waste (Manual Cold Vapor Technique)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	0.02	mg/L	10X Primary Standard	mg/L	-	<0.0002	<0.0002	<0.070	-	-	<0.000080	<0.00020	<0.00020	<0.00020
PCBs	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB-1016	***	ug/l	10X Primary Standard	ug/l	-	<1	<0.97	<0.11	-	-	<0.19	-	-	-
PCB-1221	***	ug/l	10X Primary Standard	ug/l	-	<2	<1.9	<0.088	-	-	<0.15	-	-	-
PCB-1232	***	ug/l	10X Primary Standard	ug/l	-	<1	<0.97	<0.040	-	-	<0.13	-	-	-
PCB-1242	***	ug/l	10X Primary Standard	ug/l	-	<1	<0.97	<0.014	-	-	<0.18	-	-	-
PCB-1248	***	ug/l	10X Primary Standard	ug/l	-	<1	<0.97	<0.0080	-	-	<0.082	-	-	-
PCB-1254	***	ug/l	10X Primary Standard	ug/l	-	<1	<0.97	<0.023	-	-	<0.15	-	-	-
PCB-1260	***	ug/l	10X Primary Standard	ug/l	-	<1	<0.97	<0.061	-	-	<0.13	-	-	-
Pesticides	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4,4'-DDD	1	ug/l	10X Primary Standard	ug/l	-	-	<0.049	<0.0012	-	-	<0.0079	-	-	-
4,4'-DDE	1	ug/l	10X Primary Standard	ug/l	-	-	<0.049	<0.00088	-	-	<0.0076	-	-	-
4,4'-DDT	1	ug/l	10X Primary Standard	ug/l	-	-	<0.049	<0.0016	-	-	<0.0087	-	-	-
Aldrin	0.02	ug/l	10X Primary Standard	ug/l	-	-	<0.049	<0.0012	-	-	<0.0075	-	-	-
alpha-BHC	0.06	ug/l	10X Primary Standard	ug/l	-	-	<0.049	<0.0014	-	-	<0.0080	-	-	-
beta-BHC	0.2	ug/l	10X Primary Standard	ug/l	-	-	<0.049	<0.0012	-	-	<0.012	-	-	-
Chlordane (technical)	***	ug/l	10X Primary Standard	ug/l	-	-	<0.49	<0.0017	-	-	<0.11	-	-	-
delta-BHC	21	ug/l	10X Primary Standard	ug/l	-	-	<0.049	<0.00084	-	-	<0.013	-	-	-
Dieldrin	0.02	ug/l	10X Primary Standard	ug/l	-	-	<0.049	<0.0012	-	-	<0.0088	-	-	-
Endosulfan I	420	ug/l	10X Primary Standard	ug/l	-	-	<0.049	<0.0012	-	-	<0.0084	-	-	-
Endosulfan II	420	ug/l	10X Primary Standard	ug/l	-	-	<0.049	<0.0030	-	-	<0.0087	-	-	-
Endosulfan sulfate	420	ug/l	10X Primary Standard	ug/l	-	-	<0.049	<0.00084	-	-	<0.0085	-	-	-
Endrin	***	ug/l	10X Primary Standard	ug/l	-	-	<0.049	<0.0012	-	-	<0.0090	-	-	-
Endrin aldehyde	***	ug/l	10X Primary Standard	ug/l	-	-	<0.049	<0.0011	-	-	<0.017	-	-	-
Endrin ketone	***	ug/l	10X Primary Standard	ug/l	-	-	<0.049	<0.0015	-	-	<0.0091	-	-	-
gamma-BHC (Lindane)	***	ug/l	10X Primary Standard	ug/l	-	-	<0.049	<0.010	-	-	<0.0085	-	-	-

Paramater	Florida Clean up Standard Low Yield/ Poor Quality Criteria			Reporting Unit	MW8	MW8	MW8	MW8	MW8	MW8	MW8	MW9	MW9	MW9
					2010	2011	2013	2015	2016	2019	2020	2006	2007	2008
	MCL	Unit	Source		01/07/2010	01/07/2011	01/07/2013	15/04/2015	16/12/2016	28/08/2019	27/07/2020	01/07/2006	01/07/2007	01/07/2008
Heptachlor	***	ug/l	10X Primary Standard	ug/l	-	-	<0.049	<0.0012	-	-	<0.0081	-	-	-
Heptachlor epoxide	***	ug/l	10X Primary Standard	ug/l	-	-	<0.049	<0.0013	-	-	<0.0083	-	-	-
Methoxychlor	***	ug/l	10X Primary Standard	ug/l	-	-	<0.049	<0.0016	-	-	<0.0095	-	-	-
Toxaphene	***	ug/l	10X Primary Standard	ug/l	-	-	<4.9	<0.12	-	-	<0.19	-	-	-
Hydrocarbons	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diesel Range Organics [C10-C28]	-	-	No Standard	mg/l	-	-	-	1.1	1.2	-	-	-	-	-
Gasoline Range Organics (GRO)-C6-C10	-	-	No Standard	mg/l	-	-	-	<0.047	<0.050	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	14000	ug/l	10X Minimum criteria	mg/l	-	3.4	3.3	-	-	-	-	-	-	-
Cyanide, Total	***	ug/l	10X Primary Standard	mg/l	-	<0.01	<0.01	0.020	0.0047	-	<0.0025	-	-	-
Sulphate	-	mg/l	-	mg/l	-	-	-	-	-	-	580	-	-	-
Chloride	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Paramater	Florida Clean up Standard Low Yield/ Poor Quality Criteria MCL	Unit	Source	Reporting Unit	MW9 2010 01/07/2010	MW9 2011 01/07/2011	MW9 2013 01/07/2013	MW9 2015 15/04/2015	MW9 2020 27/07/2020	MW9 2021 30/11/2021	MW9 Jul-22 01/07/2022	MW9B 2010 01/07/2010	MW10 2006 01/07/2006	MW10 2007 01/07/2007
Ammonia or total Nitrogen	28	mg/l	GW Cleanup Target Levels	mg/L	7.4	7.7	8.1	8.0	9.2	9.9	8.3	7.1	41	-
Unionised Ammonia	-	mg/l	-	mg/l	-	-	-	-	-	0.12	0.15	-	-	-
Nitrogen, Kjeldahl	-	mg/L	-	-	7**	-	-	-	4.2	-	-	6.6**	46	16
Nitrate plus Nitrite, as N	110*	mg/l	10X Primary Standard	mg/L	<0.050	0.12	<0.05	<0.018	0.29	0.014	0.033	<0.050	-	<0.050
Orthophosphate	-	-	-	mg/L	<0.050	0.051	<0.05	0.060	<0.016	<1.6	0.044	<0.050	0.18	-
Phosphorus	-	-	-	mg/L	<0.10	-	-	-	<0.041	-	-	<0.10	0.41	0.18
Chemical Oxygen Demand	-	-	-	mg/L	830	470	160	190	160	-	-	620	700	340
pH	6-8.5	-	UK other surface water maximum allowable	-	7.33	7.5	7.43	-	8.1	7.5	7.4	7.36	7.12	7.48
Specific Conductance	-	-	-	umhos/cm	12000	13000	13000	-	6700	9600	16000	11000	7000	18000
Total Dissolved Solids	5,000	mg/l	10X Second Standard	mg/L	4100	3900	7700	8800	8500	5700	9300	5100	4100	9100
Total Suspended Solids	-	-	-	mg/L	-	-	-	-	-	-	-	-	180	28
Turbidity	-	-	-	NTU	50	3.2	35	-	330	150	65	25	70	160
Biochemical Oxygen Demand	-	-	-	mg/L	<2.0	31	14	<72.00	-	-	-	18	15	26
8260B Volatile Organic Compounds by GC/MS	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acetone	63000	ug/L	GW Cleanup Target Levels	ug/L	<25	<25	<25	-	<7.0	<3.7	<0.0037	<25	<25	-
Acrylonitrile	420	ug/L	GW Cleanup Target Levels	ug/L	<20	<20	<20	-	<10	<5.5	-	<20	<20	-
Benzene	10	ug/L	10X Primary Standard	ug/L	<1	<1	<1	-	<0.43	<0.27	-	<1	<1	-
Bromochloromethane	910	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<1	-	<0.45	<0.34	-	<1	<1	-
Bromodichloromethane	6	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<1	-	<0.44	<0.25	-	<1	<1	-
Bromoform	44	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<1	-	<0.43	<0.59	-	<1	<1	-
Carbon disulfide	7000	ug/L	GW Cleanup Target Levels	ug/L	<2	<2	<2	-	<1.0	<0.43	<0.00043	<2	<2	-
Carbon tetrachloride	30	ug/L	10X Primary Standard	ug/L	<1	<1	<1	-	<0.33	<0.30	-	<1	<1	-
Chlorobenzene	1000	ug/L	10X Primary Standard	ug/L	<1	<1	<1	-	<0.26	<0.15	-	<1	<1	-
Chloroethane	120	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<1	-	<2.5	<4.6	-	<1	<1	-
Chloroform	700	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<1	-	<0.50	<0.27	-	<1	<1	-
Dibromochloromethane	4	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<1	-	<0.32	<0.39	-	<1	<1	-
1,2-Dibromo-3-Chloropropane	2	ug/L	10X Primary Standard	ug/L	<1	<1	<1	-	<1.1	<1.8	-	<1	<1	-
1,2-Dibromoethane (EDB)	0.2	ug/L	10X Primary Standard	ug/L	<1	<1	<1	-	<0.44	<0.33	-	<1	<1	-
1,2-Dichlorobenzene	6000	ug/L	10X Primary Standard	ug/L	<1	<1	<1	-	<0.37	<0.31	-	<1	<1	-
1,4-Dichlorobenzene	750	ug/L	10X Primary Standard	ug/L	<1	<1	<1	-	<0.46	<0.31	<0.00031	<1	3.1	-
trans-1,4-Dichloro-2-butene	-	-	No Standard	ug/L	<2	<2	<2	-	<0.51	<1.3	-	<2	<2	-
1,1-Dichloroethane	700	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<1	-	<0.38	<0.33	-	<1	<1	-
1,2-Dichloroethane	30	ug/L	10X Primary Standard	ug/L	<1	<1	<1	-	<0.50	<0.25	-	<1	<1	-
1,1-Dichloroethene	70	ug/l	10X Primary Standard	ug/L	<1	<1	<1	-	<0.36	<0.33	-	<1	<1	-
cis-1,2-Dichloroethene	700	ug/l	10X Primary Standard	ug/L	<1	<1	<1	-	<0.41	<0.25	<0.00025	<1	<1	-
trans-1,2-Dichloroethene	1000	ug/l	10X Primary Standard	ug/L	<1	<1	<1	-	<0.37	<0.34	-	<1	<1	-
1,2-Dichloropropane	50	ug/L	10X Primary Standard	ug/L	<1	<1	<1	-	<0.67	<0.22	-	<1	<1	-
cis-1,3-Dichloropropene	4	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<1	-	<0.40	<0.26	-	<1	<1	-
trans-1,3-Dichloropropene	4	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<1	-	<0.42	<0.23	-	<1	<1	-
Ethylbenzene	300	ug/L	10X Second Standard	ug/L	<1	<1	<1	-	<0.33	<0.20	-	<1	<1	-
2-Hexanone	2800	ug/L	GW Cleanup Target Levels	ug/L	<10	<10	<10	-	<2.0	<3.2	-	<10	<10	-
Bromomethane	98	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<1	-	<2.5	<3.7	-	<1	<1	-
Chloromethane (methyl chloride)	27	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<1	-	<0.40	<0.54	-	<1	<1	-
Dibromomethane (EDB)	0.2	ug/l	10X Primary Standard	ug/L	<1	<1	<1	-	<0.35	<0.34	-	<1	<1	-
Methylene Chloride	50	ugL	10X Primary Standard	ug/L	<5	<5	<5	-	<2.5	<3.2	-	<5	<5	-
Methyl Ethyl Ketone	42000	ug/L	GW Cleanup Target Levels	ug/L	<10	<10	<10	-	-	-	-	<10	<10	-
Iodomethane	-	-	No Standard	ug/L	<5	<5	<5	-	<5.0	<3.9	-	<5	<5	-
methyl isobutyl ketone	5600	ug/L	GW Cleanup Target Levels	ug/L	<10	<10	<10	-	-	-	-	<10	<10	-
Styrene	1000	ug/L	10X Primary Standard	ug/L	<1	<1	<1	-	<0.27	<0.27	-	<1	<1	-
1,1,1,2-Tetrachloroethane	13	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<1	-	<0.37	<0.36	-	<1	<1	-
1,1,2,2-Tetrachloroethane	2	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<1	-	<0.62	<0.40	-	<1	<1	-
Tetrachloroethene	30	ug/L	10X Primary Standard	ug/L	<1	<1	<1	-	<0.74	<0.35	-	<1	<1	-
Toluene	400	ug/L	10X Second Standard	ug/L	<1	<1	<1	-	<0.48	<0.25	-	<1	<1	-
1,1,1-Trichloroethane	2000	ug/L	10X Primary Standard	ug/L	<1	<1	<1	-	<0.37	<0.21	-	<1	<1	-

Paramater	Florida Clean up Standard Low Yield/ Poor Quality Criteria			Reporting Unit	MW9	MW9	MW9	MW9	MW9	MW9	MW9	MW9B	MW10	MW10
					2010	2011	2013	2015	2020	2021	Jul-22	2010	2006	2007
	MCL	Unit	Source		01/07/2010	01/07/2011	01/07/2013	15/04/2015	27/07/2020	30/11/2021	01/07/2022	01/07/2010	01/07/2006	01/07/2007
1,1,2-Trichloroethane	50	ug/L	10X Primary Standard	ug/L	<1	<1	<1	-	<0.33	<0.32	-	<1	<1	-
Trichloroethene	30	ug/L	10X Primary Standard	ug/L	<1	<1	<1	-	<0.48	<0.20	-	<1	<1	-
Trichlorofluoromethane	21000	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<1	-	<0.42	<0.33	-	<1	<1	-
1,2,3-Trichloropropane	0.2	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<1	-	<0.39	<0.48	-	<1	<1	-
8260B Volatile Organic Compounds	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vinyl acetate	880	ug/L	GW Cleanup Target Levels	ug/L	<2	<2	<2	-	<0.81	<0.69	-	<2	<2	-
Vinyl chloride	10	ug/l	10X Primary Standard	ug/L	<1	<1	<1	-	<0.50	<0.40	-	<1	<1	-
Xylenes, Total	200	ug/l	10X Second Standard	ug/L	<2	<2	<2	-	<0.23	<0.23	<0.23	<2	<2	-
6010B Inductively Coupled Plasma - Atomic Emission Spectometry - Total Recoverable	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Antimony	0.06	mg/L	10X Primary Standard	mg/L	-	<0.02	<0.02	-	0.0011	0.0011	<0.00052	-	<0.0060	-
Arsenic	0.1	mg/L	10X Primary Standard	mg/L	-	<0.02	<0.02	-	0.0026	0.0033	0.0022	-	<0.010	-
Barium	20	mg/L	10X Primary Standard	mg/L	-	<0.01	<0.01	-	0.028	0.066	0.094	-	0.062	-
Beryllium	0.04	mg/L	10X Primary Standard	mg/L	-	<0.004	<0.004	-	<0.00017	0.00017	<0.0002	-	<0.0030	-
Cadmium	0.05	mg/L	10X Primary Standard	mg/L	-	<0.005	<0.005	-	<0.00015	0.00015	<0.000078	-	<0.0050	-
Chromium	1	mg/L	10X Primary Standard	mg/L	-	<0.01	<0.01	-	0.009	0.012	0.0072	-	0.011	-
Cobalt	1400	ug/L	GW Cleanup Target Levels	mg/L	-	<0.01	<0.01	-	0.00052	0.72	0.00041	-	<0.010	-
Copper	10	mg/L	10X Second Standard	mg/L	-	<0.02	<0.02	-	0.0023	0.0077	0.0018	-	<0.020	-
Iron	3	mg/L	10X Second Standard	mg/L	-	<0.05	<0.05	-	0.94	-	-	-	6.5	-
Lead	0.15	mg/L	10X Primary Standard	mg/L	-	<0.01	<0.01	-	<0.00098	0.0035	0.00069	-	0.042	-
Magnesium	-	-	No Standard	mg/L	-	270	270	-	-	-	-	-	160	-
Nickel	1	mg/L	10X Primary Standard	mg/L	-	<0.04	<0.04	-	0.0091	0.0052	0.0025	-	<0.040	-
Selenium	0.5	mg/L	10X Primary Standard	mg/L	-	<0.02	<0.04	-	<0.001	<0.001	<0.0012	-	<0.010	-
Silver	1	mg/L	10X Second Standard	mg/L	-	<0.01	<0.01	-	<0.00010	<0.00010	<0.00039	-	<0.010	-
Thallium	0.02	mg/L	10X Primary Standard	mg/L	-	<0.025	<0.025	-	<0.00049	<0.00049	<0.26	-	<0.025	-
Vanadium	490	ug/L	GW Cleanup Target Levels	mg/L	-	<0.01	<0.01	-	0.019	0.019	0.0073	-	<0.010	-
Zinc	50	mg/L	10X Second Standard	mg/L	-	<0.02	<0.02	-	0.022	0.088	0.02	-	0.052	-
7470A Mercury in Liquid Waste (Manual Cold Vapor Technique)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	0.02	mg/L	10X Primary Standard	mg/L	-	<0.0002	<0.0002	-	<0.000080	<0.000080	<0.00008	-	<0.00020	-
PCBs	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB-1016	***	ug/l	10X Primary Standard	ug/l	-	<1	<19	-	<0.19	<0.15	-	-	-	-
PCB-1221	***	ug/l	10X Primary Standard	ug/l	-	<2	<38	-	<0.15	<0.12	-	-	-	-
PCB-1232	***	ug/l	10X Primary Standard	ug/l	-	<1	<19	-	<0.13	<0.10	-	-	-	-
PCB-1242	***	ug/l	10X Primary Standard	ug/l	-	<1	<19	-	<0.18	<0.14	-	-	-	-
PCB-1248	***	ug/l	10X Primary Standard	ug/l	-	<1	<19	-	<0.080	<0.062	-	-	-	-
PCB-1254	***	ug/l	10X Primary Standard	ug/l	-	<1	<19	-	<0.15	<0.12	-	-	-	-
PCB-1260	***	ug/l	10X Primary Standard	ug/l	-	<1	<19	-	<0.13	<0.10	-	-	-	-
Pesticides	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4,4'-DDD	1	ug/l	10X Primary Standard	ug/l	-	-	<0.95	-	<0.0077	<0.0059	-	-	-	-
4,4'-DDE	1	ug/l	10X Primary Standard	ug/l	-	-	<0.95	-	<0.0074	<0.0057	-	-	-	-
4,4'-DDT	1	ug/l	10X Primary Standard	ug/l	-	-	<0.95	-	<0.0085	<0.0066	-	-	-	-
Aldrin	0.02	ug/l	10X Primary Standard	ug/l	-	-	<0.95	-	<0.0073	<0.0056	-	-	-	-
alpha-BHC	0.06	ug/l	10X Primary Standard	ug/l	-	-	<0.95	-	<0.0078	<0.0060	-	-	-	-
beta-BHC	0.2	ug/l	10X Primary Standard	ug/l	-	-	<0.95	-	<0.012	<0.0092	-	-	-	-
Chlordane (technical)	***	ug/l	10X Primary Standard	ug/l	-	-	<9.5	-	<0.11	<0.085	-	-	-	-
delta-BHC	21	ug/l	10X Primary Standard	ug/l	-	-	<0.95	-	<0.013	<0.010	-	-	-	-
Dieldrin	0.02	ug/l	10X Primary Standard	ug/l	-	-	<0.95	-	<0.0086	<0.0066	-	-	-	-
Endosulfan I	420	ug/l	10X Primary Standard	ug/l	-	-	<0.95	-	<0.0082	<0.0063	-	-	-	-
Endosulfan II	420	ug/l	10X Primary Standard	ug/l	-	-	<0.95	-	<0.0085	<0.0066	-	-	-	-
Endosulfan sulfate	420	ug/l	10X Primary Standard	ug/l	-	-	<0.95	-	<0.0083	<0.0064	-	-	-	-
Endrin	***	ug/l	10X Primary Standard	ug/l	-	-	<0.95	-	<0.0088	<0.0068	-	-	-	-
Endrin aldehyde	***	ug/l	10X Primary Standard	ug/l	-	-	<0.95	-	<0.017	<0.013	-	-	-	-
Endrin ketone	***	ug/l	10X Primary Standard	ug/l	-	-	<0.95	-	<0.0089	<0.0069	-	-	-	-
gamma-BHC (Lindane)	***	ug/l	10X Primary Standard	ug/l	-	-	<0.95	-	<0.0083	<0.0064	-	-	-	-

Paramater	Florida Clean up Standard Low Yield/ Poor Quality Criteria			Reporting Unit	MW9	MW9	MW9	MW9	MW9	MW9	MW9	MW9B	MW10	MW10
					2010	2011	2013	2015	2020	2021	Jul-22	2010	2006	2007
	MCL	Unit	Source		01/07/2010	01/07/2011	01/07/2013	15/04/2015	27/07/2020	30/11/2021	01/07/2022	01/07/2010	01/07/2006	01/07/2007
Heptachlor	***	ug/l	10X Primary Standard	ug/l	-	-	<0.95	-	<0.0079	<0.0061	-	-	-	-
Heptachlor epoxide	***	ug/l	10X Primary Standard	ug/l	-	-	<0.95	-	<0.0081	<0.0062	-	-	-	-
Methoxychlor	***	ug/l	10X Primary Standard	ug/l	-	-	<0.95	-	<0.0093	<0.0072	-	-	-	-
Toxaphene	***	ug/l	10X Primary Standard	ug/l	-	-	<95	-	<0.19	<0.15	-	-	-	-
Hydrocarbons	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diesel Range Organics [C10-C28]	-	-	No Standard	mg/l	-	-	-	1.4	-	-	-	-	-	-
Gasoline Range Organics (GRO)-C6-C10	-	-	No Standard	mg/l	-	-	-	<0.047	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	14000	ug/l	10X Minimum criteria	mg/l	-	2.5	2.1	-	-	-	-	-	-	-
Cyanide, Total	***	ug/l	10X Primary Standard	mg/l	-	<0.01	<0.01	0.022	0.007	<0.0025	<0.0025	-	-	-
Sulphate	-	mg/l	-	mg/l	-	-	-	-	270	290	400	-	-	-
Chloride	-	-	-	-	-	-	-	-	-	-	4700	-	-	-

Paramater	Florida Clean up Standard Low Yield/ Poor Quality Criteria			Reporting Unit	MW10	MW11	MW11	MW11	MW11	MW11	MW11	MW11	MW12	MW12
					2011	2011	2015	2016	2019	2020	2021	Jul-22	2007	2008
	MCL	Unit	Source		01/07/2011	01/07/2011	15/04/2015	16/12/2016	28/08/2019	27/07/2020	30/11/2021	01/07/2022	01/07/2007	01/07/2008
Ammonia or total Nitrogen	28	mg/l	GW Cleanup Target Levels	mg/L	37	150	16	19	15	120	68	7	19	15
Unionised Ammonia	-	mg/l	-	mg/l	-	-	-	-	-	0.91	0.75	0.084	-	-
Nitrogen, Kjeldahl	-	mg/L	-	-	-	-	-	-	-	75	-	-	21	17
Nitrate plus Nitrite, as N	110*	mg/l	10X Primary Standard	mg/L	<0.05	<0.05	<0.018	<0.2	<0.010	0.024	<0.010	<0.01	<0.050	<0.050
Orthophosphate	-	-	-	mg/L	0.28	0.71	1.2	1.1	1.1	0.48	0.35	0.32	0.15	0.16
Phosphorus	-	-	-	mg/L	-	-	-	-	-	0.93	-	-	0.18	0.19
Chemical Oxygen Demand	-	-	-	mg/L	260	1300	220	260	280	460	-	-	1100	1600
pH	6-8.5	-	UK other surface water maximum allowable	-	7.17	7.33	-	7.5	7.4	7.5	7.4	7.6	7.41	7.34
Specific Conductance	-	-	-	umhos/cm	6200	8700	-	27000	33000	18000	7000	19000	24000	2300
Total Dissolved Solids	5,000	mg/l	10X Second Standard	mg/L	4100	4800	18000	25000	18000	14000	3400	1200	12000	13000
Total Suspended Solids	-	-	-	mg/L	-	-	-	-	-	-	-	-	17	20
Turbidity	-	-	-	NTU	160	290	-	130	56	280	200	1500	120	70
Biochemical Oxygen Demand	-	-	-	mg/L	17	36	<168.00	43	29	-	-	-	26	25
8260B Volatile Organic Compounds by GC/MS	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acetone	63000	ug/L	GW Cleanup Target Levels	ug/L	<25	<25	-	-	-	9.3	<3.7	<0.0037	<25	<25
Acrylonitrile	420	ug/L	GW Cleanup Target Levels	ug/L	<20	<20	-	-	-	<10	<5.5	-	<20	<20
Benzene	10	ug/L	10X Primary Standard	ug/L	<1	<1	<0.38	-	-	<0.43	<0.27	-	<1	<1
Bromochloromethane	910	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<0.52	-	-	<0.45	<0.34	-	<1	<1
Bromodichloromethane	6	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<0.50	-	-	<0.44	<0.25	-	<1	<1
Bromoform	44	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<0.71	-	-	<0.43	<0.59	-	<1	<1
Carbon disulfide	7000	ug/L	GW Cleanup Target Levels	ug/L	<2	2.5	-	4.2	-	3.4	0.44	<0.00043	<2	<2
Carbon tetrachloride	30	ug/L	10X Primary Standard	ug/L	<1	<1	<0.50	-	-	<0.33	<0.30	-	<1	<1
Chlorobenzene	1000	ug/L	10X Primary Standard	ug/L	8.5	<1	<0.50	-	-	<0.26	<0.15	-	<1	<1
Chloroethane	120	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<0.76	-	-	<2.5	<4.6	-	<1	<1
Chloroform	700	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<0.60	-	-	<0.50	<0.27	-	<1	<1
Dibromochloromethane	4	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<0.85	-	-	<0.32	<0.39	-	<1	<1
1,2-Dibromo-3-Chloropropane	2	ug/L	10X Primary Standard	ug/L	<1	<1	-	-	-	<1.1	<1.8	-	<1	<1
1,2-Dibromoethane (EDB)	0.2	ug/L	10X Primary Standard	ug/L	<1	<1	-	-	-	<0.44	<0.33	-	<1	<1
1,2-Dichlorobenzene	6000	ug/L	10X Primary Standard	ug/L	<1	<1	<0.50	-	-	<0.37	<0.31	-	<1	<1
1,4-Dichlorobenzene	750	ug/L	10X Primary Standard	ug/L	2.4	<1	<0.64	-	-	<0.46	<0.31	<0.00031	<1	<1
trans-1,4-Dichloro-2-butene	-	-	No Standard	ug/L	<2	<2	-	-	-	<0.51	<1.3	-	<2	<2
1,1-Dichloroethane	700	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<0.50	-	-	<0.38	<0.33	-	<1	<1
1,2-Dichloroethane	30	ug/L	10X Primary Standard	ug/L	<1	<1	<0.50	-	-	<0.50	<0.25	-	<1	<1
1,1-Dichloroethene	70	ug/l	10X Primary Standard	ug/L	<1	<1	<0.50	-	-	<0.36	<0.33	-	<1	<1
cis-1,2-Dichloroethene	700	ug/l	10X Primary Standard	ug/L	<1	<1	<0.50	-	-	<0.41	<0.25	<0.00025	<1	<1
trans-1,2-Dichloroethene	1000	ug/l	10X Primary Standard	ug/L	<1	<1	<0.50	-	-	<0.37	<0.34	-	<1	<1
1,2-Dichloropropane	50	ug/L	10X Primary Standard	ug/L	<1	<1	<0.50	-	-	<0.67	<0.22	-	<1	<1
cis-1,3-Dichloropropene	4	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<0.50	-	-	<0.40	<0.26	-	<1	<1
trans-1,3-Dichloropropene	4	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<0.50	-	-	<0.42	<0.23	-	<1	<1
Ethylbenzene	300	ug/L	10X Second Standard	ug/L	<1	<1	<0.50	-	-	<0.33	<0.20	-	<1	<1
2-Hexanone	2800	ug/L	GW Cleanup Target Levels	ug/L	<10	<10	-	-	-	<2.0	<3.2	-	<10	<10
Bromomethane	98	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<0.98	-	-	<2.5	<3.7	-	<1	<1
Chloromethane (methyl chloride)	27	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<0.83	-	-	<0.40	<0.54	-	<1	<1
Dibromomethane (EDB)	0.2	ug/l	10X Primary Standard	ug/L	<1	<1	<0.59	-	-	<0.35	<0.34	-	<1	<1
Methylene Chloride	50	ugL	10X Primary Standard	ug/L	<5	<5	<3.0	-	-	<2.5	<3.2	-	<5	<5
Methyl Ethyl Ketone	42000	ug/L	GW Cleanup Target Levels	ug/L	<10	<10	-	-	-	-	-	-	<10	<10
Iodomethane	-	-	No Standard	ug/L	<5	<5	-	-	-	<5.0	<3.9	-	<5	<5
methyl isobutyl ketone	5600	ug/L	GW Cleanup Target Levels	ug/L	<10	<10	-	-	-	-	-	-	<10	<10
Styrene	1000	ug/L	10X Primary Standard	ug/L	<1	<1	<1.0	-	-	<0.27	<0.27	-	<1	<1
1,1,1,2-Tetrachloroethane	13	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<0.52	-	-	<0.37	<0.36	-	<1	<1
1,1,2,2-Tetrachloroethane	2	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<0.50	-	-	<0.62	<0.40	-	<1	<1
Tetrachloroethene	30	ug/L	10X Primary Standard	ug/L	<1	<1	<0.58	-	-	<0.74	<0.35	-	<1	<1
Toluene	400	ug/L	10X Second Standard	ug/L	<1	<1	<0.70	-	-	1.4	<0.25	-	<1	<1
1,1,1-Trichloroethane	2000	ug/L	10X Primary Standard	ug/L	<1	<1	<0.50	-	-	<0.37	<0.21	-	<1	<1

	Florida Clean up Standard Low Yield/ Poor Quality Criteria			Reporting	MW10	MW11	MW11	MW11	MW11	MW11	MW11	MW11	MW12	MW12
					2011	2011	2015	2016	2019	2020	2021	Jul-22	2007	2008
Paramater	MCL	Unit	Source	Unit	01/07/2011	01/07/2011	15/04/2015	16/12/2016	28/08/2019	27/07/2020	30/11/2021	01/07/2022	01/07/2007	01/07/2008
1,1,2-Trichloroethane	50	ug/L	10X Primary Standard	ug/L	<1	<1	<0.50	-	-	<0.33	<0.32	-	<1	<1
Trichloroethene	30	ug/L	10X Primary Standard	ug/L	<1	<1	<0.50	-	-	<0.48	<0.20	-	<1	<1
Trichlorofluoromethane	21000	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<0.52	-	-	<0.42	<0.33	-	<1	<1
1,2,3-Trichloropropane	0.2	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<0.84	-	-	<0.39	<0.48	-	<1	<1
8260B Volatile Organic Compounds	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vinyl acetate	880	ug/L	GW Cleanup Target Levels	ug/L	<2	<2	-	<0.81	-	<0.81	<0.69	-	<2	<2
Vinyl chloride	10	ug/l	10X Primary Standard	ug/L	<1	<1	<0.50	<0.50	-	<0.50	<0.40	-	<1	<1
Xylenes, Total	200	ug/l	10X Second Standard	ug/L	<2	<2	-	<0.023	-	<0.23	<0.23	<0.23	<2	2.5
6010B Inductively Coupled Plasma - Atomic Emission Spectometry - Total Recoverable	-	-		-	-	-	-	-	-	-	-	-	-	-
Antimony	0.06	mg/L	10X Primary Standard	mg/L	<0.02	<0.02	<0.010	0.0014	-	0.0017	0.0018	0.0014	<0.0060	<0.0060
Arsenic	0.1	mg/L	10X Primary Standard	mg/L	<0.02	0.044	0.0078	0.029	0.003	0.019	0.028	0.036	<0.010	<0.010
Barium	20	mg/L	10X Primary Standard	mg/L	0.062	0.051	0.02	0.028	0.014	0.035	0.021	0.046	0.072	0.082
Beryllium	0.04	mg/L	10X Primary Standard	mg/L	<0.004	<0.004	<0.0010	<0.00017	-	<0.00017	<0.00017	0.00035	<0.0030	<0.0030
Cadmium	0.05	mg/L	10X Primary Standard	mg/L	<0.005	<0.005	<0.0010	<0.00015	-	<0.00015	<0.00015	0.00021	<0.0050	<0.005
Chromium	1	mg/L	10X Primary Standard	mg/L	<0.01	0.079	0.014	0.017	0.0032	0.033	0.02	0.045	0.011	<0.010
Cobalt	1400	ug/L	GW Cleanup Target Levels	mg/L	<0.01	<0.01	<0.0030	0.0032	0.00022	0.0049	3.0	0.0037	<0.010	<0.010
Copper	10	mg/L	10X Second Standard	mg/L	<0.02	<0.02	0.011	0.021	-	0.01	0.019	0.032	<0.020	<0.020
Iron	3	mg/L	10X Second Standard	mg/L	3.6	0.67	-	-	0.031	8	-	-	0.46	0.066
Lead	0.15	mg/L	10X Primary Standard	mg/L	<0.01	<0.01	0.011	0.0025	-	0.0012	0.0021	0.009	<0.0050	<0.005
Magnesium	-	-	No Standard	mg/L	170	140	-	-	630	-	-	-	420	<0.010
Nickel	1	mg/L	10X Primary Standard	mg/L	<0.04	<0.04	<0.0030	0.0092	0.0019	0.023	0.01	0.018	<0.040	<0.040
Selenium	0.5	mg/L	10X Primary Standard	mg/L	<0.02	<0.02	<0.0040	<1.0	0.0018	0.0014	<0.001	0.0029	<0.010	<0.010
Silver	1	mg/L	10X Second Standard	mg/L	<0.01	<0.01	<0.0020	0.0001	-	<0.00010	<0.0001	<0.00039	<0.010	<0.010
Thallium	0.02	mg/L	10X Primary Standard	mg/L	<0.025	<0.025	<0.0040	<0.00049	-	<0.00049	<0.00049	0.28	<0.025	<0.025
Vanadium	490	ug/L	GW Cleanup Target Levels	mg/L	<0.01	0.018	<0.0030	0.0099	-	0.013	6.4	0.029	<0.010	<0.010
Zinc	50	mg/L	10X Second Standard	mg/L	<0.02	<0.02	0.040	0.2	-	0.19	0.15	0.42	0.042	<0.020
7470A Mercury in Liquid Waste (Manual Cold Vapor Technique)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	0.02	mg/L	10X Primary Standard	mg/L	<0.0002	<0.0002	<0.070	-	-	<0.000080	<0.000080	-	<0.00020	<0.00020
PCBs	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB-1016	***	ug/l	10X Primary Standard	ug/l	<0.96	<1	<0.11	-	-	<1.8	<0.16	-	-	-
PCB-1221	***	ug/l	10X Primary Standard	ug/l	<1.9	<2.1	<0.088	-	-	<1.4	<0.12	-	-	-
PCB-1232	***	ug/l	10X Primary Standard	ug/l	<0.96	<1	<0.040	-	-	<1.2	<0.11	-	-	-
PCB-1242	***	ug/l	10X Primary Standard	ug/l	<0.96	<1	<0.014	-	-	<1.7	<0.15	-	-	-
PCB-1248	***	ug/l	10X Primary Standard	ug/l	<0.96	<1	<0.0080	-	-	<0.75	<0.066	-	-	-
PCB-1254	***	ug/l	10X Primary Standard	ug/l	<0.96	<1	<0.023	-	-	<1.4	<0.12	-	-	-
PCB-1260	***	ug/l	10X Primary Standard	ug/l	<0.96	<1	<0.061	-	-	<1.2	<0.11	-	-	-
Pesticides	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4,4'-DDD	1	ug/l	10X Primary Standard	ug/l	-	-	<0.0012	-	-	<0.072	<0.0063	-	-	-
4,4'-DDE	1	ug/l	10X Primary Standard	ug/l	-	-	<0.00088	-	-	<0.070	<0.0061	-	-	-
4,4'-DDT	1	ug/l	10X Primary Standard	ug/l	-	-	<0.0016	-	-	<0.080	<0.0070	-	-	-
Aldrin	0.02	ug/l	10X Primary Standard	ug/l	-	-	<0.0012	-	-	<0.069	<0.0060	-	-	-
alpha-BHC	0.06	ug/l	10X Primary Standard	ug/l	-	-	<0.0014	-	-	<0.073	<0.0064	-	-	-
beta-BHC	0.2	ug/l	10X Primary Standard	ug/l	-	-	<0.0012	-	-	<0.11	<0.0098	-	-	-
Chlordane (technical)	***	ug/l	10X Primary Standard	ug/l	-	-	<0.0017	-	-	<1.0	<0.090	-	-	-
delta-BHC	21	ug/l	10X Primary Standard	ug/l	-	-	<0.00084	-	-	<0.12	<0.011	-	-	-
Dieldrin	0.02	ug/l	10X Primary Standard	ug/l	-	-	<0.0012	-	-	<0.081	<0.0071	-	-	-
Endosulfan I	420	ug/l	10X Primary Standard	ug/l	-	-	<0.0012	-	-	<0.077	<0.0067	-	-	-
Endosulfan II	420	ug/l	10X Primary Standard	ug/l	-	-	<0.0030	-	-	<0.080	<0.0070	-	-	-
Endosulfan sulfate	420	ug/l	10X Primary Standard	ug/l	-	-	<0.00084	-	-	<0.078	<0.0068	-	-	-
Endrin	***	ug/l	10X Primary Standard	ug/l	-	-	<0.0012	-	-	<0.083	<0.0072	-	-	-
Endrin aldehyde	***	ug/l	10X Primary Standard	ug/l	-	-	<0.0011	-	-	<0.16	<0.014	-	-	-
Endrin ketone	***	ug/l	10X Primary Standard	ug/l	-	-	<0.0015	-	-	<0.084	<0.0073	-	-	-
gamma-BHC (Lindane)	***	ug/l	10X Primary Standard	ug/l	-	-	<0.010	-	-	<0.078	<0.0068	-	-	-

Paramater	Florida Clean up Standard Low Yield/ Poor Quality Criteria			Reporting Unit	MW10	MW11	MW11	MW11	MW11	MW11	MW11	MW11	MW12	MW12
					2011	2011	2015	2016	2019	2020	2021	Jul-22	2007	2008
	MCL	Unit	Source		01/07/2011	01/07/2011	15/04/2015	16/12/2016	28/08/2019	27/07/2020	30/11/2021	01/07/2022	01/07/2007	01/07/2008
Heptachlor	***	ug/l	10X Primary Standard	ug/l	-	-	<0.0012	-	-	<0.074	<0.0065	-	-	-
Heptachlor epoxide	***	ug/l	10X Primary Standard	ug/l	-	-	<0.0013	-	-	<0.076	<0.0066	-	-	-
Methoxychlor	***	ug/l	10X Primary Standard	ug/l	-	-	<0.0016	-	-	<0.087	<0.0076	-	-	-
Toxaphene	***	ug/l	10X Primary Standard	ug/l	-	-	<0.12	-	-	<1.8	<0.16	-	-	-
Hydrocarbons	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diesel Range Organics [C10-C28]	-	-	No Standard	mg/l	-	-	0.48	1.9	-	-	-	-	-	-
Gasoline Range Organics (GRO)-C6-C10	-	-	No Standard	mg/l	-	-	<0.047	<0.050	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	14000	ug/l	10X Minimum criteria	mg/l	1.4	4000	-	-	-	-	-	-	-	-
Cyanide, Total	***	ug/l	10X Primary Standard	mg/l	<0.01	<0.01	0.052	<0.0025	-	<0.0025	<0.0025	0.0037	-	-
Sulphate	-	mg/l	-	mg/l	-	-	-	-	-	930	310	1300	-	-
Chloride	-	-	-	-	-	-	-	-	-	-	-	7600	-	-

Paramater	Florida Clean up Standard Low Yield/ Poor Quality Criteria			Reporting Unit	MW12	MW12	MW13	MW13	MW13	MW13	MW13	MW14	MW14	MW14
					2010	2011	2011	2013	2015	2019	2020	2006	2011	2013
	MCL	Unit	Source		01/07/2010	01/07/2011	01/07/2011	01/07/2013	15/04/2015	28/08/2019	27/07/2020	01/07/2006	01/07/2011	01/07/2013
Ammonia or total Nitrogen	28	mg/l	GW Cleanup Target Levels	mg/L	9.4	0.74	6.4	6.9	9	6.5	3.5	-	13	12
Unionised Ammonia	-	mg/l	-	mg/l	-	-	-	-	-	-	0.017	-	-	-
Nitrogen, Kjeldahl	-	mg/L	-	-	11	-	-	-	-	-	6	39	-	-
Nitrate plus Nitrite, as N	110*	mg/l	10X Primary Standard	mg/L	<0.050	-	<0.05	<0.05	<0.018	0.019	0.01	<0.050	0.093	<0.05
Orthophosphate	-	-	-	mg/L	0.088	-	0.12	0.58	0.52	0.42	0.31	-	0.073	0.11
Phosphorus	-	-	-	mg/L	0.29	-	-	-	-		0.35	0.51	-	-
Chemical Oxygen Demand	-	-	-	mg/L	460	-	570	340	150	<50	90 J	330	430	170
pH	6-8.5	-	UK other surface water maximum allowable	-	7.58	-	7.24	7.38	-	7.4	7.6	7.35	7.26	7.38
Specific Conductance	-	-	-	umhos/cm	10000	-	9700	22000	-	4800	14000	8900	9100	14000
Total Dissolved Solids	5,000	mg/l	10X Second Standard	mg/L	3400	-	5800	13000	16000	330	20000	4900	4300	8600
Total Suspended Solids	-	-	-	mg/L	-	-	-	-	-	-	-	16	-	-
Turbidity	-	-	-	NTU	75	-	2100	72	-	61	170	400	69	18
Biochemical Oxygen Demand	-	-	-	mg/L	14	-	6	<2	18	4	-	42	7.4	6.5
8260B Volatile Organic Compounds by GC/MS	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acetone	63000	ug/L	GW Cleanup Target Levels	ug/L	<25	-	<25	<25	-	-	14	-	<25	<25
Acrylonitrile	420	ug/L	GW Cleanup Target Levels	ug/L	<20	-	<20	<20	-	-	<10	-	<20	<20
Benzene	10	ug/L	10X Primary Standard	ug/L	<1	-	<1	<1	<0.38	-	<0.43	-	<1	<1
Bromochloromethane	910	ug/L	GW Cleanup Target Levels	ug/L	<1	-	<1	<1	<0.52	-	<0.45	-	<1	<1
Bromodichloromethane	6	ug/L	GW Cleanup Target Levels	ug/L	<1	-	<1	<1	<0.50	-	<0.44	-	<1	<1
Bromoform	44	ug/L	GW Cleanup Target Levels	ug/L	<1	-	<1	<1	<0.71	-	<0.43	-	<1	<1
Carbon disulfide	7000	ug/L	GW Cleanup Target Levels	ug/L	<2	-	<2	<2	-	-	<1.0	-	<2	<2
Carbon tetrachloride	30	ug/L	10X Primary Standard	ug/L	<1	-	<1	<1	<0.50	-	<0.33	-	<1	<1
Chlorobenzene	1000	ug/L	10X Primary Standard	ug/L	<1	-	<1	<1	<0.50	-	<0.26	-	<1	<1
Chloroethane	120	ug/L	GW Cleanup Target Levels	ug/L	<1	-	<1	<1	<0.76	-	<2.5	-	<1	<1
Chloroform	700	ug/L	GW Cleanup Target Levels	ug/L	<1	-	<1	<1	<0.60	-	<0.50	-	<1	<1
Dibromochloromethane	4	ug/L	GW Cleanup Target Levels	ug/L	<1	-	<1	<1	<0.85	-	<0.32	-	<1	<1
1,2-Dibromo-3-Chloropropane	2	ug/L	10X Primary Standard	ug/L	<1	-	<1	<1	-	-	<1.1	-	<1	<1
1,2-Dibromoethane (EDB)	0.2	ug/L	10X Primary Standard	ug/L	<1	-	<1	<1	-	-	<0.44	-	<1	<1
1,2-Dichlorobenzene	6000	ug/L	10X Primary Standard	ug/L	<1	-	<1	<1	<0.50	-	<0.37	-	<1	<1
1,4-Dichlorobenzene	750	ug/L	10X Primary Standard	ug/L	<1	-	<1	<1	<0.64	-	<0.46	-	<1	<1
trans-1,4-Dichloro-2-butene	-	-	No Standard	ug/L	<2	-	<2	<2	-	-	<0.51	-	<2	<2
1,1-Dichloroethane	700	ug/L	GW Cleanup Target Levels	ug/L	<1	-	<1	<1	<0.50	-	<0.38	-	<1	<1
1,2-Dichloroethane	30	ug/L	10X Primary Standard	ug/L	<1	-	<1	<1	<0.50	-	<0.50	-	<1	<1
1,1-Dichloroethene	70	ug/l	10X Primary Standard	ug/L	<1	-	<1	<1	<0.50	-	<0.36	-	<1	<1
cis-1,2-Dichloroethene	700	ug/l	10X Primary Standard	ug/L	<1	-	<1	<1	<0.50	-	<0.41	-	<1	<1
trans-1,2-Dichloroethene	1000	ug/l	10X Primary Standard	ug/L	<1	-	<1	<1	<0.50	-	<0.37	-	<1	<1
1,2-Dichloropropane	50	ug/L	10X Primary Standard	ug/L	<1	-	<1	<1	<0.50	-	<0.67	-	<1	<1
cis-1,3-Dichloropropene	4	ug/L	GW Cleanup Target Levels	ug/L	<1	-	<1	<1	<0.50	-	<0.40	-	<1	<1
trans-1,3-Dichloropropene	4	ug/L	GW Cleanup Target Levels	ug/L	<1	-	<1	<1	<0.50	-	<0.42	-	<1	<1
Ethylbenzene	300	ug/L	10X Second Standard	ug/L	<1	-	<1	<1	<0.50	-	1.2	-	<1	<1
2-Hexanone	2800	ug/L	GW Cleanup Target Levels	ug/L	<10	-	<10	<10	-	-	<2.0	-	<10	<10
Bromomethane	98	ug/L	GW Cleanup Target Levels	ug/L	<1	-	<1	<1	<0.98	-	<2.5	-	<1	<1
Chloromethane (methyl chloride)	27	ug/L	GW Cleanup Target Levels	ug/L	<1	-	<1	<1	<0.83	-	<0.40	-	<1	<1
Dibromomethane (EDB)	0.2	ug/l	10X Primary Standard	ug/L	<1	-	<1	<1	<0.59	-	<0.35	-	<1	<1
Methylene Chloride	50	ugL	10X Primary Standard	ug/L	<5	-	<5	<5	<3.0	-	<2.5	-	<5	<5
Methyl Ethyl Ketone	42000	ug/L	GW Cleanup Target Levels	ug/L	<10	-	<10	<10	-	-	-	-	<10	<10
Iodomethane	-	-	No Standard	ug/L	<5	-	<5	<5	-	-	<5.0	-	<5	<5
methyl isobutyl ketone	5600	ug/L	GW Cleanup Target Levels	ug/L	<10	-	<10	<10	-	-	-	-	<10	<10
Styrene	1000	ug/L	10X Primary Standard	ug/L	<1	-	<1	<1	<1.0	-	<0.27	-	<1	<1
1,1,1,2-Tetrachloroethane	13	ug/L	GW Cleanup Target Levels	ug/L	<1	-	<1	<1	<0.52	-	<0.37	-	<1	<1
1,1,2,2-Tetrachloroethane	2	ug/L	GW Cleanup Target Levels	ug/L	<1	-	<1	<1	<0.50	-	<0.62	-	<1	<1
Tetrachloroethene	30	ug/L	10X Primary Standard	ug/L	<1	-	<1	<1	<0.58	-	<0.74	-	<1	<1
Toluene	400	ug/L	10X Second Standard	ug/L	<1	-	<1	<1	<0.70	-	2.8	-	<1	<1
1,1,1-Trichloroethane	2000	ug/L	10X Primary Standard	ug/L	<1	-	<1	<1	<0.50	-	<0.37	-	<1	<1

Paramater	Florida Clean up Standard Low Yield/ Poor Quality Criteria MCL	Unit	Source	Reporting Unit	MW12 2010 01/07/2010	MW12 2011 01/07/2011	MW13 2011 01/07/2011	MW13 2013 01/07/2013	MW13 2015 15/04/2015	MW13 2019 28/08/2019	MW13 2020 27/07/2020	MW14 2006 01/07/2006	MW14 2011 01/07/2011	MW14 2013 01/07/2013
1,1,2-Trichloroethane	50	ug/L	10X Primary Standard	ug/L	<1	-	<1	<1	<0.50	-	<0.33	-	<1	<1
Trichloroethene	30	ug/L	10X Primary Standard	ug/L	<1	-	<1	<1	<0.50	-	<0.48	-	<1	<1
Trichlorofluoromethane	21000	ug/L	GW Cleanup Target Levels	ug/L	<1	-	<1	<1	<0.52	-	<0.42	-	<1	<1
1,2,3-Trichloropropane	0.2	ug/L	GW Cleanup Target Levels	ug/L	<1	-	<1	<1	<0.84	-	<0.39	-	<1	<1
8260B Volatile Organic Compounds	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vinyl acetate	880	ug/L	GW Cleanup Target Levels	ug/L	<2	-	<2	<2	-	-	<0.81	-	<2	<2
Vinyl chloride	10	ug/l	10X Primary Standard	ug/L	<1	-	<1	<1	<0.50	-	<0.50	-	<1	<1
Xylenes, Total	200	ug/l	10X Second Standard	ug/L	<2	-	<2	<2	-	-	4.4	-	<2	<2
6010B Inductively Coupled Plasma - Atomic Emission Spectometry - Total Recoverable	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Antimony	0.06	mg/L	10X Primary Standard	mg/L	<0.0060	-	<0.02	<0.02	<0.010	0.0012	0.00075	<0.0060	<0.02	<0.02
Arsenic	0.1	mg/L	10X Primary Standard	mg/L	0.014	-	<0.02	<0.02	<0.020	0.0022	0.0018	0.049	<0.02	<0.02
Barium	20	mg/L	10X Primary Standard	mg/L	0.068	-	0.05	0.022	0.022	0.037	0.045	0.11	0.068	0.018
Beryllium	0.04	mg/L	10X Primary Standard	mg/L	<0.0030	-	<0.004	<0.004	<0.0010	-	<0.00017	<0.0030	<0.004	<0.004
Cadmium	0.05	mg/L	10X Primary Standard	mg/L	<0.0050	-	<0.005	<0.005	<0.0010	-	0.00038	<0.0050	<0.005	<0.005
Chromium	1	mg/L	10X Primary Standard	mg/L	0.015	-	<0.01	<0.01	0.0060	0.0046	0.0011	0.025	<0.01	<0.01
Cobalt	1400	ug/L	GW Cleanup Target Levels	mg/L	<0.010	-	<0.01	<0.01	<0.0030	0.00041	0.00093	<0.010	<0.01	<0.01
Copper	10	mg/L	10X Second Standard	mg/L	<0.020	-	<0.02	<0.02	0.0062	0.0074	0.055	<0.020	<0.02	<0.02
Iron	3	mg/L	10X Second Standard	mg/L	0.59	-	<0.05	0.49	-	-	2.1	0.96	<0.05	<0.05
Lead	0.15	mg/L	10X Primary Standard	mg/L	<0.0050	-	<0.01	<0.01	0.0079	-	0.0051	<0.0050	<0.01	<0.01
Magnesium	-	-	No Standard	mg/L	290	-	370	590	-	330	-	120	200	320
Nickel	1	mg/L	10X Primary Standard	mg/L	<0.040	-	<0.04	<0.04	<0.0030	0.0049	0.0069	<0.040	<0.04	<0.04
Selenium	0.5	mg/L	10X Primary Standard	mg/L	<0.010	-	<0.02	<0.04	<0.0040	-	0.0011	<0.010	<0.02	<0.04
Silver	1	mg/L	10X Second Standard	mg/L	<0.010	-	<0.01	<0.01	<0.0020	-	<0.00010	<0.010	<0.01	<0.01
Thallium	0.02	mg/L	10X Primary Standard	mg/L	<0.025	-	<0.025	<0.025	<0.0040	-	<0.00049	<0.025	<0.025	<0.025
Vanadium	490	ug/L	GW Cleanup Target Levels	mg/L	<0.010	-	<0.01	<0.01	<0.0030	-	0.0069	<0.010	<0.01	<0.01
Zinc	50	mg/L	10X Second Standard	mg/L	0.069	-	<0.02	<0.02	0.017	0.016	0.045	0.19	<0.02	<0.02
7470A Mercury in Liquid Waste (Manual Cold Vapor Technique)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	0.02	mg/L	10X Primary Standard	mg/L	<0.00020	-	<0.0002	<0.0002	<0.070	0.000086	<0.000080	<0.00020	<0.0002	<0.0002
PCBs	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB-1016	***	ug/l	10X Primary Standard	ug/l	-	-	<1	<4.8	<0.11	-	<0.20	-	<0.98	<0.96
PCB-1221	***	ug/l	10X Primary Standard	ug/l	-	-	<2	<9.5	<0.088	-	<0.16	-	<2	<1.9
PCB-1232	***	ug/l	10X Primary Standard	ug/l	-	-	<1	<4.8	<0.040	-	<0.13	-	<0.98	<0.96
PCB-1242	***	ug/l	10X Primary Standard	ug/l	-	-	<1	<4.8	<0.014	-	<0.19	-	<0.98	<0.96
PCB-1248	***	ug/l	10X Primary Standard	ug/l	-	-	<1	<4.8	<0.0080	-	<0.083	-	<0.98	<0.96
PCB-1254	***	ug/l	10X Primary Standard	ug/l	-	-	<1	<4.8	<0.023	-	<0.16	-	<0.98	<0.96
PCB-1260	***	ug/l	10X Primary Standard	ug/l	-	-	<1	<4.8	<0.061	-	<0.13	-	<0.98	<0.96
Pesticides	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4,4'-DDD	1	ug/l	10X Primary Standard	ug/l	-	-	-	<0.24	<0.0012	-	<0.0080	-	-	<0.048
4,4'-DDE	1	ug/l	10X Primary Standard	ug/l	-	-	-	<0.24	<0.00088	-	<0.0077	-	-	<0.048
4,4'-DDT	1	ug/l	10X Primary Standard	ug/l	-	-	-	<0.24	<0.0016	-	<0.0088	-	-	<0.048
Aldrin	0.02	ug/l	10X Primary Standard	ug/l	-	-	-	<0.24	<0.0012	-	<0.0076	-	-	<0.048
alpha-BHC	0.06	ug/l	10X Primary Standard	ug/l	-	-	-	<0.24	<0.0014	-	<0.0081	-	-	<0.048
beta-BHC	0.2	ug/l	10X Primary Standard	ug/l	-	-	-	<0.24	<0.0012	-	<0.012	-	-	<0.048
Chlordane (technical)	***	ug/l	10X Primary Standard	ug/l	-	-	-	<2.4	<0.0017	-	<0.11	-	-	<0.48
delta-BHC	21	ug/l	10X Primary Standard	ug/l	-	-	-	<0.24	<0.00084	-	<0.013	-	-	<0.048
Dieldrin	0.02	ug/l	10X Primary Standard	ug/l	-	-	-	<0.24	<0.0012	-	<0.0089	-	-	<0.048
Endosulfan I	420	ug/l	10X Primary Standard	ug/l	-	-	-	<0.24	<0.0012	-	<0.0085	-	-	<0.048
Endosulfan II	420	ug/l	10X Primary Standard	ug/l	-	-	-	<0.24	<0.0030	-	<0.0088	-	-	<0.048
Endosulfan sulfate	420	ug/l	10X Primary Standard	ug/l	-	-	-	<0.24	<0.00084	-	<0.0086	-	-	<0.048
Endrin	***	ug/l	10X Primary Standard	ug/l	-	-	-	<0.24	<0.0012	-	<0.0091	-	-	<0.048
Endrin aldehyde	***	ug/l	10X Primary Standard	ug/l	-	-	-	<0.24	<0.0011	-	<0.018	-	-	<0.048
Endrin ketone	***	ug/l	10X Primary Standard	ug/l	-	-	-	<0.24	<0.0015	-	<0.0092	-	-	<0.048
gamma-BHC (Lindane)	***	ug/l	10X Primary Standard	ug/l	-	-	-	<0.24	<0.010	-	<0.0086	-	-	<0.048

Paramater	Florida Clean up Standard Low Yield/ Poor Quality Criteria			Reporting Unit	MW12	MW12	MW13	MW13	MW13	MW13	MW13	MW14	MW14	MW14
					2010	2011	2011	2013	2015	2019	2020	2006	2011	2013
	MCL	Unit	Source		01/07/2010	01/07/2011	01/07/2011	01/07/2013	15/04/2015	28/08/2019	27/07/2020	01/07/2006	01/07/2011	01/07/2013
Heptachlor	***	ug/l	10X Primary Standard	ug/l	-	-	-	<0.24	<0.0012	-	<0.0082	-	-	<0.048
Heptachlor epoxide	***	ug/l	10X Primary Standard	ug/l	-	-	-	<0.24	<0.0013	-	<0.0084	-	-	<0.048
Methoxychlor	***	ug/l	10X Primary Standard	ug/l	-	-	-	<0.24	<0.0016	-	<0.0096	-	-	<0.048
Toxaphene	***	ug/l	10X Primary Standard	ug/l	-	-	-	<24	<0.12	-	<0.20	-	-	<4.8
Hydrocarbons	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diesel Range Organics [C10-C28]	-	-	No Standard	mg/l	-	-	-	0.19	0.066	-	-	-	-	-
Gasoline Range Organics (GRO)-C6-C10	-	-	No Standard	mg/l	-	-	-	<0.05	<0.047	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	14000	ug/l	10X Minimum criteria	mg/l	-	-	1.8	2.7	-	-	-	-	2300	1.8
Cyanide, Total	***	ug/l	10X Primary Standard	mg/l	-	-	<0.01	<0.01	<0.0070	0.021	0.003	-	<0.01	<0.01
Sulphate	-	mg/l	-	mg/l	-	-	-	-	-	-	540	-	-	-
Chloride	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Paramater	Florida Clean up Standard Low Yield/ Poor Quality Criteria			Reporting Unit	MW14 2015 15/04/2015	MW15 2006 01/07/2006	MW15 2007 01/07/2007	MW15 2011 01/07/2011	MW15 2013 01/07/2013	MW-15A 2015 15/04/2015	MW-15A 2016 16/12/2016	MW16 2006 01/07/2006	MW16 2013 01/07/2013	MW 17 2011 01/07/2011
	MCL	Unit	Source											
Ammonia or total Nitrogen	28	mg/l	GW Cleanup Target Levels	mg/L	16	-	6.6	6.3	6.9	14	8.3	3.2	8.3	5.4
Unionised Ammonia	-	mg/l	-	mg/l	-	-	-	-	-	-	-	-	-	-
Nitrogen, Kjeldahl	-	mg/L	-	-	-	13	8.2	-	-	-	-	-	-	-
Nitrate plus Nitrite, as N	110*	mg/l	10X Primary Standard	mg/L	<0.018	<0.050	<0.050	0.69	<0.05	<0.018	0.048	<0.050	<0.05	0.15
Orthophosphate	-	-	-	mg/L	0.99	-	0.073	0.055	0.067	0.067	<0.016	-	0.16	0.082
Phosphorus	-	-	-	mg/L	-	0.22	<0.10	-	-	-	-	1.3	-	-
Chemical Oxygen Demand	-	-	-	mg/L	130	240	540	640	210	110	150	140	290	470
pH	6-8.5	-	UK other surface water maximum allowable	-	-	7.53	7.17	7.2	7.42	-	7.6	7.47	7.35	7.29
Specific Conductance	-	-	-	umhos/cm	-	13000	18000	14000	16000	-	17000	12000	19000	10000
Total Dissolved Solids	5,000	mg/l	10X Second Standard	mg/L	7900	6900	3300	3500	10000	11000	13000	6300	12000	5400
Total Suspended Solids	-	-	-	mg/L	-	33	<5.0	-	-	-	-	2600	-	-
Turbidity	-	-	-	NTU	-	120	0.33	17	2.8	-	8.5	330	4	160
Biochemical Oxygen Demand	-	-	-	mg/L	<90	11	20	10	1800	5.1	5.1	3.8	46	29
8260B Volatile Organic Compounds by GC/MS	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acetone	63000	ug/L	GW Cleanup Target Levels	ug/L	-	-	<25	<25	<25	-	-	-	<25	<25
Acrylonitrile	420	ug/L	GW Cleanup Target Levels	ug/L	-	-	<20	<20	<20	-	-	-	<20	<20
Benzene	10	ug/L	10X Primary Standard	ug/L	-	-	<1	<1	<1	-	-	-	<1	<1
Bromochloromethane	910	ug/L	GW Cleanup Target Levels	ug/L	-	-	<1	<1	<1	-	-	-	<1	<1
Bromodichloromethane	6	ug/L	GW Cleanup Target Levels	ug/L	-	-	<1	<1	<1	-	-	-	<1	<1
Bromoform	44	ug/L	GW Cleanup Target Levels	ug/L	-	-	<1	<1	<1	-	-	-	<1	<1
Carbon disulfide	7000	ug/L	GW Cleanup Target Levels	ug/L	-	-	<2	<2	<2	-	-	-	<2	<2
Carbon tetrachloride	30	ug/L	10X Primary Standard	ug/L	-	-	<1	<1	<1	-	-	-	<1	<1
Chlorobenzene	1000	ug/L	10X Primary Standard	ug/L	-	-	<1	<1	<1	-	-	-	<1	<1
Chloroethane	120	ug/L	GW Cleanup Target Levels	ug/L	-	-	<1	<1	<1	-	-	-	<1	<1
Chloroform	700	ug/L	GW Cleanup Target Levels	ug/L	-	-	<1	<1	<1	-	-	-	<1	<1
Dibromochloromethane	4	ug/L	GW Cleanup Target Levels	ug/L	-	-	<1	<1	<1	-	-	-	<1	<1
1,2-Dibromo-3-Chloropropane	2	ug/L	10X Primary Standard	ug/L	-	-	<1	<1	<1	-	-	-	<1	<1
1,2-Dibromoethane (EDB)	0.2	ug/L	10X Primary Standard	ug/L	-	-	<1	<1	<1	-	-	-	<1	<1
1,2-Dichlorobenzene	6000	ug/L	10X Primary Standard	ug/L	-	-	<1	<1	<1	-	-	-	<1	<1
1,4-Dichlorobenzene	750	ug/L	10X Primary Standard	ug/L	-	-	<1	<1	<1	-	-	-	<1	<1
trans-1,4-Dichloro-2-butene	-	-	No Standard	ug/L	-	-	<2	<2	<2	-	-	-	<2	<2
1,1-Dichloroethane	700	ug/L	GW Cleanup Target Levels	ug/L	-	-	<1	<1	<1	-	-	-	<1	<1
1,2-Dichloroethane	30	ug/L	10X Primary Standard	ug/L	-	-	<1	<1	<1	-	-	-	<1	<1
1,1-Dichloroethene	70	ug/l	10X Primary Standard	ug/L	-	-	<1	<1	<1	-	-	-	<1	<1
cis-1,2-Dichloroethene	700	ug/l	10X Primary Standard	ug/L	-	-	<1	<1	<1	-	-	-	<1	<1
trans-1,2-Dichloroethene	1000	ug/l	10X Primary Standard	ug/L	-	-	<1	<1	<1	-	-	-	<1	<1
1,2-Dichloropropane	50	ug/L	10X Primary Standard	ug/L	-	-	<1	<1	<1	-	-	-	<1	<1
cis-1,3-Dichloropropene	4	ug/L	GW Cleanup Target Levels	ug/L	-	-	<1	<1	<1	-	-	-	<1	<1
trans-1,3-Dichloropropene	4	ug/L	GW Cleanup Target Levels	ug/L	-	-	<1	<1	<1	-	-	-	<1	<1
Ethylbenzene	300	ug/L	10X Second Standard	ug/L	-	-	<1	<1	<1	-	-	-	<1	<1
2-Hexanone	2800	ug/L	GW Cleanup Target Levels	ug/L	-	-	<10	<10	<10	-	-	-	<10	<10
Bromomethane	98	ug/L	GW Cleanup Target Levels	ug/L	-	-	<1	<1	<1	-	-	-	<1	<1
Chloromethane (methyl chloride)	27	ug/L	GW Cleanup Target Levels	ug/L	-	-	<1	<1	<1	-	-	-	<1	<1
Dibromomethane (EDB)	0.2	ug/l	10X Primary Standard	ug/L	-	-	<1	<1	<1	-	-	-	<1	<1
Methylene Chloride	50	ugL	10X Primary Standard	ug/L	-	-	<5	<5	<5	-	-	-	<5	<5
Methyl Ethyl Ketone	42000	ug/L	GW Cleanup Target Levels	ug/L	-	-	<10	<10	<10	-	-	-	<10	<10
Iodomethane	-	-	No Standard	ug/L	-	-	<5	<5	<5	-	-	-	<5	<5
methyl isobutyl ketone	5600	ug/L	GW Cleanup Target Levels	ug/L	-	-	<10	<10	<10	-	-	-	<10	<10
Styrene	1000	ug/L	10X Primary Standard	ug/L	-	-	<1	<1	<1	-	-	-	<1	<1
1,1,1,2-Tetrachloroethane	13	ug/L	GW Cleanup Target Levels	ug/L	-	-	<1	<1	<1	-	-	-	<1	<1
1,1,2,2-Tetrachloroethane	2	ug/L	GW Cleanup Target Levels	ug/L	-	-	<1	<1	<1	-	-	-	<1	<1
Tetrachloroethene	30	ug/L	10X Primary Standard	ug/L	-	-	<1	<1	<1	-	-	-	<1	<1
Toluene	400	ug/L	10X Second Standard	ug/L	-	-	<1	<1	<1	-	-	-	<1	<1
1,1,1-Trichloroethane	2000	ug/L	10X Primary Standard	ug/L	-	-	<1	<1	<1	-	-	-	<1	<1

Paramater	Florida Clean up Standard Low Yield/ Poor Quality Criteria MCL	Unit	Source	Reporting Unit	MW14 2015 15/04/2015	MW15 2006 01/07/2006	MW15 2007 01/07/2007	MW15 2011 01/07/2011	MW15 2013 01/07/2013	MW-15A 2015 15/04/2015	MW-15A 2016 16/12/2016	MW16 2006 01/07/2006	MW16 2013 01/07/2013	MW 17 2011 01/07/2011
1,1,2-Trichloroethane	50	ug/L	10X Primary Standard	ug/L	-	-	<1	<1	<1	-	-	-	<1	<1
Trichloroethene	30	ug/L	10X Primary Standard	ug/L	-	-	<1	<1	<1	-	-	-	<1	<1
Trichlorofluoromethane	21000	ug/L	GW Cleanup Target Levels	ug/L	-	-	<1	<1	<1	-	-	-	<1	<1
1,2,3-Trichloropropane	0.2	ug/L	GW Cleanup Target Levels	ug/L	-	-	<1	<1	<1	-	-	-	<1	<1
8260B Volatile Organic Compounds	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vinyl acetate	880	ug/L	GW Cleanup Target Levels	ug/L	-	-	<2	<2	<2	-	<0.81	-	<2	<2
Vinyl chloride	10	ug/l	10X Primary Standard	ug/L	-	-	<1	<1	<1	-	<0.5	-	<1	<1
Xylenes, Total	200	ug/l	10X Second Standard	ug/L	-	-	<2	<2	<2	-	<0.23	-	<2	<2
6010B Inductively Coupled Plasma - Atomic Emission Spectometry - Total Recoverable	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Antimony	0.06	mg/L	10X Primary Standard	mg/L	-	<0.0060	<0.0060	<0.02	<0.02	-	0.002	<0.0060	<0.02	<0.02
Arsenic	0.1	mg/L	10X Primary Standard	mg/L	-	0.031	<0.010	<0.02	<0.02	-	0.0051	0.015	<0.02	<0.02
Barium	20	mg/L	10X Primary Standard	mg/L	-	0.057	0.014	<0.01	0.014	-	0.0063	0.082	0.013	0.061
Beryllium	0.04	mg/L	10X Primary Standard	mg/L	-	<0.0030	<0.0030	<0.004	<0.004	-	0.00017	<0.0030	<0.004	<0.004
Cadmium	0.05	mg/L	10X Primary Standard	mg/L	-	<0.0050	<0.0050	<0.005	<0.005	-	0.00071	<0.0050	<0.005	<0.005
Chromium	1	mg/L	10X Primary Standard	mg/L	-	0.021	<0.010	<0.01	<0.01	-	0.00036	0.035	<0.01	<0.01
Cobalt	1400	ug/L	GW Cleanup Target Levels	mg/L	-	<0.010	<0.010	<0.01	<0.01	-	0.00097	<0.010	<0.01	<0.01
Copper	10	mg/L	10X Second Standard	mg/L	-	<0.020	<0.020	<0.02	<0.02	-	0.19	0.055	<0.02	<0.02
Iron	3	mg/L	10X Second Standard	mg/L	-	3.8	<0.050	<0.05	<0.05	-	-	11	1.1	<0.05
Lead	0.15	mg/L	10X Primary Standard	mg/L	-	<0.0050	<0.0050	<0.01	<0.01	-	0.0086	0.034	<0.01	<0.01
Magnesium	-	-	No Standard	mg/L	-	210	350	290	350	-	-	200	420	200
Nickel	1	mg/L	10X Primary Standard	mg/L	-	<0.040	<0.040	<0.04	<0.04	-	0.021	<0.040	<0.04	<0.04
Selenium	0.5	mg/L	10X Primary Standard	mg/L	-	<0.010	<0.010	<0.02	<0.04	-	0.0036	<0.010	<0.04	<0.02
Silver	1	mg/L	10X Second Standard	mg/L	-	<0.010	<0.010	<0.01	<0.01	-	0.00022	<0.010	<0.01	<0.01
Thallium	0.02	mg/L	10X Primary Standard	mg/L	-	<0.025	<0.025	<0.025	<0.025	-	<0.00049	<0.025	<0.025	<0.025
Vanadium	490	ug/L	GW Cleanup Target Levels	mg/L	-	<0.010	<0.010	<0.01	<0.01	-	0.0089	0.037	0.016	<0.01
Zinc	50	mg/L	10X Second Standard	mg/L	-	0.46	<0.020	<0.02	<0.02	-	2.5	0.077	<0.02	<0.02
7470A Mercury in Liquid Waste (Manual Cold Vapor Technique)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	0.02	mg/L	10X Primary Standard	mg/L	-	<0.00020	<0.00020	<0.0002	<0.0002	-	-	0.00032	<0.0002	<0.0002
PCBs	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB-1016	***	ug/l	10X Primary Standard	ug/l	-	-	-	<0.99	<0.95	-	-	-	<0.99	<1
PCB-1221	***	ug/l	10X Primary Standard	ug/l	-	-	-	<2	<1.9	-	-	-	<2	<2
PCB-1232	***	ug/l	10X Primary Standard	ug/l	-	-	-	<0.99	<0.95	-	-	-	<0.99	<1
PCB-1242	***	ug/l	10X Primary Standard	ug/l	-	-	-	<0.99	<0.95	-	-	-	<0.99	<1
PCB-1248	***	ug/l	10X Primary Standard	ug/l	-	-	-	<0.99	<0.95	-	-	-	<0.99	<1
PCB-1254	***	ug/l	10X Primary Standard	ug/l	-	-	-	<0.99	<0.95	-	-	-	<0.99	<1
PCB-1260	***	ug/l	10X Primary Standard	ug/l	-	-	-	<0.99	<0.95	-	-	-	<0.99	<1
Pesticides	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4,4'-DDD	1	ug/l	10X Primary Standard	ug/l	-	-	-	-	<0.048	-	-	-	<0.05	-
4,4'-DDE	1	ug/l	10X Primary Standard	ug/l	-	-	-	-	<0.048	-	-	-	<0.05	-
4,4'-DDT	1	ug/l	10X Primary Standard	ug/l	-	-	-	-	<0.048	-	-	-	<0.05	-
Aldrin	0.02	ug/l	10X Primary Standard	ug/l	-	-	-	-	<0.048	-	-	-	<0.05	-
alpha-BHC	0.06	ug/l	10X Primary Standard	ug/l	-	-	-	-	<0.048	-	-	-	<0.05	-
beta-BHC	0.2	ug/l	10X Primary Standard	ug/l	-	-	-	-	<0.048	-	-	-	<0.05	-
Chlordane (technical)	***	ug/l	10X Primary Standard	ug/l	-	-	-	-	<0.48	-	-	-	<0.5	-
delta-BHC	21	ug/l	10X Primary Standard	ug/l	-	-	-	-	<0.048	-	-	-	<0.05	-
Dieldrin	0.02	ug/l	10X Primary Standard	ug/l	-	-	-	-	<0.048	-	-	-	<0.05	-
Endosulfan I	420	ug/l	10X Primary Standard	ug/l	-	-	-	-	<0.048	-	-	-	<0.05	-
Endosulfan II	420	ug/l	10X Primary Standard	ug/l	-	-	-	-	<0.048	-	-	-	<0.05	-
Endosulfan sulfate	420	ug/l	10X Primary Standard	ug/l	-	-	-	-	<0.048	-	-	-	<0.05	-
Endrin	***	ug/l	10X Primary Standard	ug/l	-	-	-	-	<0.048	-	-	-	<0.05	-
Endrin aldehyde	***	ug/l	10X Primary Standard	ug/l	-	-	-	-	<0.048	-	-	-	<0.05	-
Endrin ketone	***	ug/l	10X Primary Standard	ug/l	-	-	-	-	<0.048	-	-	-	<0.05	-
gamma-BHC (Lindane)	***	ug/l	10X Primary Standard	ug/l	-	-	-	-	<0.048	-	-	-	<0.05	-

Paramater	Florida Clean up Standard Low Yield/ Poor Quality Criteria			Reporting Unit	MW14	MW15	MW15	MW15	MW15	MW-15A	MW-15A	MW16	MW16	MW 17
					2015	2006	2007	2011	2013	2015	2016	2006	2013	2011
	MCL	Unit	Source		15/04/2015	01/07/2006	01/07/2007	01/07/2011	01/07/2013	15/04/2015	16/12/2016	01/07/2006	01/07/2013	01/07/2011
Heptachlor	***	ug/l	10X Primary Standard	ug/l	-	-	-	-	<0.048	-	-	-	<0.05	-
Heptachlor epoxide	***	ug/l	10X Primary Standard	ug/l	-	-	-	-	<0.048	-	-	-	<0.05	-
Methoxychlor	***	ug/l	10X Primary Standard	ug/l	-	-	-	-	<0.048	-	-	-	<0.05	-
Toxaphene	***	ug/l	10X Primary Standard	ug/l	-	-	-	-	<4.8	-	-	-	<5	-
Hydrocarbons	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diesel Range Organics [C10-C28]	-	-	No Standard	mg/l	1.0	-	-	-	-	0.38	0.74	-	1.7	-
Gasoline Range Organics (GRO)-C6-C10	-	-	No Standard	mg/l	<0.047	-	-	-	-	<0.047	<0.050	-	<0.05	-
Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	14000	ug/l	10X Minimum criteria	mg/l	-	-	-	1400	1.7	-	-	-	2.1	1900
Cyanide, Total	***	ug/l	10X Primary Standard	mg/l	<0.007	-	-	<0.01	<0.01	<0.0070	-	-	<0.01	<0.01
Sulphate	-	mg/l	-	mg/l	-	-	-	-	-	-	-	-	-	-
Chloride	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Paramater	Florida Clean up Standard Low Yield/ Poor Quality Criteria			Reporting Unit	MW 18	MW 18	MW 19	MW 19	MW 19	MW 19	MW 19	MW 19	MW 19	MW 20
					2011	2013	2015	2016	2019	2020	2021	Jul-22	Dec-22	2015
	MCL	Unit	Source		01/07/2011	01/07/2013	15/04/2015	16/12/2016	28/08/2019	27/07/2020	30/11/2021	01/07/2022	05/12/2022	15/04/2015
Ammonia or total Nitrogen	28	mg/l	GW Cleanup Target Levels	mg/L	12	34	4.4	14	5.6	9.4	8.5	5.9	-	6.6
Unionised Ammonia	-	mg/l	-	mg/l	-	-	-	-	-	0.095	0.064	0.072	0.092	-
Nitrogen, Kjeldahl	-	mg/L	-	-	-	-	-	-	-	20	-	-	-	-
Nitrate plus Nitrite, as N	110*	mg/l	10X Primary Standard	mg/L	0.17	<0.05	<0.018	<0.010	0.017	0.013	<0.010	<0.01	-	<0.018
Orthophosphate	-	-	-	mg/L	<0.05	0.15	0.052	0.11	0.076	<0.016	0.062	<0.016	0.054	0.061
Phosphorus	-	-	-	mg/L	-	-	-	-	-	0.13	-	-	-	-
Chemical Oxygen Demand	-	-	-	mg/L	460	430	18	48	<50	57	-	-	-	170
pH	6-8.5	-	UK other surface water maximum allowable	-	7.22	7.26	-	7.6	7.6	7.7	7.3	8.1	7.7	-
Specific Conductance	-	-	-	umhos/cm	6400	10000	-	4200	2900	3400	2700	3000	3500	-
Total Dissolved Solids	5,000	mg/l	10X Second Standard	mg/L	3500	6300	2600	2100	2100	1900	1200	1800	1600	11000
Total Suspended Solids	-	-	-	mg/L	-	-	-	-	-	-	-	-	-	-
Turbidity	-	-	-	NTU	3000	41	-	1.4	0.76	65	27	38	18	-
Biochemical Oxygen Demand	-	-	-	mg/L	18	10	<2.0	98	2.2	-	-	-	-	20
8260B Volatile Organic Compounds by GC/MS	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acetone	63000	ug/L	GW Cleanup Target Levels	ug/L	<25	<25	-	-	-	<7.0	<3.7	<0.0037	<3.7	-
Acrylonitrile	420	ug/L	GW Cleanup Target Levels	ug/L	<20	<20	-	-	-	<10	<5.5	-	<5.5	-
Benzene	10	ug/L	10X Primary Standard	ug/L	<1	<1	<0.38	-	-	<0.43	<0.27	-	<0.27	<0.38
Bromochloromethane	910	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<0.52	-	-	<0.45	<0.34	-	-	<0.52
Bromodichloromethane	6	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<0.50	-	-	<0.44	<0.25	-	-	<0.50
Bromoform	44	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<0.71	-	-	<0.43	<0.59	-	<0.59	<0.71
Carbon disulfide	7000	ug/L	GW Cleanup Target Levels	ug/L	<2	<2	-	-	-	<1.0	<0.43	<0.00043	<0.43	-
Carbon tetrachloride	30	ug/L	10X Primary Standard	ug/L	<1	<1	<0.50	-	-	<0.33	<0.30	-	<0.3	<0.50
Chlorobenzene	1000	ug/L	10X Primary Standard	ug/L	<1	<1	<0.50	-	-	<0.26	<0.15	-	<0.15	<0.50
Chloroethane	120	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<0.76	-	-	<2.5	<4.6	-	<4.6	<0.76
Chloroform	700	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<0.60	-	-	<0.50	<0.27	-	<0.27	<0.60
Dibromochloromethane	4	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<0.85	-	-	<0.32	<0.39	-	-	<0.85
1,2-Dibromo-3-Chloropropane	2	ug/L	10X Primary Standard	ug/L	<1	<1	-	-	-	<1.1	<1.8	-	<1.8	-
1,2-Dibromoethane (EDB)	0.2	ug/L	10X Primary Standard	ug/L	<1	<1	-	-	-	<0.44	<0.33	-	<0.25	-
1,2-Dichlorobenzene	6000	ug/L	10X Primary Standard	ug/L	<1	<1	<0.50	-	-	<0.37	<0.31	-	<0.31	<0.50
1,4-Dichlorobenzene	750	ug/L	10X Primary Standard	ug/L	<1	<1	<0.64	-	-	<0.46	<0.31	<0.00031	<0.31	<0.64
trans-1,4-Dichloro-2-butene	-	-	No Standard	ug/L	<2	<2	-	-	-	<0.51	<1.3	-	<1.3	-
1,1-Dichloroethane	700	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<0.50	-	-	<0.38	<0.33	-	<0.33	<0.50
1,2-Dichloroethane	30	ug/L	10X Primary Standard	ug/L	<1	<1	<0.50	-	-	<0.50	<0.25	-	<0.25	<0.50
1,1-Dichloroethene	70	ug/l	10X Primary Standard	ug/L	<1	<1	<0.50	-	-	<0.36	<0.33	-	<0.33	<0.50
cis-1,2-Dichloroethene	700	ug/l	10X Primary Standard	ug/L	<1	<1	<0.50	-	-	<0.41	<0.25	<0.00025	<0.25	<0.50
trans-1,2-Dichloroethene	1000	ug/l	10X Primary Standard	ug/L	<1	<1	<0.50	-	-	<0.37	<0.34	-	<0.34	<0.50
1,2-Dichloropropane	50	ug/L	10X Primary Standard	ug/L	<1	<1	<0.50	-	-	<0.67	<0.22	-	<0.22	<0.50
cis-1,3-Dichloropropene	4	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<0.50	-	-	<0.40	<0.26	-	<0.26	<0.50
trans-1,3-Dichloropropene	4	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<0.50	-	-	<0.42	<0.23	-	<0.23	<0.50
Ethylbenzene	300	ug/L	10X Second Standard	ug/L	<1	<1	<0.50	-	-	<0.33	<0.20	-	<0.2	<0.50
2-Hexanone	2800	ug/L	GW Cleanup Target Levels	ug/L	<10	<10	-	-	-	<2.0	<3.2	-	<3.2	-
Bromomethane	98	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<0.98	-	-	<2.5	<3.7	-	<3.7	<0.98
Chloromethane (methyl chloride)	27	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<0.83	-	-	<0.40	<0.54	-	<0.54	<0.83
Dibromomethane (EDB)	0.2	ug/l	10X Primary Standard	ug/L	<1	<1	<0.59	-	-	<0.35	<0.34	-	<0.34	<0.59
Methylene Chloride	50	ugL	10X Primary Standard	ug/L	<5	<5	<3.0	-	-	<2.5	<3.2	-	<3.2	<3.0
Methyl Ethyl Ketone	42000	ug/L	GW Cleanup Target Levels	ug/L	<10	<10	-	-	-	-	-	-	-	-
Iodomethane	-	-	No Standard	ug/L	<5	<5	-	-	-	<5.0	<3.9	-	<3.9	-
methyl isobutyl ketone	5600	ug/L	GW Cleanup Target Levels	ug/L	<10	<10	-	-	-	-	-	-	-	-
Styrene	1000	ug/L	10X Primary Standard	ug/L	<1	<1	<1.0	-	-	<0.27	<0.27	-	<0.27	<1.0
1,1,1,2-Tetrachloroethane	13	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<0.52	-	-	<0.37	<0.36	-	<0.36	<0.52
1,1,2,2-Tetrachloroethane	2	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<0.50	-	-	<0.62	<0.40	-	<0.4	<0.50
Tetrachloroethene	30	ug/L	10X Primary Standard	ug/L	<1	<1	<0.58	-	-	<0.74	<0.35	-	<0.35	<0.58
Toluene	400	ug/L	10X Second Standard	ug/L	<1	<1	<0.70	-	-	<0.48	<0.25	-	<0.25	<0.70
1,1,1-Trichloroethane	2000	ug/L	10X Primary Standard	ug/L	<1	<1	<0.50	-	-	<0.37	<0.21	-	<0.21	<0.50

Paramater	Florida Clean up Standard Low Yield/ Poor Quality Criteria			Reporting Unit	MW 18	MW 18	MW 19	MW 19	MW 19	MW 19	MW 19	MW 19	MW 19	MW 20
					2011	2013	2015	2016	2019	2020	2021	Jul-22	Dec-22	2015
	MCL	Unit	Source		01/07/2011	01/07/2013	15/04/2015	16/12/2016	28/08/2019	27/07/2020	30/11/2021	01/07/2022	05/12/2022	15/04/2015
1,1,2-Trichloroethane	50	ug/L	10X Primary Standard	ug/L	<1	<1	<0.50	-	-	<0.33	<0.32	-	<0.32	<0.50
Trichloroethene	30	ug/L	10X Primary Standard	ug/L	<1	<1	<0.50	-	-	<0.48	<0.20	-	<0.2	<0.50
Trichlorofluoromethane	21000	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<0.52	-	-	<0.42	<0.33	-	<0.33	<0.52
1,2,3-Trichloropropane	0.2	ug/L	GW Cleanup Target Levels	ug/L	<1	<1	<0.84	-	-	<0.39	<0.48	-	<0.48	<0.84
8260B Volatile Organic Compounds	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vinyl acetate	880	ug/L	GW Cleanup Target Levels	ug/L	<2	<2	-	-	-	<0.81	<0.69	-	<0.69	-
Vinyl chloride	10	ug/l	10X Primary Standard	ug/L	<1	<1	<0.50	-	-	<0.50	<0.40	-	<0.4	<0.50
Xylenes, Total	200	ug/l	10X Second Standard	ug/L	<2	<2	-	-	-	<0.23	<0.23	<0.23	<0.23	-
6010B Inductively Coupled Plasma - Atomic Emission Spectometry - Total Recoverable	-	-		-	-	-	-	-	-	-	-	-	-	
Antimony	0.06	mg/L	10X Primary Standard	mg/L	<0.02	<0.02	<0.010	-	-	0.66 J	0.00055	0.00054	<0.52	-
Arsenic	0.1	mg/L	10X Primary Standard	mg/L	<0.02	<0.02	<0.0040	-	-	8.5	0.0037	0.0033	2.3	-
Barium	20	mg/L	10X Primary Standard	mg/L	0.056	0.012	0.018	0.091	0.0056	290	0.13	0.1	70	-
Beryllium	0.04	mg/L	10X Primary Standard	mg/L	<0.004	<0.004	<0.0010	-	-	<0.17	<0.17	0.0002	<0.20	-
Cadmium	0.05	mg/L	10X Primary Standard	mg/L	<0.005	<0.005	<0.0010	-	-	<0.15	0.00033	0.00034	0.11	-
Chromium	1	mg/L	10X Primary Standard	mg/L	<0.01	<0.01	<0.0020	-	0.0076	3.6 J	<0.0016	<0.0026	<2.6	-
Cobalt	1400	ug/L	GW Cleanup Target Levels	mg/L	<0.01	<0.01	<0.0030	0.00025	0.00037	0.78	1.0	0.0011	0.23	-
Copper	10	mg/L	10X Second Standard	mg/L	<0.02	<0.02	<0.0020	-	0.0044	13	0.028	0.024	2.7	-
Iron	3	mg/L	10X Second Standard	mg/L	<0.05	<0.05	-	-	-	5700	-	-	350	-
Lead	0.15	mg/L	10X Primary Standard	mg/L	<0.01	<0.01	0.0043	-	-	12	0.015	0.015	6	-
Magnesium	-	-	No Standard	mg/L	170	260	-	-	82	-	-	-	-	-
Nickel	1	mg/L	10X Primary Standard	mg/L	<0.04	<0.04	<0.0030	-	0.0045	7.3	0.0039	0.0047	<1.8	-
Selenium	0.5	mg/L	10X Primary Standard	mg/L	<0.02	<0.04	<0.0040	-	-	<1.0	<0.001	<0.0012	<1.2	-
Silver	1	mg/L	10X Second Standard	mg/L	<0.01	<0.01	<0.0020	-	-	<0.10	0.00023	<0.00039	<0.39	-
Thallium	0.02	mg/L	10X Primary Standard	mg/L	<0.025	<0.025	<0.0040	-	-	<0.49	<0.00049	<0.26	<0.26	-
Vanadium	490	ug/L	GW Cleanup Target Levels	mg/L	<0.01	<0.01	<0.0030	-	-	<5.3	<5.3	<0.0018	<1.8	-
Zinc	50	mg/L	10X Second Standard	mg/L	<0.02	<0.02	<0.0080	-	-	37	0.093	0.1	43	-
7470A Mercury in Liquid Waste (Manual Cold Vapor Technique)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	0.02	mg/L	10X Primary Standard	mg/L	<0.0002	<0.0002	<0.070	-	-	<0.000080	<0.000080	<0.00080	<0.08	-
PCBs	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB-1016	***	ug/l	10X Primary Standard	ug/l	<0.95	<19	<0.11	-	-	<0.20	<0.16	-	<0.33	<0.11
PCB-1221	***	ug/l	10X Primary Standard	ug/l	<1.9	<38	<0.088	-	-	<0.15	<0.12	-	<0.35	<0.088
PCB-1232	***	ug/l	10X Primary Standard	ug/l	<0.95	<19	<0.040	-	-	<0.13	<0.11	-	<0.35	<0.040
PCB-1242	***	ug/l	10X Primary Standard	ug/l	<0.95	<19	<0.014	-	-	<0.19	<0.15	-	<0.35	<0.014
PCB-1248	***	ug/l	10X Primary Standard	ug/l	<0.95	<19	<0.0080	-	-	<0.083	<0.066	-	<0.35	<0.0080
PCB-1254	***	ug/l	10X Primary Standard	ug/l	<0.95	<19	<0.023	-	-	<0.15	<0.12	-	<0.35	<0.023
PCB-1260	***	ug/l	10X Primary Standard	ug/l	<0.95	<19	<0.061	-	-	<0.13	<0.11	-	<0.35	<0.061
Pesticides	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4,4'-DDD	1	ug/l	10X Primary Standard	ug/l	-	<0.95	<0.0012	-	-	<0.0079	<0.0063	-	<0.0021	<0.0012
4,4'-DDE	1	ug/l	10X Primary Standard	ug/l	-	<0.95	<0.00088	-	-	<0.0076	<0.0061	-	<0.0010	<0.00088
4,4'-DDT	1	ug/l	10X Primary Standard	ug/l	-	<0.95	<0.0016	-	-	<0.0088	<0.0070	-	<0.0010	<0.0016
Aldrin	0.02	ug/l	10X Primary Standard	ug/l	-	<0.95	<0.0012	-	-	<0.0075	<0.0060	-	<0.0021	<0.0012
alpha-BHC	0.06	ug/l	10X Primary Standard	ug/l	-	<0.95	<0.0014	-	-	<0.0080	<0.0064	-	<0.0010	<0.0014
beta-BHC	0.2	ug/l	10X Primary Standard	ug/l	-	<0.95	<0.0012	-	-	<0.012	<0.0099	-	<0.0021	<0.0012
Chlordane (technical)	***	ug/l	10X Primary Standard	ug/l	-	<9.5	<0.0017	-	-	<0.11	<0.090	-	-	<0.0017
delta-BHC	21	ug/l	10X Primary Standard	ug/l	-	<0.95	<0.00084	-	-	<0.013	<0.011	-	<0.0021	<0.00084
Dieldrin	0.02	ug/l	10X Primary Standard	ug/l	-	<0.95	<0.0012	-	-	<0.0089	<0.0071	-	<0.0021	<0.0012
Endosulfan I	420	ug/l	10X Primary Standard	ug/l	-	<0.95	<0.0012	-	-	0.038 J	<0.0067	-	<0.0021	<0.0012
Endosulfan II	420	ug/l	10X Primary Standard	ug/l	-	<0.95	<0.0030	-	-	<0.0088	<0.0070	-	<0.0021	<0.0030
Endosulfan sulfate	420	ug/l	10X Primary Standard	ug/l	-	<0.95	<0.00084	-	-	<0.0086	<0.0068	-	<0.0021	<0.00084
Endrin	***	ug/l	10X Primary Standard	ug/l	-	<0.95	<0.0012	-	-	<0.0091	<0.0072	-	<0.0010	<0.0012
Endrin aldehyde	***	ug/l	10X Primary Standard	ug/l	-	<0.95	<0.0011	-	-	<0.018	<0.014	-	<0.0041	<0.0011
Endrin ketone	***	ug/l	10X Primary Standard	ug/l	-	<0.95	<0.0015	-	-	<0.0092	<0.0073	-	<0.0041	<0.0015
gamma-BHC (Lindane)	***	ug/l	10X Primary Standard	ug/l	-	<0.95	<0.010	-	-	<0.0086	<0.0068	-	<0.0010	<0.010

Paramater	Florida Clean up Standard Low Yield/ Poor Quality Criteria			Reporting Unit	MW 18	MW 18	MW 19	MW 19	MW 19	MW 19	MW 19	MW 19	MW 19	MW 20
					2011	2013	2015	2016	2019	2020	2021	Jul-22	Dec-22	2015
	MCL	Unit	Source		01/07/2011	01/07/2013	15/04/2015	16/12/2016	28/08/2019	27/07/2020	30/11/2021	01/07/2022	05/12/2022	15/04/2015
Heptachlor	***	ug/l	10X Primary Standard	ug/l	-	<0.95	<0.0012	-	-	<0.0082	<0.0065	-	<0.0010	<0.0012
Heptachlor epoxide	***	ug/l	10X Primary Standard	ug/l	-	<0.95	<0.0013	-	-	<0.0084	<0.0067	-	<0.0021	<0.0013
Methoxychlor	***	ug/l	10X Primary Standard	ug/l	-	<0.95	<0.0016	-	-	<0.0096	<0.0077	-	<0.0021	<0.0016
Toxaphene	***	ug/l	10X Primary Standard	ug/l	-	<95	<0.12	-	-	<0.20	<0.16	-	<0.32	<0.12
Hydrocarbons	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diesel Range Organics [C10-C28]	-	-	No Standard	mg/l	1	3.8	0.61	0.86	-	-	-	-	-	1.5
Gasoline Range Organics (GRO)-C6-C10	-	-	No Standard	mg/l	-	<0.05	<0.047	<0.050	-	-	-	-	-	<0.047
Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	14000	ug/l	10X Minimum criteria	mg/l	2000	2.4	-	-	-	-	-	-	-	-
Cyanide, Total	***	ug/l	10X Primary Standard	mg/l	<0.01	<0.01	<0.0035	<0.0025	0.031	<0.0025	<0.0025	0.011	-	<0.0070
Sulphate	-	mg/l	-	mg/l	-	-	-	-	-	330	120	170	-	-
Chloride	-	-	-	-	-	-	-	-	-	-	-	590	-	-

Paramater	Florida Clean up Standard Low Yield/ Poor Quality Criteria MCL	Unit	Source	Reporting Unit	MW 20 2016 16/12/2016	MW 20 2020 27/07/2020	MW 20 Jul-22 01/07/2022	MW 20 Dec-22 05/12/2022	MW 21 2015 15/04/2015	MW 21 2016 16/12/2016	MW 21 2019 28/08/2019	MW 21 2020 27/07/2020	MW 21 2021 30/11/2021	MW 21 Jul-22 01/07/2022
Ammonia or total Nitrogen	28	mg/l	GW Cleanup Target Levels	mg/L	16	8.3	16	-	270	330	200	150	170	230
Unionised Ammonia	-	mg/l	-	mg/l	-	0.039	0.17	0.089	-	-	-	1.6	1.5	3.4
Nitrogen, Kjeldahl	-	mg/L	-	-	-	13	-	-	-	-	-	190	-	-
Nitrate plus Nitrite, as N	110*	mg/l	10X Primary Standard	mg/L	<0.20	<0.010	<0.01	-	<0.018	0.16	<0.1	<0.010	0.079	<0.010
Orthophosphate	-	-	-	mg/L	0.076	0.086	0.1	0.048	1.1	0.85	0.53	0.36	<1.6	0.47
Phosphorus	-	-	-	mg/L	-	0.12	-	-	-	-	-	0.54	-	-
Chemical Oxygen Demand	-	-	-	mg/L	220	170	-	-	1000	1500	650	510	-	-
pH	6-8.5	-	UK other surface water maximum allowable	-	7.5	7.8	8.1	7.6	-	7.6	7.2	7.6	7.3	7.4
Specific Conductance	-	-	-	umhos/cm	19000	14000	12000	11000	-	15000	4900	13000	8700	11000
Total Dissolved Solids	5,000	mg/l	10X Second Standard	mg/L	20000	8300	5500	6300	19000	8200	16000	7500	12000	5400
Total Suspended Solids	-	-	-	mg/L	-	-	-	-	-	-	-	-	-	-
Turbidity	-	-	-	NTU	53	190	55	140	-	46	16	48	600	210
Biochemical Oxygen Demand	-	-	-	mg/L	110	-	-	-	80	49	19	-	-	-
8260B Volatile Organic Compounds by GC/MS	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acetone	63000	ug/L	GW Cleanup Target Levels	ug/L	-	8.1	<0.0037	<3.7	-	-	-	9.5	<3.7	0.008
Acrylonitrile	420	ug/L	GW Cleanup Target Levels	ug/L	-	<10	-	<5.5	-	-	-	<10	<5.5	-
Benzene	10	ug/L	10X Primary Standard	ug/L	-	<0.43	-	<0.27	-	6.2	1.8	1.5	1.4	0.0016
Bromochloromethane	910	ug/L	GW Cleanup Target Levels	ug/L	-	<0.45	-	-	-	-	-	<0.45	<0.34	-
Bromodichloromethane	6	ug/L	GW Cleanup Target Levels	ug/L	-	<0.44	-	-	-	-	-	<0.44	<0.25	-
Bromoform	44	ug/L	GW Cleanup Target Levels	ug/L	-	<0.43	-	<0.59	-	-	-	<0.43	<0.59	-
Carbon disulfide	7000	ug/L	GW Cleanup Target Levels	ug/L	3.6	2.8	<0.00043	0.83	-	-	-	1.8	<0.43	0.0001
Carbon tetrachloride	30	ug/L	10X Primary Standard	ug/L	-	<0.33	-	<0.30	-	-	-	<0.33	<0.30	-
Chlorobenzene	1000	ug/L	10X Primary Standard	ug/L	-	<0.26	-	<0.15	-	-	-	<0.26	<0.15	-
Chloroethane	120	ug/L	GW Cleanup Target Levels	ug/L	-	<2.5	-	<4.6	-	-	-	<2.5	<4.6	-
Chloroform	700	ug/L	GW Cleanup Target Levels	ug/L	-	<0.50	-	<0.27	-	-	-	<0.50	<0.27	-
Dibromochloromethane	4	ug/L	GW Cleanup Target Levels	ug/L	-	<0.32	-	-	-	-	-	<0.32	<0.39	-
1,2-Dibromo-3-Chloropropane	2	ug/L	10X Primary Standard	ug/L	-	<1.1	-	<1.8	-	-	-	<1.1	<1.8	-
1,2-Dibromoethane (EDB)	0.2	ug/L	10X Primary Standard	ug/L	-	<0.44	-	<0.25	-	-	-	<0.44	-	-
1,2-Dichlorobenzene	6000	ug/L	10X Primary Standard	ug/L	-	<0.37	-	<0.31	-	-	-	<0.37	<0.31	-
1,4-Dichlorobenzene	750	ug/L	10X Primary Standard	ug/L	-	<0.46	0.005	<0.31	-	-	-	<0.46	0.34	0.00035
trans-1,4-Dichloro-2-butene	-	-	No Standard	ug/L	-	<0.51	-	<1.3	-	-	-	<0.51	<1.3	-
1,1-Dichloroethane	700	ug/L	GW Cleanup Target Levels	ug/L	-	<0.38	-	<0.33	-	-	-	<0.38	<0.33	-
1,2-Dichloroethane	30	ug/L	10X Primary Standard	ug/L	-	<0.50	-	<0.25	-	-	-	<0.50	<0.25	-
1,1-Dichloroethene	70	ug/l	10X Primary Standard	ug/L	-	<0.36	-	<0.33	-	-	-	<0.36	<0.33	-
cis-1,2-Dichloroethene	700	ug/l	10X Primary Standard	ug/L	-	<0.41	<0.00025	<0.25	-	-	-	<0.41	<0.25	0.00025
trans-1,2-Dichloroethene	1000	ug/l	10X Primary Standard	ug/L	-	<0.37	-	<0.34	-	-	-	<0.37	<0.34	-
1,2-Dichloropropane	50	ug/L	10X Primary Standard	ug/L	-	<0.67	-	<0.22	-	-	-	<0.67	<0.22	-
cis-1,3-Dichloropropene	4	ug/L	GW Cleanup Target Levels	ug/L	-	<0.40	-	<0.26	-	-	-	<0.40	<0.26	-
trans-1,3-Dichloropropene	4	ug/L	GW Cleanup Target Levels	ug/L	-	<0.42	-	<0.23	-	-	-	<0.42	<0.23	-
Ethylbenzene	300	ug/L	10X Second Standard	ug/L	-	<0.33	-	<0.2	-	9.8	-	1	0.65	-
2-Hexanone	2800	ug/L	GW Cleanup Target Levels	ug/L	-	<2.0	-	<3.2	-	-	-	<2.0	<3.2	-
Bromomethane	98	ug/L	GW Cleanup Target Levels	ug/L	-	<2.5	-	<3.7	-	-	-	<2.5	<3.7	-
Chloromethane (methyl chloride)	27	ug/L	GW Cleanup Target Levels	ug/L	-	<0.40	-	<0.54	-	-	-	<0.40	<0.54	-
Dibromomethane (EDB)	0.2	ug/l	10X Primary Standard	ug/L	-	<0.35	-	<0.34	-	-	-	<0.35	<0.34	-
Methylene Chloride	50	ugL	10X Primary Standard	ug/L	-	<2.5	-	<3.2	-	-	-	<2.5	<3.2	-
Methyl Ethyl Ketone	42000	ug/L	GW Cleanup Target Levels	ug/L	-	-	-	-	-	-	-	-	-	-
Iodomethane	-	-	No Standard	ug/L	-	<5.0	-	<3.9	-	-	-	<5.0	<3.9	-
methyl isobutyl ketone	5600	ug/L	GW Cleanup Target Levels	ug/L	-	-	-	-	-	-	-	-	-	-
Styrene	1000	ug/L	10X Primary Standard	ug/L	-	<0.27	-	<0.27	-	-	-	<0.27	<0.27	-
1,1,1,2-Tetrachloroethane	13	ug/L	GW Cleanup Target Levels	ug/L	-	<0.37	-	<0.36	-	-	-	<0.37	<0.36	-
1,1,2,2-Tetrachloroethane	2	ug/L	GW Cleanup Target Levels	ug/L	-	<0.62	-	<0.4	-	-	-	<0.62	<0.40	-
Tetrachloroethene	30	ug/L	10X Primary Standard	ug/L	-	<0.74	-	<0.35	-	-	-	<0.74	<0.35	-
Toluene	400	ug/L	10X Second Standard	ug/L	-	1.6	-	<0.25	-	-	-	<0.48	<0.25	-
1,1,1-Trichloroethane	2000	ug/L	10X Primary Standard	ug/L	-	<0.37	-	<0.21	-	-	-	<0.37	<0.21	-

Paramater	Florida Clean up Standard Low Yield/ Poor Quality Criteria			Reporting Unit	MW 20	MW 20	MW 20	MW 20	MW 21	MW 21	MW 21	MW 21	MW 21	MW 21
					2016	2020	Jul-22	Dec-22	2015	2016	2019	2020	2021	Jul-22
	MCL	Unit	Source	Unit	16/12/2016	27/07/2020	01/07/2022	05/12/2022	15/04/2015	16/12/2016	28/08/2019	27/07/2020	30/11/2021	01/07/2022
1,1,2-Trichloroethane	50	ug/L	10X Primary Standard	ug/L	-	<0.33	-	<0.32	-	-	-	<0.33	<0.32	-
Trichloroethene	30	ug/L	10X Primary Standard	ug/L	-	<0.48	-	<0.2	-	-	-	<0.48	<0.20	-
Trichlorofluoromethane	21000	ug/L	GW Cleanup Target Levels	ug/L	-	<0.42	-	<0.33	-	-	-	<0.42	<0.33	-
1,2,3-Trichloropropane	0.2	ug/L	GW Cleanup Target Levels	ug/L	-	<0.39	-	<0.48	-	-	-	<0.39	<0.48	-
8260B Volatile Organic Compounds	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vinyl acetate	880	ug/L	GW Cleanup Target Levels	ug/L	-	<0.81	-	<0.69	-	<8.1	-	<0.81	<0.69	-
Vinyl chloride	10	ug/l	10X Primary Standard	ug/L	-	<0.50	-	<0.4	-	<5	-	<0.50	<0.40	-
Xylenes, Total	200	ug/l	10X Second Standard	ug/L	-	<0.23	<0.23	<0.23	-	7.9	1.5	1.4	1.1	1.2
6010B Inductively Coupled Plasma - Atomic Emission Spectometry - Total Recoverable	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Antimony	0.06	mg/L	10X Primary Standard	mg/L	0.0094	0.00066	0.00081	0.68	-	0.0024	0.00066	0.0011	0.0017	0.0016
Arsenic	0.1	mg/L	10X Primary Standard	mg/L	0.035	0.002	0.0025	1.6	-	0.063	0.014	0.02	0.014	0.024
Barium	20	mg/L	10X Primary Standard	mg/L	0.032	0.018	0.014	14	-	0.13	0.15	0.12	0.097	0.15
Beryllium	0.04	mg/L	10X Primary Standard	mg/L	<0.00017	<0.00017	<0.0002	<0.20	-	0.00036	-	<0.00017	0.0003	0.024
Cadmium	0.05	mg/L	10X Primary Standard	mg/L	0.00099	<0.00015	<0.000078	<0.078	-	0.00017	-	<0.00015	0.00017	<0.000078
Chromium	1	mg/L	10X Primary Standard	mg/L	0.014	0.0063	0.0053	4.7	-	0.31	0.083	0.05	0.042	0.078
Cobalt	1400	ug/L	GW Cleanup Target Levels	mg/L	0.003	0.00077	0.00028	0.22	-	0.01	0.0059	0.0032	3.2	0.0059
Copper	10	mg/L	10X Second Standard	mg/L	0.18	<0.0017	<0.0009	<0.90	-	0.026	-	0.01	0.075	0.018
Iron	3	mg/L	10X Second Standard	mg/L	-	0.22	-	23	-	-	1.2	0.91	-	-
Lead	0.15	mg/L	10X Primary Standard	mg/L	0.019	<0.00098	<0.00034	<0.34	-	0.014	-	<0.00098	0.014	0.0077
Magnesium	-	-	No Standard	mg/L	-	-	-	-	-	-	250	-	-	-
Nickel	1	mg/L	10X Primary Standard	mg/L	0.0068	0.0038	<0.0018	<1.8	-	0.042	0.02	0.017	0.011	0.014
Selenium	0.5	mg/L	10X Primary Standard	mg/L	0.0016	<0.001	<0.0012	<1.2	-	<0.001	0.0022	<0.001	<0.001	0.0013
Silver	1	mg/L	10X Second Standard	mg/L	0.00038	<0.0001	<0.00039	<0.39	-	<0.0001	-	<0.0001	0.00027	0.00039
Thallium	0.02	mg/L	10X Primary Standard	mg/L	<0.00049	<0.00049	<0.26	<0.26	-	<0.00049	-	<0.00049	<0.00049	<0.26
Vanadium	490	ug/L	GW Cleanup Target Levels	mg/L	0.019	0.011	0.0089	5.6	-	0.11	0.063	<0.0053	5.5	0.0062
Zinc	50	mg/L	10X Second Standard	mg/L	0.64	<0.0096	<10	<10	-	0.05	-	<0.0096	0.091	0.038
7470A Mercury in Liquid Waste (Manual Cold Vapor Technique)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	0.02	mg/L	10X Primary Standard	mg/L	0.0001	<0.000080	<0.000080	<0.08	-	<0.080	-	<0.000080	<0.000080	<0.000080
PCBs	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB-1016	***	ug/l	10X Primary Standard	ug/l	-	<0.19	-	<0.31	-	<0.19	-	<0.19	<1.5	-
PCB-1221	***	ug/l	10X Primary Standard	ug/l	-	<0.15	-	<0.33	-	<0.15	-	<0.15	<1.2	-
PCB-1232	***	ug/l	10X Primary Standard	ug/l	-	<0.13	-	<0.33	-	<0.13	-	<0.13	<1.0	-
PCB-1242	***	ug/l	10X Primary Standard	ug/l	-	<0.18	-	<0.33	-	<0.18	-	<0.18	<1.4	-
PCB-1248	***	ug/l	10X Primary Standard	ug/l	-	<0.079	-	<0.33	-	<0.078	-	<0.082	<0.63	-
PCB-1254	***	ug/l	10X Primary Standard	ug/l	-	<0.15	-	<0.33	-	<0.15	-	<0.15	<1.2	-
PCB-1260	***	ug/l	10X Primary Standard	ug/l	-	<0.13	-	<0.33	-	<0.13	-	<0.13	<1.0	-
Pesticides	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4,4'-DDD	1	ug/l	10X Primary Standard	ug/l	-	<0.0076	-	<0.0020	-	-	-	<0.0079	<0.060	-
4,4'-DDE	1	ug/l	10X Primary Standard	ug/l	-	<0.0073	-	<0.00098	-	-	-	<0.0076	<0.058	-
4,4'-DDT	1	ug/l	10X Primary Standard	ug/l	-	<0.0084	-	<0.00098	-	-	-	<0.0087	<0.067	-
Aldrin	0.02	ug/l	10X Primary Standard	ug/l	-	<0.0072	-	<0.0020	-	-	-	<0.0075	<0.057	-
alpha-BHC	0.06	ug/l	10X Primary Standard	ug/l	-	<0.0077	-	<0.00098	-	-	-	<0.0080	<0.061	-
beta-BHC	0.2	ug/l	10X Primary Standard	ug/l	-	<0.012	-	<0.0020	-	-	-	<0.012	<0.094	-
Chlordane (technical)	***	ug/l	10X Primary Standard	ug/l	-	<0.11	-	-	-	-	-	<0.11	<0.86	-
delta-BHC	21	ug/l	10X Primary Standard	ug/l	-	<0.013	-	<0.0020	-	-	-	<0.013	<0.10	-
Dieldrin	0.02	ug/l	10X Primary Standard	ug/l	-	<0.0085	-	<0.0020	-	-	-	<0.0088	<0.068	-
Endosulfan I	420	ug/l	10X Primary Standard	ug/l	-	<0.0081	-	<0.0020	-	-	-	0.061 p	<0.064	-
Endosulfan II	420	ug/l	10X Primary Standard	ug/l	-	<0.0084	-	<0.0020	-	-	-	<0.0087	<0.067	-
Endosulfan sulfate	420	ug/l	10X Primary Standard	ug/l	-	<0.0082	-	<0.0020	-	-	-	<0.0085	<0.065	-
Endrin	***	ug/l	10X Primary Standard	ug/l	-	<0.0087	-	<0.00098	-	-	-	<0.0090	<0.069	-
Endrin aldehyde	***	ug/l	10X Primary Standard	ug/l	-	<0.017	-	<0.0039	-	-	-	<0.017	<0.13	-
Endrin ketone	***	ug/l	10X Primary Standard	ug/l	-	<0.0087	-	<0.0039	-	-	-	<0.0091	<0.070	-
gamma-BHC (Lindane)	***	ug/l	10X Primary Standard	ug/l	-	<0.0082	-	<0.00098	-	-	-	<0.0085	<0.065	-

Paramater	Florida Clean up Standard Low Yield/ Poor Quality Criteria			Reporting Unit	MW 20	MW 20	MW 20	MW 20	MW 21	MW 21	MW 21	MW 21	MW 21	MW 21
					2016	2020	Jul-22	Dec-22	2015	2016	2019	2020	2021	Jul-22
	MCL	Unit	Source		16/12/2016	27/07/2020	01/07/2022	05/12/2022	15/04/2015	16/12/2016	28/08/2019	27/07/2020	30/11/2021	01/07/2022
Heptachlor	***	ug/l	10X Primary Standard	ug/l	-	<0.0078	-	<0.00098	-	-	-	<0.0081	<0.062	-
Heptachlor epoxide	***	ug/l	10X Primary Standard	ug/l	-	<0.0080	-	<0.0020	-	-	-	<0.0083	<0.064	-
Methoxychlor	***	ug/l	10X Primary Standard	ug/l	-	<0.0091	-	<0.0020	-	-	-	<0.0095	<0.073	-
Toxaphene	***	ug/l	10X Primary Standard	ug/l	-	<0.19	-	<0.30	-	-	-	<0.19	<1.5	-
Hydrocarbons	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diesel Range Organics [C10-C28]	-	-	No Standard	mg/l	1.7	-	-	-	18	26	-	-	-	-
Gasoline Range Organics (GRO)-C6-C10	-	-	No Standard	mg/l	<0.050	-	-	-	0.3	<1.0	-	-	-	-
Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	14000	ug/l	10X Minimum criteria	mg/l	-	-	-	-	-	-	-	-	-	-
Cyanide, Total	***	ug/l	10X Primary Standard	mg/l	-	0.0045	0.011	-	0.15	0.0089	0.044	0.0039	0.0038	0.0057
Sulphate	-	mg/l	-	mg/l	-	300	330	-	-	-	-	1700	<2.5	<2.5
Chloride	-	-	-	-	-	-	3600	-	-	-	-	-	-	-

Paramater	Florida Clean up Standard Low Yield/ Poor Quality Criteria			Reporting Unit	MW22	MW22	MW22	MW23	MW23	MW23A
					2016	2019	2020	2020	Jul-22	2021
	MCL	Unit	Source		16/12/2016	28/08/2019	27/07/2020	27/07/2020	01/07/2022	30/11/2021
Ammonia or total Nitrogen	28	mg/l	GW Cleanup Target Levels	mg/L	8.6	12	-	44	96	170
Unionised Ammonia	-	mg/l	-	mg/l	-	-	-	0.64	1.2	1.2
Nitrogen, Kjeldahl	-	mg/L	-	-	-	-	12	76	-	-
Nitrate plus Nitrite, as N	110*	mg/l	10X Primary Standard	mg/L	0.05	0.034	<0.010	<0.010	<0.01	0.016
Orthophosphate	-	-	-	mg/L	0.68	0.99	0.84	0.16	0.54	0.76
Phosphorus	-	-	-	mg/L	-	-	0.84	0.37	-	-
Chemical Oxygen Demand	-	-	-	mg/L	170	130	130	380	-	-
pH	6-8.5	-	UK other surface water maximum allowable	-	7.4	1.4	7.4	7.8	7.3	7.3
Specific Conductance	-	-	-	umhos/cm	29000	34000	28000	12000	19000	17000
Total Dissolved Solids	5,000	mg/l	10X Second Standard	mg/L	27000	19000	17000	7400	11000	11000
Total Suspended Solids	-	-	-	mg/L	-	-	-	-	-	-
Turbidity	-	-	-	NTU	28	6	53	39	330	250
Biochemical Oxygen Demand	-	-	-	mg/L	180	27	-	-	-	-
8260B Volatile Organic Compounds by GC/MS	-	-	-	-	-	-	-	-	-	-
Acetone	63000	ug/L	GW Cleanup Target Levels	ug/L	-	-	<7.0	<7.0	<0.0037	<3.7
Acrylonitrile	420	ug/L	GW Cleanup Target Levels	ug/L	-	-	<10	<10	-	<5.5
Benzene	10	ug/L	10X Primary Standard	ug/L	-	-	<0.43	<0.43	-	<0.27
Bromochloromethane	910	ug/L	GW Cleanup Target Levels	ug/L	-	-	<0.45	<0.45	-	<0.34
Bromodichloromethane	6	ug/L	GW Cleanup Target Levels	ug/L	-	-	<0.44	<0.44	-	<0.25
Bromoform	44	ug/L	GW Cleanup Target Levels	ug/L	-	-	<0.43	<0.43	-	<0.59
Carbon disulfide	7000	ug/L	GW Cleanup Target Levels	ug/L	1	1.1	<1.0	3.7	0.00099	2.1
Carbon tetrachloride	30	ug/L	10X Primary Standard	ug/L	-	-	<0.33	<0.33	-	<0.30
Chlorobenzene	1000	ug/L	10X Primary Standard	ug/L	-	-	<0.26	<0.26	-	<0.15
Chloroethane	120	ug/L	GW Cleanup Target Levels	ug/L	-	-	<2.5	<2.5	-	<4.6
Chloroform	700	ug/L	GW Cleanup Target Levels	ug/L	-	-	<0.50	<0.50	-	<0.27
Dibromochloromethane	4	ug/L	GW Cleanup Target Levels	ug/L	-	-	<0.32	<0.32	-	<0.39
1,2-Dibromo-3-Chloropropane	2	ug/L	10X Primary Standard	ug/L	-	-	<1.1	<1.1	-	<1.8
1,2-Dibromoethane (EDB)	0.2	ug/L	10X Primary Standard	ug/L	-	-	<0.44	<0.44	-	<0.33
1,2-Dichlorobenzene	6000	ug/L	10X Primary Standard	ug/L	-	-	<0.37	<0.37	-	<0.31
1,4-Dichlorobenzene	750	ug/L	10X Primary Standard	ug/L	-	-	<0.46	<0.46	<0.00031	<0.31
trans-1,4-Dichloro-2-butene	-	-	No Standard	ug/L	-	-	<0.51	<0.51	-	<1.3
1,1-Dichloroethane	700	ug/L	GW Cleanup Target Levels	ug/L	-	-	<0.38	<0.38	-	<0.33
1,2-Dichloroethane	30	ug/L	10X Primary Standard	ug/L	-	-	<0.50	<0.50	-	<0.25
1,1-Dichloroethene	70	ug/l	10X Primary Standard	ug/L	-	-	<0.36	<0.36	-	<0.33
cis-1,2-Dichloroethene	700	ug/l	10X Primary Standard	ug/L	-	-	<0.41	<0.41	0.00044	<0.25
trans-1,2-Dichloroethene	1000	ug/l	10X Primary Standard	ug/L	-	-	<0.37	<0.37	-	<0.34
1,2-Dichloropropane	50	ug/L	10X Primary Standard	ug/L	-	-	<0.67	<0.67	-	<0.22
cis-1,3-Dichloropropene	4	ug/L	GW Cleanup Target Levels	ug/L	-	-	<0.40	<0.40	-	<0.26
trans-1,3-Dichloropropene	4	ug/L	GW Cleanup Target Levels	ug/L	-	-	<0.42	<0.42	-	<0.23
Ethylbenzene	300	ug/L	10X Second Standard	ug/L	-	-	<0.33	<0.33	-	<0.20
2-Hexanone	2800	ug/L	GW Cleanup Target Levels	ug/L	-	-	<2.0	<2.0	-	<3.2
Bromomethane	98	ug/L	GW Cleanup Target Levels	ug/L	-	-	<2.5	<2.5	-	<3.7
Chloromethane (methyl chloride)	27	ug/L	GW Cleanup Target Levels	ug/L	-	-	<0.40	<0.40	-	<0.54
Dibromomethane (EDB)	0.2	ug/l	10X Primary Standard	ug/L	-	-	<0.35	<0.35	-	<0.34
Methylene Chloride	50	ugL	10X Primary Standard	ug/L	-	-	<2.5	<2.5	-	<3.2
Methyl Ethyl Ketone	42000	ug/L	GW Cleanup Target Levels	ug/L	-	-	-	-	-	-
Iodomethane	-	-	No Standard	ug/L	-	-	<5.0	<5.0	-	<3.9
methyl isobutyl ketone	5600	ug/L	GW Cleanup Target Levels	ug/L	-	-	-	-	-	-
Styrene	1000	ug/L	10X Primary Standard	ug/L	-	-	<0.27	<0.27	-	<0.27
1,1,1,2-Tetrachloroethane	13	ug/L	GW Cleanup Target Levels	ug/L	-	-	<0.37	<0.37	-	<0.36
1,1,2,2-Tetrachloroethane	2	ug/L	GW Cleanup Target Levels	ug/L	-	-	<0.62	<0.62	-	<0.40
Tetrachloroethene	30	ug/L	10X Primary Standard	ug/L	-	-	<0.74	<0.74	-	<0.35
Toluene	400	ug/L	10X Second Standard	ug/L	-	-	<0.48	<0.48	-	<0.25
1,1,1-Trichloroethane	2000	ug/L	10X Primary Standard	ug/L	-	-	<0.37	<0.37	-	<0.21

Paramater	Florida Clean up Standard Low Yield/ Poor Quality Criteria MCL	Unit	Source	Reporting Unit	MW22 2016 16/12/2016	MW22 2019 28/08/2019	MW22 2020 27/07/2020	MW23 2020 27/07/2020	MW23 Jul-22 01/07/2022	MW23A 2021 30/11/2021
1,1,2-Trichloroethane	50	ug/L	10X Primary Standard	ug/L	-	-	<0.33	<0.33	-	<0.32
Trichloroethene	30	ug/L	10X Primary Standard	ug/L	-	-	<0.48	<0.48	-	<0.20
Trichlorofluoromethane	21000	ug/L	GW Cleanup Target Levels	ug/L	-	-	<0.42	<0.42	-	<0.33
1,2,3-Trichloropropane	0.2	ug/L	GW Cleanup Target Levels	ug/L	-	-	<0.39	<0.39	-	<0.48
8260B Volatile Organic Compounds	-	-	-	-	-	-	-	-	-	-
Vinyl acetate	880	ug/L	GW Cleanup Target Levels	ug/L	<0.81	-	<0.81	<0.81	-	<0.69
Vinyl chloride	10	ug/l	10X Primary Standard	ug/L	<0.5	-	<0.50	<0.50	-	<0.40
Xylenes, Total	200	ug/l	10X Second Standard	ug/L	<0.23	-	<0.23	<0.23	<0.23	<0.23
6010B Inductively Coupled Plasma - Atomic Emission Spectometry - Total Recoverable	-	-	-	-	-	-	-	-	-	-
Antimony	0.06	mg/L	10X Primary Standard	mg/L	0.00052	-	<0.00050	0.0028	0.00059	0.0015
Arsenic	0.1	mg/L	10X Primary Standard	mg/L	0.0083	0.0021	0.0022	0.016	0.0096	0.036
Barium	20	mg/L	10X Primary Standard	mg/L	0.017	0.011	0.014	0.1	0.094	0.091
Beryllium	0.04	mg/L	10X Primary Standard	mg/L	<0.00017	-	<0.00017	<0.00017	<0.0002	<0.00017
Cadmium	0.05	mg/L	10X Primary Standard	mg/L	0.00023	-	<0.00015	<0.00015	<0.000078	<0.00015
Chromium	1	mg/L	10X Primary Standard	mg/L	0.011	0.0027	0.0055	0.032	0.023	0.047
Cobalt	1400	ug/L	GW Cleanup Target Levels	mg/L	0.0017	0.00021	0.57	0.0024	0.0019	0.0027
Copper	10	mg/L	10X Second Standard	mg/L	0.0032	-	<0.0017	0.024	0.0056	0.0093
Iron	3	mg/L	10X Second Standard	mg/L	-	-	0.41	1.5	-	-
Lead	0.15	mg/L	10X Primary Standard	mg/L	0.0028	-	<0.00098	0.0017	0.00069	0.002
Magnesium	-	-	No Standard	mg/L	-	6300	-	-	-	-
Nickel	1	mg/L	10X Primary Standard	mg/L	0.0065	0.0026	0.0065	0.019	0.0055	0.012
Selenium	0.5	mg/L	10X Primary Standard	mg/L	0.0054	0.0023	<0.001	<0.001	<0.0012	<0.001
Silver	1	mg/L	10X Second Standard	mg/L	<0.0001	-	<0.0001	<0.0001	<0.00039	<0.0001
Thallium	0.02	mg/L	10X Primary Standard	mg/L	<0.00049	-	<0.00049	<0.00049	<0.26	<0.00049
Vanadium	490	ug/L	GW Cleanup Target Levels	mg/L	0.013	-	0.0054	0.074	0.0042	0.011
Zinc	50	mg/L	10X Second Standard	mg/L	<0.0096	-	<0.0096	0.049	0.012	0.03
7470A Mercury in Liquid Waste (Manual Cold Vapor Technique)	-	-	-	-	-	-	-	-	-	-
Mercury	0.02	mg/L	10X Primary Standard	mg/L	0.000094	-	<0.000080	<0.000080	<0.00008	<0.000080
PCBs	-	-	-	-	-	-	-	-	-	-
PCB-1016	***	ug/l	10X Primary Standard	ug/l	-	-	<0.19	<0.19	-	<1.5
PCB-1221	***	ug/l	10X Primary Standard	ug/l	-	-	<0.15	<0.15	-	<1.2
PCB-1232	***	ug/l	10X Primary Standard	ug/l	-	-	<0.13	<0.13	-	<1.0
PCB-1242	***	ug/l	10X Primary Standard	ug/l	-	-	<0.18	<0.18	-	<1.4
PCB-1248	***	ug/l	10X Primary Standard	ug/l	-	-	<0.082	<0.079	-	<0.63
PCB-1254	***	ug/l	10X Primary Standard	ug/l	-	-	<0.15	<0.15	-	<1.2
PCB-1260	***	ug/l	10X Primary Standard	ug/l	-	-	<0.13	<0.13	-	<1.0
Pesticides	-	-	-	-	-	-	-	-	-	-
4,4'-DDD	1	ug/l	10X Primary Standard	ug/l	-	-	<0.0079	<0.0076	-	<0.060
4,4'-DDE	1	ug/l	10X Primary Standard	ug/l	-	-	<0.0076	<0.0073	-	<0.058
4,4'-DDT	1	ug/l	10X Primary Standard	ug/l	-	-	<0.0087	<0.0084	-	<0.067
Aldrin	0.02	ug/l	10X Primary Standard	ug/l	-	-	<0.0075	<0.0072	-	<0.057
alpha-BHC	0.06	ug/l	10X Primary Standard	ug/l	-	-	<0.0080	<0.0077	-	<0.061
beta-BHC	0.2	ug/l	10X Primary Standard	ug/l	-	-	<0.012	<0.012	-	<0.094
Chlordane (technical)	***	ug/l	10X Primary Standard	ug/l	-	-	<0.11	<0.11	-	<0.86
delta-BHC	21	ug/l	10X Primary Standard	ug/l	-	-	<0.013	<0.013	-	<0.10
Dieldrin	0.02	ug/l	10X Primary Standard	ug/l	-	-	<0.0088	<0.0085	-	<0.067
Endosulfan I	420	ug/l	10X Primary Standard	ug/l	-	-	<0.0084	0.027 J	-	<0.064
Endosulfan II	420	ug/l	10X Primary Standard	ug/l	-	-	<0.0087	<0.0084	-	<0.067
Endosulfan sulfate	420	ug/l	10X Primary Standard	ug/l	-	-	<0.0085	<0.0082	-	<0.065
Endrin	***	ug/l	10X Primary Standard	ug/l	-	-	<0.0090	<0.0087	-	<0.069
Endrin aldehyde	***	ug/l	10X Primary Standard	ug/l	-	-	<0.017	<0.017	-	<0.13
Endrin ketone	***	ug/l	10X Primary Standard	ug/l	-	-	<0.0091	<0.0088	-	<0.070
gamma-BHC (Lindane)	***	ug/l	10X Primary Standard	ug/l	-	-	<0.0085	<0.0082	-	<0.065

Paramater	Florida Clean up Standard Low Yield/ Poor Quality Criteria			Reporting Unit	MW22 2016 16/12/2016	MW22 2019 28/08/2019	MW22 2020 27/07/2020	MW23 2020 27/07/2020	MW23 Jul-22 01/07/2022	MW23A 2021 30/11/2021
	MCL	Unit	Source							
Heptachlor	***	ug/l	10X Primary Standard	ug/l	-	-	<0.0081	<0.0078	-	<0.062
Heptachlor epoxide	***	ug/l	10X Primary Standard	ug/l	-	-	<0.0083	<0.0080	-	<0.063
Methoxychlor	***	ug/l	10X Primary Standard	ug/l	-	-	<0.0095	<0.0091	-	<0.073
Toxaphene	***	ug/l	10X Primary Standard	ug/l	-	-	<0.19	<0.19	-	<1.5
Hydrocarbons	-	-	-	-	-	-	-	-	-	-
Diesel Range Organics [C10-C28]	-	-	No Standard	mg/l	0.54	-	-	-	-	-
Gasoline Range Organics (GRO)-C6-C10	-	-	No Standard	mg/l	<0.050	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-	-
Boron	14000	ug/l	10X Minimum criteria	mg/l	-	-	-	-	-	-
Cyanide, Total	***	ug/l	10X Primary Standard	mg/l	-	-	<0.0025	0.0054	0.017	0.0063
Sulphate	-	mg/l	-	mg/l	-	-	1300	620	410	720
Chloride	-	-	-	-	-	-	-	-	6300	-

					SW1	SW1	SW1	SW1	SW1	SW1	SW1	NS#1	NS#1	NS#1
	Florida Clean up Standard Marine Surface Water Criteria			Reporting	2006	2007	2008	2010	2011	2011 Duplicate	2013	2015	2016	2019
Paramaters	MCL	Unit	Source	Unit	01/07/2006	01/07/2007	01/07/2008	01/07/2010	01/07/2011	01/07/2011	01/07/2013	15/04/2015	16/12/2016	28/08/2019
Ammonia	N/A	mg/L	SW Cleanup Target Levels	mg/L	-	2.6	0.32	5.5	1.6	1.9	7.8	2.5	2.6	1.4
Nitrogen, Kjeldahl	-	mg/L	-	-	9.5	4.3	0.61	5.7	-	-	-	3.7	-	-
Nitrate Nitrite as N	N/A	mg/L	SW Cleanup Target Levels	mg/L	<0.050	<0.050	<0.050	<0.05	0.16	<0.05	<0.05	<0.018	0.15	0.076
Orthophosphate	-	-	-	mg/L	-	0.051	<0.050	<0.05	0.086	0.076	0.44	0.1	0.12	<0.016
Phosphorus	-	-	-	mg/L	0.26	0.12	<0.10	0.18	-	-	-	-	-	-
Chemical Oxygen Demand	-	-	-	mg/L	1300	3200	10000	2100	1100	1300	49	260	<25	250
pH	-	-	-	-	7.43	7.64	8.25	7.45	7.66	7.71	7.43	-	7.5	1.4
Specific Conductance	-	-	-	umhos/cm	60000	61000	95000	22000	49000	48000	39000	-	46000	59000
Total Dissolved Solids	N/A	mg/L	SW Cleanup Target Levels	mg/L	31000	220000	38000	12000	31000	27000	24000	39000	42000	39000
Total Suspended Solids	-	-	-	mg/L	48	18	35	-	-	-	-	23	-	-
Turbidity	29	NTU	62-302.530 SW Quality Criteria*	NTU	12	3.6	13	94	5.8	3.5	48	3.6	68	1.7
Biochemical Oxygen Demand	-	-	-	mg/L	7.1	3.5	<2.0	13	3.4	3.4	<2	10	<16.00	<24
8260B Volatile Organic Compounds by GC/MS	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acetone	1700	ug/L	SW Cleanup Target Levels	ug/L	-	<25	<25	<25	<25	<25	<25	-	-	-
Acrylonitrile	0.2	ug/L	SW Cleanup Target Levels	ug/L	-	<20	<20	<20	<20	<20	<20	-	-	-
Benzene	71.28	ug/L	62-302.530 SW Quality Criteria	ug/L	-	<1	<1	<1	<1	<1	<1	<0.38	-	-
Bromochloromethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	-	<1	<1	<1	<1	<1	<1	<0.52	-	-
Bromodichloromethane	22	ug/L	62-302.530 SW Quality Criteria	ug/L	-	<1	<1	<1	<1	<1	<1	<0.50	-	-
Bromoform	360	ug/L	SW Cleanup Target Levels	ug/L	-	<1	<1	<1	<1	<1	<1	<0.71	-	-
Carbon disulfide	110	ug/L	SW Cleanup Target Levels	ug/L	-	<2	<2	<2	<2	<2	<2	-	-	-
Carbon tetrachloride	4.42	ug/L	SW Cleanup Target Levels	ug/L	-	<1	<1	<1	<1	<1	<1	<0.50	-	-
Chlorobenzene	17	ug/L	SW Cleanup Target Levels	ug/L	-	<1	<1	<1	<1	<1	<1	<0.50	-	-
Chloroethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	-	<1	<1	<1	<1	<1	<1	<0.76	-	-
Chloroform	470.8	ug/L	SW Cleanup Target Levels	ug/L	-	<1	<1	<1	<1	<1	<1	<0.60	-	-
Dibromochloromethane	34	ug/L	62-302.530 SW Quality Criteria	ug/L	-	<1	<1	<1	<1	<1	<1	<0.50	-	-
1,2-Dibromo-3-Chloropropane	N/A	ug/L	SW Cleanup Target Levels	ug/L	-	<1	<1	<1	<1	<1	<1	-	-	-
1,2-Dibromoethane (EDB)	13	ug/L	SW Cleanup Target Levels	ug/L	-	<1	<1	<1	<1	<1	<1	-	-	-
1,2-Dichlorobenzene	99	ug/L	SW Cleanup Target Levels	ug/L	-	<1	<1	<1	<1	<1	<1	<0.50	-	-
1,4-Dichlorobenzene	3	ug/L	SW Cleanup Target Levels	ug/L	-	<1	<1	<1	<1	<1	<1	<0.64	-	-
trans-1,4-Dichloro-2-butene	-	-	No Standard	ug/L	-	<2	<2	<2	<2	<2	<2	-	-	-
1,1-Dichloroethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	-	<1	<1	<1	<1	<1	<1	<0.50	-	-
1,2-Dichloroethane	37	ug/L	SW Cleanup Target Levels	ug/L	-	<1	<1	<1	<1	<1	<1	<0.50	-	-
1,1-Dichloroethene	3.2	ug/L	62-302.530 SW Quality Criteria	ug/L	-	<1	<1	<1	<1	<1	<1	<0.50	-	-
cis-1,2-Dichloroethene	N/A	ug/L	SW Cleanup Target Levels	ug/L	-	<1	<1	<1	<1	<1	<1	<0.50	-	-
trans-1,2-Dichloroethene	11000	ug/L	SW Cleanup Target Levels	ug/L	-	<1	<1	<1	<1	<1	<1	<0.50	-	-
1,2-Dichloropropane	14	ug/L	SW Cleanup Target Levels	ug/L	-	<1	<1	<1	<1	<1	<1	<0.50	-	-
cis-1,3-Dichloropropene	12	ug/L	SW Cleanup Target Levels	ug/L	-	<1	<1	<1	<1	<1	<1	<0.50	-	-
trans-1,3-Dichloropropene	12	ug/L	SW Cleanup Target Levels	ug/L	-	<1	<1	<1	<1	<1	<1	<0.50	-	-
Ethylbenzene	610	ug/L	SW Cleanup Target Levels	ug/L	-	<1	<1	<1	<1	<1	<1	<0.50	-	-
2-Hexanone	NA	ug/L	SW Cleanup Target Levels	ug/L	-	<10	<10	<10	<10	<10	<10	-	-	-
Bromomethane	35	ug/L	SW Cleanup Target Levels	ug/L	-	<1	<1	<1	<1	<1	<1	<0.98	-	-
Chloromethane (methyl chloride)	470.8	ug/L	62-302.530 SW Quality Criteria	ug/L	-	<1	<1	<1	<1	<1	<1	<0.52	-	-
Dibromomethane (EDB)	13	ug/L	SW Cleanup Target Levels	ug/L	-	<1	<1	<1	<1	<1	<1	<0.59	-	-
Methylene Chloride	1580	ug/L	62-302.530 SW Quality Criteria	ug/L	-	<5	<5	<5	<5	<5	<5	<3.0	-	-
Methyl Ethyl Ketone (MEK)	120000	ug/L	SW Cleanup Target Levels	ug/L	-	<10	<10	<10	<10	<10	<10	-	-	-
Iodomethane	-	-	No Standard	ug/L	-	<5	<5	<5	<5	<5	<5	-	-	-
methyl isobutyl ketone	23000	ug/L	SW Cleanup Target Levels	ug/L	-	<10	<10	<10	<10	<10	<10	-	-	-
Styrene	460	ug/L	SW Cleanup Target Levels	ug/L	-	<1	<1	<1	<1	<1	<1	<1.0	-	-
1,1,1,2-Tetrachloroethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	-	<1	<1	<1	<1	<1	<1	<0.52	-	-
1,1,2,2-Tetrachloroethane	10.8	ug/L	62-302.530 SW Quality Criteria	ug/L	-	<1	<1	<1	<1	<1	<1	<0.50	-	-
Tetrachloroethene (Tetrachloroethylene)	8.85	ug/L	62-302.530 SW Quality Criteria	ug/L	-	<1	<1	<1	<1	<1	<1	<0.58	-	-
Toluene	480	ug/L	SW Cleanup Target Levels	ug/L	-	<1	<1	<1	<1	<1	<1	<0.70	-	-
1,1,1-Trichloroethane	270	ug/L	SW Cleanup Target Levels	ug/L	-	<1	<1	<1	<1	<1	<1	<0.50	-	-
1,1,2-Trichloroethane	16	ug/L	SW Cleanup Target Levels	ug/L	-	<1	<1	<1	<1	<1	<1	<0.50	-	-
Trichloroethene	80.7	ug/L	62-302.530 SW Quality Criteria	ug/L	-	<1	<1	<1	<1	<1	<1	<0.50	-	-
Trichlorofluoromethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	-	<1	<1	<1	<1	<1	<1	<0.52	-	-
1,2,3-Trichloropropane	0.2	ug/L	SW Cleanup Target Levels	ug/L	-	<1	<1	<1	<1	<1	<1	<0.84	-	-

Paramaters	Florida Clean up Standard Marine Surface Water Criteria			Reporting Unit	SW1	SW1	SW1	SW1	SW1	SW1	SW1	NS#1	NS#1	NS#1
					2006	2007	2008	2010	2011	2011 Duplicate	2013	2015	2016	2019
	MCL	Unit	Source		01/07/2006	01/07/2007	01/07/2008	01/07/2010	01/07/2011	01/07/2011	01/07/2013	15/04/2015	16/12/2016	28/08/2019
8260B Volatile Organic Compounds	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vinyl acetate	700	ug/L	SW Cleanup Target Levels	ug/L	-	<2	<2	<2	<2	<2	<2	-	-	-
Vinyl chloride	2.4	ug/L	SW Cleanup Target Levels	ug/L	-	<1	<1	<1	<1	<1	<1	<0.50	-	-
Xylenes, Total	370	ug/L	SW Cleanup Target Levels	ug/L	-	<2	<2	<2	<2	<2	<2	-	-	-
6010B Inductively Coupled Plasma - Atomic Emission Spectrometry- Total	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Antimony	4.3	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.0060	<0.0060	<0.0060	<0.02	<0.02	<0.02	<0.02	<0.010	<0.0005	-
Arsenic	0.05	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.010	<0.010	<0.010	<0.02	<0.02	<0.02	<0.02	<0.0040	0.0035	0.0024
Barium	N/A	mg/L	SW Cleanup Target Levels	mg/L	0.017	0.014	<0.010	0.016	0.022	0.019	0.024	0.01	0.01	0.009
Beryllium	0.00013	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.0030	<0.0030	<0.0030	<0.004	<0.004	<0.004	<0.004	<0.0010	<0.00017	-
Cadmium	0.0088	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.0050	<0.0050	<0.005	<0.005	0.0051	<0.005	<0.005	<0.0010	<0.00015	-
Chromium (Hexavalent)	0.05	mg/L	SW Cleanup Target Levels	mg/L	<0.010	<0.010	<0.010	<0.01	<0.01	<0.01	<0.01	0.01	0.0018	0.0046
Cobalt	N/A	mg/L	SW Cleanup Target Levels	mg/L	<0.010	<0.010	<0.010	<0.01	<0.01	<0.01	<0.01	<0.0030	<0.00012	0.00022
Copper	0.0037	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.020	<0.020	<0.020	<0.02	<0.02	<0.02	<0.02	<0.0020	<0.0017	-
Iron	0.3	mg/L	62-302.530 SW Quality Criteria	mg/L	0.76	0.11	0.058	0.065	<0.05	<0.05	<0.05	-	-	-
Lead	0.0085	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.0050	<0.0050	<0.005	<0.01	<0.01	<0.01	<0.01	0.0036	<0.00098	-
Magnesium	-	-	No Standard	mg/L	960	1300	1400	640	1100	1200	1100	-	-	1300
Nickel	0.0083	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.040	<0.040	<0.040	<0.04	<0.04	<0.04	<0.04	<0.0030	<0.0019	-
Selenium	71	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.010	<0.010	<0.010	<0.02	0.028	0.028	<0.04	<0.0040	0.0035	0.0014
Silver	0.0004	mg/L	SW Cleanup Target Levels	mg/L	<0.010	<0.010	<0.010	<0.01	<0.01	<0.01	<0.01	<0.0020	<0.0001	0.0002
Thallium	0.0063	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.0040	<0.0053	-
Vanadium	N/A	mg/L	SW Cleanup Target Levels	mg/L	<0.010	<0.20	<0.05	<0.01	<0.01	<0.01	<0.01	<0.0030	<0.0096	-
Zinc	0.086	mg/L	SW Cleanup Target Levels	mg/L	<0.020	<0.020	<0.020	<0.02	<0.02	<0.02	<0.02	<0.0080	<0.00049	-
7470A Mercury in Liquid Waste (Manual Cold Vapor Technique)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	0.000025	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	-	-	-
PCBs	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB-1016	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	<1	<0.98	<9.4	<0.11	-	-
PCB-1221	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	<2	<2	<19	<0.088	-	-
PCB-1232	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	<1	<0.98	<9.4	<0.040	-	-
PCB-1242	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	<1	<0.98	<9.4	<0.014	-	-
PCB-1248	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	<1	<0.98	<9.4	<0.0080	-	-
PCB-1254	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	<1	<0.98	<9.4	<0.023	-	-
PCB-1260	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	<1	<0.98	<9.4	<0.061	-	-
Persticides	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4,4'-DDD	0.0003	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	-	-	<0.47	<0.0012	-	-
4,4'-DDE	0.0002	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	-	-	<0.47	<0.00088	-	-
4,4'-DDT	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	-	-	<0.47	<0.0016	-	-
Aldrin	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	-	-	<0.47	<0.0012	-	-
alpha-BHC	0.005	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	-	-	<0.47	<0.0014	-	-
beta-BHC	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	-	-	<0.47	<0.0012	-	-
Chlordane (technical)	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	-	-	<4.7	<0.0017	-	-
delta-BHC	NA	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	-	-	<0.47	<0.00084	-	-
Dieldrin	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	-	-	<0.47	<0.0012	-	-
Endosulfan I	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	-	-	<0.47	<0.0012	-	-
Endosulfan II	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	-	-	<0.47	<0.0030	-	-
Endosulfan sulfate	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	-	-	<0.47	<0.00084	-	-
Endrin	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	-	-	<0.47	<0.0012	-	-
Endrin aldehyde	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	-	-	<0.47	<0.0011	-	-
Endrin ketone	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	-	-	<0.47	<0.0015	-	-
gamma-BHC (Lindane)	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	-	-	<0.47	<0.010	-	-
Heptachlor	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	-	-	<0.47	<0.0012	-	-
Heptachlor epoxide	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	-	-	<0.47	<0.0013	-	-
Methoxychlor	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	-	-	<0.47	<0.0016	-	-
Toxaphene	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	-	-	<47	<0.12	-	-
Hydrocarbons	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diesel Range Organics [C10-C28]	-	-	No Standard	mg/L	-	-	-	-	-	-	-	0.049	0.2	-

Paramaters	Florida Clean up Standard Marine Surface Water Criteria MCL	Unit	Source	Reporting Unit	SW1 2006 01/07/2006	SW1 2007 01/07/2007	SW1 2008 01/07/2008	SW1 2010 01/07/2010	SW1 2011 01/07/2011	SW1 2011 Duplicate 01/07/2011	SW1 2013 01/07/2013	NS#1 2015 15/04/2015	NS#1 2016 16/12/2016	NS#1 2019 28/08/2019
Gasoline Range Organics (GRO)-C6-C10	-	-	No Standard	mg/L	-	-	-	-	-	-	-	<0.047	<0.050	-
Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	NA	ug/L	Freshwater Surface Water Criteria	mg/L	-	-	-	-	5.2	4.9	4.2	-	-	-
Cyanide, Total	**	ug/L	Freshwater Surface Water Criteria	mg/L	-	-	-	-	<0.01	<0.01	<0.01	<0.0035	-	-
Phenol	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C6-C8 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C5-C7 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
TPH	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Hardness as calcium carbonate	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Nitrogen, Total	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Sulfate	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Total Non-purgeable Organic Carbon	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Unionized Ammonia	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Chlorophyll A	-	mg/m3	-	-	-	-	-	-	-	-	-	-	-	-
Faecal Coliform	-	mpn/100ml	-	-	-	-	-	-	-	-	-	-	-	-
Temperature	-	Degree	-	-	-	-	-	-	-	-	-	-	-	-
4-Methyl-2-pentanone	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Nitrate as N	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Nitrite as N	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Resistivity	-	ohm cm	-	-	-	-	-	-	-	-	-	-	-	-
1-Methylnaphthalene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
2-Methylnaphthalene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthylene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Anthracene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Benzo[a]anthracene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Benzo[a]pyrene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Benzo[b]fluoranthene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Benzo[g,h,i]perylene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Benzo[k]fluoranthene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Fluoranthene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Ideno[1,2,3-cd]pyrene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Napthalene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C10-C12 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C10-C12 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C12-C16 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C12-C16 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C16-C21 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C16-C35 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C21-C35 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C5-C6 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C5-C7 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C6-C8 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C7-C8 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C8-C10 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C8-C10 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sodium	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Paramaters	Florida Clean up Standard Marine Surface Water Criteria MCL	Unit	Source	Reporting Unit	NS#1 2020 27/07/2020	NS#1 Jul-21 14/07/2021	NS#1 Dec-21 30/11/2021	NS#1 Jul-22 01/07/2022	POND near SW1 2015 15/04/2015	POND near SW1 2016 16/12/2016	POND near SW1 2019 28/08/2019	POND near SW1 2020 27/07/2020
Ammonia	N/A	mg/L	SW Cleanup Target Levels	mg/L	10	3.5	3.7	4.8	3	3.3	3.1	10
Nitrogen, Kjeldahl	-	mg/L	-	-	11	4.8	3.5	4.4	6	-	-	11
Nitrate Nitrite as N	N/A	mg/L	SW Cleanup Target Levels	mg/L	<0.010	<0.010	<0.010	<0.01	0.069	0.15	0.15	<0.010
Orthophosphate	-	-	-	mg/L	-	-	-	-	0.083	0.15	0.017	-
Phosphorus	-	-	-	mg/L	0.48	-	0.13	0.34	-	-	-	0.48
Chemical Oxygen Demand	-	-	-	mg/L	180	-	<50	200	240	150	110	180
pH	-	-	-	-	7.6	6.5	7.3	7.2	-	7.6	7.6	7.6
Specific Conductance	-	-	-	umhos/cm	35000	-	44000	42000	-	43000	53000	35000
Total Dissolved Solids	N/A	mg/L	SW Cleanup Target Levels	mg/L	25000	-	30000	27000	36000	25000	440	25000
Total Suspended Solids	-	-	-	mg/L	35	-	140	9	41	-	-	35
Turbidity	29	NTU	62-302.530 SW Quality Criteria*	NTU	110	-	9.1	29	12	7	18	110
Biochemical Oxygen Demand	-	-	-	mg/L	23	-	<240	<24	10	320	<24	23
8260B Volatile Organic Compounds by GC/MS	-	-	-	-	-	-	-	-	-	-	-	-
Acetone	1700	ug/L	SW Cleanup Target Levels	ug/L	-	-	<3.7	<0.0037	-	-	-	-
Acrylonitrile	0.2	ug/L	SW Cleanup Target Levels	ug/L	-	-	<5.5	-	-	-	-	-
Benzene	71.28	ug/L	62-302.530 SW Quality Criteria	ug/L	-	-	<0.27	-	-	-	-	-
Bromochloromethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	-	-	<0.34	-	-	-	-	-
Bromodichloromethane	22	ug/L	62-302.530 SW Quality Criteria	ug/L	-	-	<0.25	-	-	-	-	-
Bromoform	360	ug/L	SW Cleanup Target Levels	ug/L	-	-	<0.59	-	-	-	-	-
Carbon disulfide	110	ug/L	SW Cleanup Target Levels	ug/L	-	-	<0.43	<0.00043	-	-	-	-
Carbon tetrachloride	4.42	ug/L	SW Cleanup Target Levels	ug/L	-	-	<0.30	-	-	-	-	-
Chlorobenzene	17	ug/L	SW Cleanup Target Levels	ug/L	-	-	<0.15	-	-	-	-	-
Chloroethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	-	-	<4.6	-	-	-	-	-
Chloroform	470.8	ug/L	SW Cleanup Target Levels	ug/L	-	-	<0.27	-	-	-	-	-
Dibromochloromethane	34	ug/L	62-302.530 SW Quality Criteria	ug/L	-	-	<0.39	-	-	-	-	-
1,2-Dibromo-3-Chloropropane	N/A	ug/L	SW Cleanup Target Levels	ug/L	-	-	<1.8	-	-	-	-	-
1,2-Dibromoethane (EDB)	13	ug/L	SW Cleanup Target Levels	ug/L	-	-	<0.33	-	-	-	-	-
1,2-Dichlorobenzene	99	ug/L	SW Cleanup Target Levels	ug/L	-	-	<0.31	-	-	-	-	-
1,4-Dichlorobenzene	3	ug/L	SW Cleanup Target Levels	ug/L	-	-	<0.31	<0.00031	-	-	-	-
trans-1,4-Dichloro-2-butene	-	-	No Standard	ug/L	-	-	<1.3	-	-	-	-	-
1,1-Dichloroethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	-	-	<0.33	-	-	-	-	-
1,2-Dichloroethane	37	ug/L	SW Cleanup Target Levels	ug/L	-	-	<0.25	-	-	-	-	-
1,1-Dichloroethene	3.2	ug/L	62-302.530 SW Quality Criteria	ug/L	-	-	<0.33	-	-	-	-	-
cis-1,2-Dichloroethene	N/A	ug/L	SW Cleanup Target Levels	ug/L	-	-	<0.25	-	-	-	-	-
trans-1,2-Dichloroethene	11000	ug/L	SW Cleanup Target Levels	ug/L	-	-	<0.34	-	-	-	-	-
1,2-Dichloropropane	14	ug/L	SW Cleanup Target Levels	ug/L	-	-	<0.22	-	-	-	-	-
cis-1,3-Dichloropropene	12	ug/L	SW Cleanup Target Levels	ug/L	-	-	<0.26	-	-	-	-	-
trans-1,3-Dichloropropene	12	ug/L	SW Cleanup Target Levels	ug/L	-	-	<0.23	-	-	-	-	-
Ethylbenzene	610	ug/L	SW Cleanup Target Levels	ug/L	-	-	<0.20	-	-	-	-	-
2-Hexanone	NA	ug/L	SW Cleanup Target Levels	ug/L	-	-	<3.2	-	-	-	-	-
Bromomethane	35	ug/L	SW Cleanup Target Levels	ug/L	-	-	<3.7	-	-	-	-	-
Chloromethane (methyl chloride)	470.8	ug/L	62-302.530 SW Quality Criteria	ug/L	-	-	<0.54	-	-	-	-	-
Dibromomethane (EDB)	13	ug/L	SW Cleanup Target Levels	ug/L	-	-	<0.34	-	-	-	-	-
Methylene Chloride	1580	ug/L	62-302.530 SW Quality Criteria	ug/L	-	-	<3.2	-	-	-	-	-
Methyl Ethyl Ketone (MEK)	120000	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	-	-	-	-	-
Iodomethane	-	-	No Standard	ug/L	-	-	<3.9	-	-	-	-	-
methyl isobutyl ketone	23000	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	-	-	-	-	-
Styrene	460	ug/L	SW Cleanup Target Levels	ug/L	-	-	<0.27	-	-	-	-	-
1,1,1,2-Tetrachloroethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	-	-	<0.36	-	-	-	-	-
1,1,2,2-Tetrachloroethane	10.8	ug/L	62-302.530 SW Quality Criteria	ug/L	-	-	<0.40	-	-	-	-	-
Tetrachloroethene (Tetrachloroethylene)	8.85	ug/L	62-302.530 SW Quality Criteria	ug/L	-	-	<0.35	-	-	-	-	-
Toluene	480	ug/L	SW Cleanup Target Levels	ug/L	-	-	<0.25	-	-	-	-	-
1,1,1-Trichloroethane	270	ug/L	SW Cleanup Target Levels	ug/L	-	-	<0.21	-	-	-	-	-
1,1,2-Trichloroethane	16	ug/L	SW Cleanup Target Levels	ug/L	-	-	<0.32	-	-	-	-	-
Trichloroethene	80.7	ug/L	62-302.530 SW Quality Criteria	ug/L	-	-	<0.20	-	-	-	-	-
Trichlorofluoromethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	-	-	<0.33	-	-	-	-	-
1,2,3-Trichloropropane	0.2	ug/L	SW Cleanup Target Levels	ug/L	-	-	<0.48	-	-	-	-	-

Paramaters	Florida Clean up Standard Marine Surface Water Criteria			Reporting	NS#1	NS#1	NS#1	NS#1	POND near SW1	POND near SW1	POND near SW1	POND near SW1
					2020	Jul-21	Dec-21	Jul-22	2015	2016	2019	2020
	MCL	Unit	Source	Unit	27/07/2020	14/07/2021	30/11/2021	01/07/2022	15/04/2015	16/12/2016	28/08/2019	27/07/2020
8260B Volatile Organic Compounds	-	-	-	-	-	-	-	-	-	-	-	-
Vinyl acetate	700	ug/L	SW Cleanup Target Levels	ug/L	-	-	<0.69	-	-	-	-	-
Vinyl chloride	2.4	ug/L	SW Cleanup Target Levels	ug/L	-	-	<0.40	-	-	-	-	-
Xylenes, Total	370	ug/L	SW Cleanup Target Levels	ug/L	-	-	<0.23	<0.00023	-	-	-	-
6010B Inductively Coupled Plasma - Atomic Emission Spectrometry- Total	-	-	-	-	-	-	-	-	-	-	-	-
Antimony	4.3	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.0005	-	<0.0005	<0.00052	-	<0.0005	-	<0.0005
Arsenic	0.05	mg/L	62-302.530 SW Quality Criteria	mg/L	0.0032	-	0.003	0.0019	-	0.0024	0.0033	0.0032
Barium	N/A	mg/L	SW Cleanup Target Levels	mg/L	0.02	-	0.011	0.013	-	0.0095	0.013	0.02
Beryllium	0.00013	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.00017	-	<0.00017	<0.0002	-	0.00019	-	<0.00017
Cadmium	0.0088	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.00015	-	<0.00015	<0.000078	-	<0.00015	-	<0.00015
Chromium (Hexavalent)	0.05	mg/L	SW Cleanup Target Levels	mg/L	0.0064	-	-	<0.0026	-	<0.0016	0.0026	0.0064
Cobalt	N/A	mg/L	SW Cleanup Target Levels	mg/L	0.00036	-	<0000.12	<0.00022	-	<0.00012	0.00023	0.00036
Copper	0.0037	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.0017	-	<0.0017	<0.0009	-	<0.0017	-	<0.0017
Iron	0.3	mg/L	62-302.530 SW Quality Criteria	mg/L	0.071	-	-	-	-	-	-	0.071
Lead	0.0085	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.00098	-	<0.00098	<0.00034	-	<0.00098	-	<0.00098
Magnesium	-	-	No Standard	mg/L	-	-	-	-	-	-	1400	-
Nickel	0.0083	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.0019	-	<0.0019	<0.0018	-	<0.0019	-	<0.0019
Selenium	71	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.001	-	0.0014	<0.0012	-	<0.0010	-	<0.001
Silver	0.0004	mg/L	SW Cleanup Target Levels	mg/L	<0.0001	-	<0.0001	<0.00039	-	<0.0001	-	<0.0001
Thallium	0.0063	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.00049	-	<0.00049	<0.00026	-	<0.0053	-	<0.00049
Vanadium	N/A	mg/L	SW Cleanup Target Levels	mg/L	<0.0053	-	<0.0053	<0.0018	-	<0.0096	-	<0.0053
Zinc	0.086	mg/L	SW Cleanup Target Levels	mg/L	<0.0096	-	<0.0096	<0.010	-	<0.00049	0.013	<0.0096
7470A Mercury in Liquid Waste (Manual Cold Vapor Technique)	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	0.000025	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.000080	-	<0.000080	-	-	-	-	<0.000080
PCBs	-	-	-	-	-	-	-	-	-	-	-	-
PCB-1016	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.18	-	<0.15	-	-	-	-	<0.18
PCB-1221	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.14	-	<0.11	-	-	-	-	<0.14
PCB-1232	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.12	-	<0.099	-	-	-	-	<0.12
PCB-1242	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.17	-	<0.14	-	-	-	-	<0.17
PCB-1248	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.075	-	<0.061	-	-	-	-	<0.075
PCB-1254	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.14	-	<0.11	-	-	-	-	<0.14
PCB-1260	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.12	-	<0.099	-	-	-	-	<0.12
Persticides	-	-	-	-	-	-	-	-	-	-	-	-
4,4'-DDD	0.0003	ug/L	Freshwater Surface Water Criteria	ug/L	<0.0072	-	<0.0059	-	-	-	-	<0.0072
4,4'-DDE	0.0002	ug/L	Freshwater Surface Water Criteria	ug/L	<0.0069	-	<0.0057	-	-	-	-	<0.0069
4,4'-DDT	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.0079	-	<0.0065	-	-	-	-	<0.0079
Aldrin	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.0068	-	<0.0056	-	-	-	-	<0.0068
alpha-BHC	0.005	ug/L	Freshwater Surface Water Criteria	ug/L	<0.0073	-	<0.0060	-	-	-	-	<0.0073
beta-BHC	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.011	-	<0.0092	-	-	-	-	<0.011
Chlordane (technical)	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.10	-	<0.084	-	-	-	-	<0.10
delta-BHC	NA	ug/L	Freshwater Surface Water Criteria	ug/L	<0.012	-	<0.0099	-	-	-	-	<0.012
Dieldrin	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.0080	-	<0.0066	-	-	-	-	<0.0080
Endosulfan I	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.0076	-	<0.0063	-	-	-	-	<0.0076
Endosulfan II	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.0079	-	<0.0065	-	-	-	-	<0.0079
Endosulfan sulfate	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.0077	-	<0.0063	-	-	-	-	<0.0077
Endrin	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.0082	-	<0.0067	-	-	-	-	<0.0082
Endrin aldehyde	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.016	-	<0.013	-	-	-	-	<0.016
Endrin ketone	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.0083	-	<0.0068	-	-	-	-	<0.0083
gamma-BHC (Lindane)	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.0077	-	<0.0063	<0.000008	-	-	-	<0.0077
Heptachlor	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.0074	-	<0.0060	-	-	-	-	<0.0074
Heptachlor epoxide	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.0076	-	<0.0062	-	-	-	-	<0.0076
Methoxychlor	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.0087	-	<0.0071	-	-	-	-	<0.0087
Toxaphene	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.18	-	<0.15	-	-	-	-	<0.18
Hydrocarbons	-	-	-	-	-	-	-	-	-	-	-	-
Diesel Range Organics [C10-C28]	-	-	No Standard	mg/L	-	-	-	-	-	0.28	-	-

	Florida Clean up Standard Marine Surface Water Criteria			Reporting	NS#1	NS#1	NS#1	NS#1	POND near SW1	POND near SW1	POND near SW1	POND near SW1
					2020	Jul-21	Dec-21	Jul-22	2015	2016	2019	2020
Paramaters	MCL	Unit	Source	Unit	27/07/2020	14/07/2021	30/11/2021	01/07/2022	15/04/2015	16/12/2016	28/08/2019	27/07/2020
Gasoline Range Organics (GRO)-C6-C10	-	-	No Standard	mg/L	-	-	-	-	-	<0.050	-	-
Other	-	-	-	-	-	-	-	-	-	-	-	-
Boron	NA	ug/L	Freshwater Surface Water Criteria	mg/L	-	-	-	-	-	-	-	-
Cyanide, Total	**	ug/L	Freshwater Surface Water Criteria	mg/L	-	-	-	-	-	-	0.012	-
Phenol	-	ug/L	-	-	-	-	-	-	-	-	-	-
Over C6-C8 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-
Over C5-C7 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-
TPH	-	mg/L	-	-	-	-	-	-	-	-	-	-
Hardness as calcium carbonate	-	mg/L	-	-	-	-	-	6400	-	-	-	-
Nitrogen, Total	-	mg/L	-	-	-	-	-	4.4	-	-	-	-
Sulfate	-	mg/L	-	-	-	-	-	2100	-	-	-	-
Total Non-purgeable Organic Carbon	-	mg/L	-	-	-	-	-	14	-	-	-	-
Unionized Ammonia	-	mg/L	-	-	-	-	-	0.0028	-	-	-	-
Chlorophyll A	-	mg/m3	-	-	-	-	-	34	-	-	-	-
Faecal Coliform	-	mpn/100ml	-	-	-	-	-	>2419.6	-	-	-	-
Temperature	-	Degree	-	-	-	-	-	19.7	-	-	-	-
4-Methyl-2-pentanone	-	ug/L	-	-	-	-	-	-	-	-	-	-
Nitrate as N	-	mg/L	-	-	-	-	-	-	-	-	-	-
Nitrite as N	-	mg/L	-	-	-	-	-	-	-	-	-	-
Resistivity	-	ohm cm	-	-	-	-	-	-	-	-	-	-
1-Methylnaphthalene	-	ug/L	-	-	-	-	-	-	-	-	-	-
2-Methylnaphthalene	-	ug/L	-	-	-	-	-	-	-	-	-	-
Acenaphthene	-	ug/L	-	-	-	-	-	-	-	-	-	-
Acenaphthylene	-	ug/L	-	-	-	-	-	-	-	-	-	-
Anthracene	-	ug/L	-	-	-	-	-	-	-	-	-	-
Benzo[a]anthracene	-	ug/L	-	-	-	-	-	-	-	-	-	-
Benzo[a]pyrene	-	ug/L	-	-	-	-	-	-	-	-	-	-
Benzo[b]fluoranthene	-	ug/L	-	-	-	-	-	-	-	-	-	-
Benzo[g,h,i]perylene	-	ug/L	-	-	-	-	-	-	-	-	-	-
Benzo[k]fluoranthene	-	ug/L	-	-	-	-	-	-	-	-	-	-
Chrysene	-	ug/L	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	-	ug/L	-	-	-	-	-	-	-	-	-	-
Fluoranthene	-	ug/L	-	-	-	-	-	-	-	-	-	-
Fluorene	-	ug/L	-	-	-	-	-	-	-	-	-	-
Ideno[1,2,3-cd]pyrene	-	ug/L	-	-	-	-	-	-	-	-	-	-
Napthalene	-	ug/L	-	-	-	-	-	-	-	-	-	-
Over C10-C12 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-
Over C10-C12 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-
Over C12-C16 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-
Over C12-C16 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-
Over C16-C21 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-
Over C16-C35 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-
Over C21-C35 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-
Over C5-C6 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-
Over C5-C7 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-
Over C6-C8 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-
Over C7-C8 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-
Over C8-C10 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-
Over C8-C10 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-
Phenanthrene	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	-	-	-	-	-	-	-	-	-	-	-	-
Sodium	-	-	-	-	-	-	-	-	-	-	-	-

Paramaters	Florida Clean up Standard Marine Surface Water Criteria MCL	Unit	Source	Reporting Unit	POND near SW1 Jul-21 14/07/2021	POND near SW1 Dec-21 30/11/2021	POND near SW1 Jul-22 01/07/2022	SW2 2006 01/07/2006	SW2 2007 01/07/2007	SW2 2008 01/07/2008	SW2 2010 01/07/2010	SW2 2011 01/07/2011	SW2 2013 01/07/2013
Ammonia	N/A	mg/L	SW Cleanup Target Levels	mg/L	0.23	6	3.3	-	5.1	1.7	4.4	4.5	13
Nitrogen, Kjeldahl	-	mg/L	-	-	4.2	6.8	3.3	12	7.1	2	5	-	-
Nitrate Nitrite as N	N/A	mg/L	SW Cleanup Target Levels	mg/L	<0.010	<0.010	<0.01	<0.050	<0.050	<2.5	<0.050	<0.05	<0.05
Orthophosphate	-	-	-	mg/L	-	-	-	-	0.078	<0.050	<0.050	0.12	0.32
Phosphorus	-	-	-	mg/L	-	0.28 F1	0.29	0.23	0.17	0.11	0.12	-	-
Chemical Oxygen Demand	-	-	-	mg/L	-	<50	150	1000	2000	11000	1200	910	53
pH	-	-	-	-	7.95	7.3	7.2	7.4	7.55	7.75	7.41	7.53	7.41
Specific Conductance	-	-	-	umhos/cm	-	40000	46000	46000	57000	130000	20000	43000	36000
Total Dissolved Solids	N/A	mg/L	SW Cleanup Target Levels	mg/L	-	26000	31000	24000	27000	33000	8900	27000	23000
Total Suspended Solids	-	-	-	mg/L	-	31	56	26	10	23	-	-	-
Turbidity	29	NTU	62-302.530 SW Quality Criteria*	NTU	-	320	38	11	3.2	7.4	58	6.6	75
Biochemical Oxygen Demand	-	-	-	mg/L	-	<240	31	5.4	4.6	<2.0	13	4.7	<2
8260B Volatile Organic Compounds by GC/MS	-	-	-	-	-	-	-	-	-	-	-	-	-
Acetone	1700	ug/L	SW Cleanup Target Levels	ug/L	-	<3.7	<0.0037	-	<25	<25	<25	<25	<25
Acrylonitrile	0.2	ug/L	SW Cleanup Target Levels	ug/L	-	<5.5	-	-	<20	<20	<20	<20	<20
Benzene	71.28	ug/L	62-302.530 SW Quality Criteria	ug/L	-	<0.27	-	-	<1	<1	<1	<1	<1
Bromochloromethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	-	<0.34	-	-	<1	<1	<1	<1	<1
Bromodichloromethane	22	ug/L	62-302.530 SW Quality Criteria	ug/L	-	<0.25	-	-	<1	<1	<1	<1	<1
Bromoform	360	ug/L	SW Cleanup Target Levels	ug/L	-	<0.59	-	-	<1	<1	<1	<1	<1
Carbon disulfide	110	ug/L	SW Cleanup Target Levels	ug/L	-	<0.43	<0.00043	-	<2	<2	<2	<2	<2
Carbon tetrachloride	4.42	ug/L	SW Cleanup Target Levels	ug/L	-	<0.30	-	-	<1	<1	<1	<1	<1
Chlorobenzene	17	ug/L	SW Cleanup Target Levels	ug/L	-	<0.15	-	-	<1	<1	<1	<1	<1
Chloroethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	-	<4.6	-	-	<1	<1	<1	<1	<1
Chloroform	470.8	ug/L	SW Cleanup Target Levels	ug/L	-	<0.27	-	-	<1	<1	<1	<1	<1
Dibromochloromethane	34	ug/L	62-302.530 SW Quality Criteria	ug/L	-	<0.39	-	-	<1	<1	<1	<1	<1
1,2-Dibromo-3-Chloropropane	N/A	ug/L	SW Cleanup Target Levels	ug/L	-	<1.8	-	-	<1	<1	<1	<1	<1
1,2-Dibromoethane (EDB)	13	ug/L	SW Cleanup Target Levels	ug/L	-	<0.33	-	-	<1	<1	<1	<1	<1
1,2-Dichlorobenzene	99	ug/L	SW Cleanup Target Levels	ug/L	-	<0.31	-	-	<1	<1	<1	<1	<1
1,4-Dichlorobenzene	3	ug/L	SW Cleanup Target Levels	ug/L	-	<0.31	<0.00031	-	<1	<1	<1	<1	<1
trans-1,4-Dichloro-2-butene	-	-	No Standard	ug/L	-	<1.3	-	-	<2	<2	<2	<2	<2
1,1-Dichloroethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	-	<0.33	-	-	<1	<1	<1	<1	<1
1,2-Dichloroethane	37	ug/L	SW Cleanup Target Levels	ug/L	-	<0.25	-	-	<1	<1	<1	<1	<1
1,1-Dichloroethene	3.2	ug/L	62-302.530 SW Quality Criteria	ug/L	-	<0.33	-	-	<1	<1	<1	<1	<1
cis-1,2-Dichloroethene	N/A	ug/L	SW Cleanup Target Levels	ug/L	-	<0.25	-	-	<1	<1	<1	<1	<1
trans-1,2-Dichloroethene	11000	ug/L	SW Cleanup Target Levels	ug/L	-	<0.34	-	-	<1	<1	<1	<1	<1
1,2-Dichloropropane	14	ug/L	SW Cleanup Target Levels	ug/L	-	<0.22	-	-	<1	<1	<1	<1	<1
cis-1,3-Dichloropropene	12	ug/L	SW Cleanup Target Levels	ug/L	-	<0.26	-	-	<1	<1	<1	<1	<1
trans-1,3-Dichloropropene	12	ug/L	SW Cleanup Target Levels	ug/L	-	<0.23	-	-	<1	<1	<1	<1	<1
Ethylbenzene	610	ug/L	SW Cleanup Target Levels	ug/L	-	<0.20	-	-	<1	<1	<1	<1	<1
2-Hexanone	NA	ug/L	SW Cleanup Target Levels	ug/L	-	<3.2	-	-	<10	<10	<10	<10	<10
Bromomethane	35	ug/L	SW Cleanup Target Levels	ug/L	-	<3.7	-	-	<1	<1	<1	<1	<1
Chloromethane (methyl chloride)	470.8	ug/L	62-302.530 SW Quality Criteria	ug/L	-	<0.54	-	-	<1	<1	<1	<1	<1
Dibromomethane (EDB)	13	ug/L	SW Cleanup Target Levels	ug/L	-	<0.34	-	-	<1	<1	<1	<1	<1
Methylene Chloride	1580	ug/L	62-302.530 SW Quality Criteria	ug/L	-	<3.2	-	-	<5	<5	<5	<5	<5
Methyl Ethyl Ketone (MEK)	120000	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	-	<10	<10	<10	<10	<10
Iodomethane	-	-	No Standard	ug/L	-	<3.9	-	-	<5	<5	<5	<5	<5
methyl isobutyl ketone	23000	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	-	<10	<10	<10	<10	<10
Styrene	460	ug/L	SW Cleanup Target Levels	ug/L	-	<0.27	-	-	<1	<1	<1	<1	<1
1,1,1,2-Tetrachloroethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	-	<0.36	-	-	<1	<1	<1	<1	<1
1,1,2,2-Tetrachloroethane	10.8	ug/L	62-302.530 SW Quality Criteria	ug/L	-	<0.40	-	-	<1	<1	<1	<1	<1
Tetrachloroethene (Tetrachloroethylene)	8.85	ug/L	62-302.530 SW Quality Criteria	ug/L	-	<0.35	-	-	<1	<1	<1	<1	<1
Toluene	480	ug/L	SW Cleanup Target Levels	ug/L	-	<0.25	-	-	<1	<1	<1	<1	<1
1,1,1-Trichloroethane	270	ug/L	SW Cleanup Target Levels	ug/L	-	<0.21	-	-	<1	<1	<1	<1	<1
1,1,2-Trichloroethane	16	ug/L	SW Cleanup Target Levels	ug/L	-	<0.32	-	-	<1	<1	<1	<1	<1
Trichloroethene	80.7	ug/L	62-302.530 SW Quality Criteria	ug/L	-	<0.20	-	-	<1	<1	<1	<1	<1
Trichlorofluoromethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	-	<0.33	-	-	<1	<1	<1	<1	<1
1,2,3-Trichloropropane	0.2	ug/L	SW Cleanup Target Levels	ug/L	-	<0.48	-	-	<1	<1	<1	<1	<1

Paramaters	Florida Clean up Standard Marine Surface Water Criteria MCL	Unit	Source	Reporting Unit	POND near SW1 Jul-21 14/07/2021	POND near SW1 Dec-21 30/11/2021	POND near SW1 Jul-22 01/07/2022	SW2 2006 01/07/2006	SW2 2007 01/07/2007	SW2 2008 01/07/2008	SW2 2010 01/07/2010	SW2 2011 01/07/2011	SW2 2013 01/07/2013
8260B Volatile Organic Compounds	-	-	-	-	-	-	-	-	-	-	-	-	-
Vinyl acetate	700	ug/L	SW Cleanup Target Levels	ug/L	-	<0.69	-	-	<2	<2	<2	<2	<2
Vinyl chloride	2.4	ug/L	SW Cleanup Target Levels	ug/L	-	<0.40	-	-	<1	<1	<1	<1	<1
Xylenes, Total	370	ug/L	SW Cleanup Target Levels	ug/L	-	<0.23	<0.00023	-	<2	<2	<2	<2	<2
6010B Inductively Coupled Plasma - Atomic Emission Spectrometry- Total	-	-	-	-	-	-	-	-	-	-	-	-	-
Antimony	4.3	mg/L	62-302.530 SW Quality Criteria	mg/L	-	<0.0005	<0.00052	<0.02	<0.0060	<0.0060	<0.0060	<0.02	<0.02
Arsenic	0.05	mg/L	62-302.530 SW Quality Criteria	mg/L	-	0.0044	0.0037	<0.010	<0.010	<0.010	<0.020	<0.02	<0.02
Barium	N/A	mg/L	SW Cleanup Target Levels	mg/L	-	0.014	0.013	0.021	0.018	<0.010	0.018	0.022	0.027
Beryllium	0.00013	mg/L	62-302.530 SW Quality Criteria	mg/L	-	<0.00017	<0.0002	<0.0030	<0.0030	<0.0030	<0.0040	<0.004	<0.004
Cadmium	0.0088	mg/L	62-302.530 SW Quality Criteria	mg/L	-	<0.00015	<0.000078	<0.0050	<0.0050	<0.0050	<0.0050	<0.005	<0.005
Chromium (Hexavalent)	0.05	mg/L	SW Cleanup Target Levels	mg/L	-	-	<0.0026	<0.010	<0.010	<0.010	<0.010	<0.01	<0.01
Cobalt	N/A	mg/L	SW Cleanup Target Levels	mg/L	-	0.00018	<0.00022	<0.010	<0.010	<0.010	<0.010	<0.01	<0.01
Copper	0.0037	mg/L	62-302.530 SW Quality Criteria	mg/L	-	<0.0017	<0.0009	<0.020	<0.020	<0.020	<0.020	<0.02	<0.02
Iron	0.3	mg/L	62-302.530 SW Quality Criteria	mg/L	-	-	-	0.13	0.14	<0.050	0.065	<0.05	<0.05
Lead	0.0085	mg/L	62-302.530 SW Quality Criteria	mg/L	-	<0.00098	<0.00034	<0.0050	<0.0050	<0.0050	<0.010	<0.01	<0.01
Magnesium	-	-	No Standard	mg/L	-	-	-	810	1200	1200	550	970	970
Nickel	0.0083	mg/L	62-302.530 SW Quality Criteria	mg/L	-	<0.0019	<0.0018	<0.040	<0.040	<0.040	<0.040	<0.04	<0.04
Selenium	71	mg/L	62-302.530 SW Quality Criteria	mg/L	-	0.0014	<0.0012	<0.010	<0.010	<0.010	<0.020	0.023	<0.04
Silver	0.0004	mg/L	SW Cleanup Target Levels	mg/L	-	<0.0001	<0.00039	<0.010	<0.010	<0.010	<0.010	<0.01	<0.01
Thallium	0.0063	mg/L	62-302.530 SW Quality Criteria	mg/L	-	<0.00049	<0.00026	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Vanadium	N/A	mg/L	SW Cleanup Target Levels	mg/L	-	<0.0053	<0.0018	<0.010	<0.20	<0.050	<0.010	<0.01	<0.01
Zinc	0.086	mg/L	SW Cleanup Target Levels	mg/L	-	<0.0096	<0.010	<0.020	<0.020	<0.020	0.037	<0.02	<0.02
7470A Mercury in Liquid Waste (Manual Cold Vapor Technique)	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	0.000025	mg/L	62-302.530 SW Quality Criteria	mg/L	-	<0.000080	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
PCBs	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB-1016	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.15	-	-	-	-	-	<0.98	<20
PCB-1221	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.12	-	-	-	-	-	<2	<41
PCB-1232	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.10	-	-	-	-	-	<0.98	<20
PCB-1242	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.14	-	-	-	-	-	<0.98	<20
PCB-1248	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.063	-	-	-	-	-	<0.98	<20
PCB-1254	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.12	-	-	-	-	-	<0.98	<20
PCB-1260	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.10	-	-	-	-	-	<0.98	<20
Persticides	-	-	-	-	-	-	-	-	-	-	-	-	-
4,4'-DDD	0.0003	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.0061	-	-	-	-	-	-	<1
4,4'-DDE	0.0002	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.0059	-	-	-	-	-	-	<1
4,4'-DDT	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.0067	-	-	-	-	-	-	<1
Aldrin	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.0058	-	-	-	-	-	-	<1
alpha-BHC	0.005	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.0062	-	-	-	-	-	-	<1
beta-BHC	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.0095	-	-	-	-	-	-	<1
Chlordane (technical)	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.087	-	-	-	-	-	-	<10
delta-BHC	NA	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.010	-	-	-	-	-	-	<1
Dieldrin	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.0068	-	-	-	-	-	-	<1
Endosulfan I	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.0065	-	-	-	-	-	-	<1
Endosulfan II	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.0067	-	-	-	-	-	-	<1
Endosulfan sulfate	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.0066	-	-	-	-	-	-	<1
Endrin	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.0070	-	-	-	-	-	-	<1
Endrin aldehyde	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.013	-	-	-	-	-	-	<1
Endrin ketone	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.0070	-	-	-	-	-	-	<1
gamma-BHC (Lindane)	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.0066	<0.0000078	-	-	-	-	-	<1
Heptachlor	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.0063	-	-	-	-	-	-	<1
Heptachlor epoxide	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.0064	-	-	-	-	-	-	<1
Methoxychlor	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.0074	-	-	-	-	-	-	<1
Toxaphene	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.15	-	-	-	-	-	-	<100
Hydrocarbons	-	-	-	-	-	-	-	-	-	-	-	-	-
Diesel Range Organics [C10-C28]	-	-	No Standard	mg/L	-	-	-	-	-	-	-	0.33	-

					POND near SW1	POND near SW1	POND near SW1	SW2	SW2	SW2	SW2	SW2	SW2
	Florida Clean up Standard Marine Surface Water Criteria			Reporting	Jul-21	Dec-21	Jul-22	2006	2007	2008	2010	2011	2013
Paramaters	MCL	Unit	Source	Unit	14/07/2021	30/11/2021	01/07/2022	01/07/2006	01/07/2007	01/07/2008	01/07/2010	01/07/2011	01/07/2013
Gasoline Range Organics (GRO)-C6-C10	-	-	No Standard	mg/L	-	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	NA	ug/L	Freshwater Surface Water Criteria	mg/L	-	-	-	-	-	-	-	4.6	4.1
Cyanide, Total	**	ug/L	Freshwater Surface Water Criteria	mg/L	-	-	-	-	-	-	-	<0.01	<0.01
Phenol	-	ug/L	-	-	-	-	-	-	-	-	-	-	-
Over C6-C8 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-
Over C5-C7 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-
TPH	-	mg/L	-	-	-	-	-	-	-	-	-	-	-
Hardness as calcium carbonate	-	mg/L	-	-	-	-	6900	-	-	-	-	-	-
Nitrogen, Total	-	mg/L	-	-	-	-	3.3	-	-	-	-	-	-
Sulfate	-	mg/L	-	-	-	-	2400	-	-	-	-	-	-
Total Non-purgeable Organic Carbon	-	mg/L	-	-	-	-	15	-	-	-	-	-	-
Unionized Ammonia	-	mg/L	-	-	-	-	0.0011	-	-	-	-	-	-
Chlorophyll A	-	mg/m3	-	-	-	-	220	-	-	-	-	-	-
Faecal Coliform	-	mpn/100ml	-	-	-	-	613	-	-	-	-	-	-
Temperature	-	Degree	-	-	-	-	20	-	-	-	-	-	-
4-Methyl-2-pentanone	-	ug/L	-	-	-	-	-	-	-	-	-	-	-
Nitrate as N	-	mg/L	-	-	-	-	-	-	-	-	-	-	-
Nitrite as N	-	mg/L	-	-	-	-	-	-	-	-	-	-	-
Resistivity	-	ohm cm	-	-	-	-	-	-	-	-	-	-	-
1-Methylnaphthalene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-
2-Methylnaphthalene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-
Acenaphthene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-
Acenaphthylene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-
Anthracene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-
Benzo[a]anthracene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-
Benzo[a]pyrene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-
Benzo[b]fluoranthene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-
Benzo[g,h,i]perylene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-
Benzo[k]fluoranthene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-
Chrysene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-
Fluoranthene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-
Fluorene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-
Ideno[1,2,3-cd]pyrene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-
Napthalene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-
Over C10-C12 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-
Over C10-C12 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-
Over C12-C16 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-
Over C12-C16 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-
Over C16-C21 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-
Over C16-C35 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-
Over C21-C35 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-
Over C5-C6 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-
Over C5-C7 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-
Over C6-C8 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-
Over C7-C8 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-
Over C8-C10 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-
Over C8-C10 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	-	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	-	-	-	-	-	-	-	-	-	-	-	-	-
Sodium	-	-	-	-	-	-	-	-	-	-	-	-	-

	Florida Clean up Standard Marine Surface Water Criteria			Reporting	SW2	SW2	SW2	SW2	SW2	SW2	SW2	SW3	SW3	SW3
					2015	2016	2019	2020	Jul-21	Dec-21	Jul-22	2006	2007	2008
Paramaters	MCL	Unit	Source	Unit	15/04/2015	16/12/2016	28/08/2019	27/07/2020	14/07/2021	30/11/2021	01/07/2022	01/07/2006	01/07/2007	01/07/2008
Ammonia	N/A	mg/L	SW Cleanup Target Levels	mg/L	3	7.8	10	9.7	13	13	5	-	5	4.7
Nitrogen, Kjeldahl	-	mg/L	-	-	10	-	-	14	16	14	9.3	11	7.9	4.7
Nitrate Nitrite as N	N/A	mg/L	SW Cleanup Target Levels	mg/L	<0.018	0.11	0.023	0.02	0.062	<0.010	<0.010	<0.050	<0.050	<2.5
Orthophosphate	-	-	-	mg/L	0.12	0.22	0.2	-	-	-	-	-	<0.050	<0.050
Phosphorus	-	-	-	mg/L	-	-	-	0.49	-	0.14	0.45	0.24	0.14	0.26
Chemical Oxygen Demand	-	-	-	mg/L	270	210	110	200	-	140	<50	1100	2000	1000
pH	-	-	-	-	-	7.7	7.4	7.5	7.88	7.3	7.3	7.57	7.43	7.56
Specific Conductance	-	-	-	umhos/cm	-	37000	43000	33000	-	31000 ^2 B	38000 BΛ2	47000	46000	110000
Total Dissolved Solids	N/A	mg/L	SW Cleanup Target Levels	mg/L	32000	33000	520	19000	-	19000	24000	24000	27000	21000
Total Suspended Solids	-	-	-	mg/L	20	-	-	13	-	8.6	25	32	10	18
Turbidity	29	NTU	62-302.530 SW Quality Criteria*	NTU	25	69	81	75	-	60	25	130	5.8	11
Biochemical Oxygen Demand	-	-	-	mg/L	10	250	<24	25	-	39 b	130	31	6.8	<2.0
8260B Volatile Organic Compounds by GC/MS	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acetone	1700	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<7.0	-	<3.7	<0.0037	-	<25	<25
Acrylonitrile	0.2	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<10	-	<5.5	-	-	<20	<20
Benzene	71.28	ug/L	62-302.530 SW Quality Criteria	ug/L	-	-	-	<0.43	-	<0.27	-	-	<1	<1
Bromochloromethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.45	-	<0.34	-	-	<1	<1
Bromodichloromethane	22	ug/L	62-302.530 SW Quality Criteria	ug/L	-	-	-	<0.44	-	<0.25	-	-	<1	<1
Bromoform	360	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.43	-	<0.59	-	-	<1	<1
Carbon disulfide	110	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<1.0	-	<0.43	0.0014	-	<2	<2
Carbon tetrachloride	4.42	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.33	-	<0.30	-	-	<1	<1
Chlorobenzene	17	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.26	-	<0.15	-	-	<1	<1
Chloroethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<2.5	-	<4.6	-	-	<1	<1
Chloroform	470.8	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.50	-	<0.27	-	-	<1	<1
Dibromochloromethane	34	ug/L	62-302.530 SW Quality Criteria	ug/L	-	-	-	<0.32	-	<0.39	-	-	<1	<1
1,2-Dibromo-3-Chloropropane	N/A	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<1.1	-	<1.8	-	-	<1	<1
1,2-Dibromoethane (EDB)	13	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.44	-	<0.33	-	-	<1	<1
1,2-Dichlorobenzene	99	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.37	-	<0.31	-	-	<1	<1
1,4-Dichlorobenzene	3	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.46	-	<0.31	<0.00031	-	<1	<1
trans-1,4-Dichloro-2-butene	-	-	No Standard	ug/L	-	-	-	<0.51	-	<1.3	-	-	<2	<2
1,1-Dichloroethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.38	-	<0.33	-	-	<1	<1
1,2-Dichloroethane	37	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.50	-	<0.25	-	-	<1	<1
1,1-Dichloroethene	3.2	ug/L	62-302.530 SW Quality Criteria	ug/L	-	-	-	<0.36	-	<0.33	-	-	<1	<1
cis-1,2-Dichloroethene	N/A	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.41	-	<0.25	-	-	<1	<1
trans-1,2-Dichloroethene	11000	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.37	-	<0.34	-	-	<1	<1
1,2-Dichloropropane	14	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.67	-	<0.22	-	-	<1	<1
cis-1,3-Dichloropropene	12	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.40	-	<0.26	-	-	<1	<1
trans-1,3-Dichloropropene	12	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.42	-	<0.23	-	-	<1	<1
Ethylbenzene	610	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.33	-	<0.20	-	-	<1	<1
2-Hexanone	NA	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<2.0	-	<3.2	-	-	<10	<10
Bromomethane	35	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<2.5	-	<3.7	-	-	<1	<1
Chloromethane (methyl chloride)	470.8	ug/L	62-302.530 SW Quality Criteria	ug/L	-	-	-	<0.40	-	<0.54	-	-	<1	<1
Dibromomethane (EDB)	13	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.35	-	<0.34	-	-	<1	<1
Methylene Chloride	1580	ug/L	62-302.530 SW Quality Criteria	ug/L	-	-	-	<2.5	-	<3.2	-	-	<5	<5
Methyl Ethyl Ketone (MEK)	120000	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	-	-	-	-	-	<10	<10
Iodomethane	-	-	No Standard	ug/L	-	-	-	<5.0	-	<3.9	-	-	<5	<5
methyl isobutyl ketone	23000	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	-	-	-	-	-	<10	<10
Styrene	460	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.27	-	<0.27	-	-	<1	<1
1,1,1,2-Tetrachloroethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.37	-	<0.36	-	-	<1	<1
1,1,2,2-Tetrachloroethane	10.8	ug/L	62-302.530 SW Quality Criteria	ug/L	-	-	-	<0.62	-	<0.40	-	-	<1	<1
Tetrachloroethene (Tetrachloroethylene)	8.85	ug/L	62-302.530 SW Quality Criteria	ug/L	-	-	-	<0.74	-	<0.35	-	-	<1	<1
Toluene	480	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.48	-	<0.25	-	-	<1	<1
1,1,1-Trichloroethane	270	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.37	-	<0.21	-	-	<1	<1
1,1,2-Trichloroethane	16	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.33	-	<0.32	-	-	<1	<1
Trichloroethene	80.7	ug/L	62-302.530 SW Quality Criteria	ug/L	-	-	-	<0.48	-	<0.20	-	-	<1	<1
Trichlorofluoromethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.42	-	<0.33	-	-	<1	<1
1,2,3-Trichloropropane	0.2	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.39	-	<0.48	-	-	<1	<1

					SW2	SW2	SW2	SW2	SW2	SW2	SW2	SW3	SW3	SW3
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Paramaters	MCL	Unit	Source	Unit	15/04/2015	16/12/2016	28/08/2019	27/07/2020	14/07/2021	30/11/2021	01/07/2022	01/07/2006	01/07/2007	01/07/2008
8260B Volatile Organic Compounds	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vinyl acetate	700	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.81	-	<0.69	-	-	<2	<2
Vinyl chloride	2.4	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.50	-	<0.40	-	-	<1	<1
Xylenes, Total	370	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.23	-	<0.23	<0.00023	-	<2	<2
6010B Inductively Coupled Plasma - Atomic Emission Spectrometry- Total	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Antimony	4.3	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.010	<0.0005	-	<0.0005	-	<0.0005	<0.00052	<0.02	<0.0060	<0.0060
Arsenic	0.05	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.0040	0.0041	0.0027	0.0031	-	0.0042	0.002	<0.010	<0.010	<0.010
Barium	N/A	mg/L	SW Cleanup Target Levels	mg/L	0.02	0.019	0.018	0.022	-	0.027	0.022	0.021	0.025	0.025
Beryllium	0.00013	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.0010	<0.00017	-	<0.00017	-	<0.00017	<0.0002	<0.0030	<0.0030	<0.0030
Cadmium	0.0088	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.0010	<0.00015	-	<0.00015	-	<0.00015	<0.000078	<0.0050	<0.0050	<0.0050
Chromium (Hexavalent)	0.05	mg/L	SW Cleanup Target Levels	mg/L	0.0069	0.0048	0.0037	0.0079	-	-	0.0031	<0.010	<0.010	<0.010
Cobalt	N/A	mg/L	SW Cleanup Target Levels	mg/L	<0.0030	0.00021	0.00025	0.00038	-	0.00042	0.00023	<0.010	<0.010	<0.010
Copper	0.0037	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.0020	<0.0017	-	<0.0017	-	<0.0017	<0.0009	<0.020	<0.020	<0.020
Iron	0.3	mg/L	62-302.530 SW Quality Criteria	mg/L	-	-	-	0.037	-	-	-	<0.050	0.1	<0.050
Lead	0.0085	mg/L	62-302.530 SW Quality Criteria	mg/L	0.0036	<0.00096	-	<0.00098	-	<0.00098	<0.00034	<0.0050	<0.0050	<0.0050
Magnesium	-	-	No Standard	mg/L	-	-	1000	-	-	-	-	770	1100	840
Nickel	0.0083	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.0030	<0.0019	-	<0.0019	-	<0.0019	<0.0018	<0.040	<0.040	<0.040
Selenium	71	mg/L	62-302.530 SW Quality Criteria	mg/L	0.0049	<0.001	-	<0.001	-	0.0015	<0.0012	<0.010	<0.010	<0.010
Silver	0.0004	mg/L	SW Cleanup Target Levels	mg/L	<0.0020	<0.0001	-	<0.0001	-	<0.0001	<0.00039	<0.010	<0.010	<0.010
Thallium	0.0063	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.0040	<0.00049	-	<0.00049	-	<0.00049	<0.00026	<0.025	<0.025	<0.025
Vanadium	N/A	mg/L	SW Cleanup Target Levels	mg/L	<0.0030	<0.0053	-	0.0056	-	<0.0053	0.0019	<0.010	<0.20	<0.050
Zinc	0.086	mg/L	SW Cleanup Target Levels	mg/L	<0.0080	<0.0096	-	<0.0096	-	<0.0096	<0.010	<0.020	<0.020	<0.020
7470A Mercury in Liquid Waste (Manual Cold Vapor Technique)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	0.000025	mg/L	62-302.530 SW Quality Criteria	mg/L	-	-	0.000083	<0.000080	-	<0.000080	-	<0.0002	<0.0002	<0.0002
PCBs	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB-1016	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	<0.18	-	<0.15	-	-	-	-
PCB-1221	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	<0.14	-	<0.12	-	-	-	-
PCB-1232	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	<0.12	-	<0.10	-	-	-	-
PCB-1242	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	<0.17	-	<0.14	-	-	-	-
PCB-1248	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	<0.075	-	<0.063	-	-	-	-
PCB-1254	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	<0.14	-	<0.12	-	-	-	-
PCB-1260	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	<0.12	-	<0.10	-	-	-	-
Persticides	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4,4'-DDD	0.0003	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	-	<0.0060	-	-	-	-
4,4'-DDE	0.0002	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	-	<0.0058	-	-	-	-
4,4'-DDT	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	-	<0.0067	-	-	-	-
Aldrin	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	-	<0.0057	-	-	-	-
alpha-BHC	0.005	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	-	<0.0061	-	-	-	-
beta-BHC	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	-	<0.0094	-	-	-	-
Chlordane (technical)	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	-	<0.086	-	-	-	-
delta-BHC	NA	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	-	<0.010	-	-	-	-
Dieldrin	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	-	<0.0067	-	-	-	-
Endosulfan I	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	-	<0.0064	-	-	-	-
Endosulfan II	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	-	<0.0067	-	-	-	-
Endosulfan sulfate	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	-	<0.0065	-	-	-	-
Endrin	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	-	<0.0069	-	-	-	-
Endrin aldehyde	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	-	<0.013	-	-	-	-
Endrin ketone	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	-	<0.0070	-	-	-	-
gamma-BHC (Lindane)	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	-	<0.0065	<0.0000080	-	-	-
Heptachlor	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	-	<0.0062	-	-	-	-
Heptachlor epoxide	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	-	<0.0064	-	-	-	-
Methoxychlor	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	-	<0.0073	-	-	-	-
Toxaphene	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	-	<0.15	-	-	-	-
Hydrocarbons	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diesel Range Organics [C10-C28]	-	-	No Standard	mg/L	-	1.3	-	-	-	-	-	-	-	-

					SW2	SW2	SW2	SW2	SW2	SW2	SW2	SW3	SW3	SW3
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Gasoline Range Organics (GRO)-C6-C10	-	-	No Standard	mg/L	-	<0.05	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	NA	ug/L	Freshwater Surface Water Criteria	mg/L	-	-	-	-	-	-	-	-	-	-
Cyanide, Total	**	ug/L	Freshwater Surface Water Criteria	mg/L	-	-	-	-	-	-	-	-	-	-
Phenol	-	ug/L	-	-	-	-	-	-	-	-	0.00017	-	-	-
Over C6-C8 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C5-C7 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
TPH	-	mg/L	-	-	-	-	-	-	-	-	<2.6	-	-	-
Hardness as calcium carbonate	-	mg/L	-	-	-	-	-	-	-	-	4500	-	-	-
Nitrogen, Total	-	mg/L	-	-	-	-	-	-	-	-	9.3	-	-	-
Sulfate	-	mg/L	-	-	-	-	-	-	-	-	1700	-	-	-
Total Non-purgeable Organic Carbon	-	mg/L	-	-	-	-	-	-	-	-	24	-	-	-
Unionized Ammonia	-	mg/L	-	-	-	-	-	-	-	-	0.006	-	-	-
Chlorophyll A	-	mg/m3	-	-	-	-	-	-	-	-	90	-	-	-
Faecal Coliform	-	mpn/100ml	-	-	-	-	-	-	-	-	1414	-	-	-
Temperature	-	Degree	-	-	-	-	-	-	-	-	20	-	-	-
4-Methyl-2-pentanone	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Nitrate as N	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Nitrite as N	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Resistivity	-	ohm cm	-	-	-	-	-	-	-	-	-	-	-	-
1-Methylnaphthalene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
2-Methylnaphthalene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthylene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Anthracene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Benzo[a]anthracene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Benzo[a]pyrene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Benzo[b]fluoranthene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Benzo[g,h,i]perylene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Benzo[k]fluoranthene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Fluoranthene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Ideno[1,2,3-cd]pyrene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Napthalene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C10-C12 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C10-C12 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C12-C16 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C12-C16 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C16-C21 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C16-C35 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C21-C35 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C5-C6 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C5-C7 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C6-C8 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C7-C8 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C8-C10 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C8-C10 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sodium	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Paramaters	Florida Clean up Standard Marine Surface Water Criteria MCL	Unit	Source	Reporting Unit	SW3 2010 01/07/2010	SW3 2011 01/07/2011	SW3 2013 01/07/2013	SW3 2015 15/04/2015	SW3 2016 16/12/2016	SW3 2019 28/08/2019	SW3 2020 27/07/2020	SW3 Jul-21 14/07/2021	SW3 Dec-21 30/11/2021	SW3 Jul-22 01/07/2022
Ammonia	N/A	mg/L	SW Cleanup Target Levels	mg/L	0.44	2	6.5	4.8	7	6.4	3.7	13	11	1.8
Nitrogen, Kjeldahl	-	mg/L	-	-	2.5	-	-	9.4	-	-	6.5	19	14	4.4
Nitrate Nitrite as N	N/A	mg/L	SW Cleanup Target Levels	mg/L	<0.050	<0.05	<0.05	<0.018	<0.10	0.032	<0.010	<0.010	<0.010	<0.010
Orthophosphate	-	-	-	mg/L	<0.050	<0.05	0.069	0.031	0.023	0.029	-	-	-	-
Phosphorus	-	-	-	mg/L	0.1	-	-	-	-	-	0.21	-	<0.041	0.15
Chemical Oxygen Demand	-	-	-	mg/L	1200	590	23	240	240	<50	200	-	280	<50
pH	-	-	-	-	7.4	7.63	7.34	-	7	7.4	7.5	7.64	7.3	7.2
Specific Conductance	-	-	-	umhos/cm	15000	31000	33000	-	36000	45000	32000	-	31000	39000
Total Dissolved Solids	N/A	mg/L	SW Cleanup Target Levels	mg/L	3900	17000	23000	31000	29000	420	17000	-	19000	25000
Total Suspended Solids	-	-	-	mg/L	-	-	-	53	-	-	16	-	42	36
Turbidity	29	NTU	62-302.530 SW Quality Criteria*	NTU	6.6	240	15	21	15	36	47	-	55	36
Biochemical Oxygen Demand	-	-	-	mg/L	2.5	36	22	15	310	<24	19	-	35	64
8260B Volatile Organic Compounds by GC/MS	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acetone	1700	ug/L	SW Cleanup Target Levels	ug/L	<25	<25	<25	-	-	-	<7.0	-	<3.7	<0.0037
Acrylonitrile	0.2	ug/L	SW Cleanup Target Levels	ug/L	<20	<20	<20	-	-	-	<10	-	<5.5	-
Benzene	71.28	ug/L	62-302.530 SW Quality Criteria	ug/L	<1	<1	<1	<0.38	-	-	<0.43	-	<0.27	-
Bromochloromethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<0.52	-	-	<0.45	-	<0.34	-
Bromodichloromethane	22	ug/L	62-302.530 SW Quality Criteria	ug/L	<1	<1	<1	<0.50	-	-	<0.44	-	<0.25	-
Bromoform	360	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<0.71	-	-	<0.43	-	<0.59	-
Carbon disulfide	110	ug/L	SW Cleanup Target Levels	ug/L	<2	<2	<2	-	-	-	<1.0	-	<0.43	<0.00043
Carbon tetrachloride	4.42	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<0.50	-	-	<0.33	-	<0.30	-
Chlorobenzene	17	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<0.50	-	-	<0.26	-	<0.15	-
Chloroethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<0.76	-	-	<2.5	-	<4.6	-
Chloroform	470.8	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<0.60	-	-	<0.50	-	<0.27	-
Dibromochloromethane	34	ug/L	62-302.530 SW Quality Criteria	ug/L	<1	<1	<1	<0.50	-	-	<0.32	-	<0.39	-
1,2-Dibromo-3-Chloropropane	N/A	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	-	-	-	<1.1	-	<1.8	-
1,2-Dibromoethane (EDB)	13	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	-	-	-	<0.44	-	<0.33	-
1,2-Dichlorobenzene	99	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<0.50	-	-	<0.37	-	<0.31	-
1,4-Dichlorobenzene	3	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<0.64	-	-	<0.46	-	<0.31	<0.00031
trans-1,4-Dichloro-2-butene	-	-	No Standard	ug/L	<2	<2	<2	-	-	-	<0.51	-	<1.3	-
1,1-Dichloroethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<0.50	-	-	<0.38	-	<0.33	-
1,2-Dichloroethane	37	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<0.50	-	-	<0.50	-	<0.25	-
1,1-Dichloroethene	3.2	ug/L	62-302.530 SW Quality Criteria	ug/L	<1	<1	<1	<0.50	-	-	<0.36	-	<0.33	-
cis-1,2-Dichloroethene	N/A	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<0.50	-	-	<0.41	-	<0.25	-
trans-1,2-Dichloroethene	11000	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<0.50	-	-	<0.37	-	<0.34	-
1,2-Dichloropropane	14	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<0.50	-	-	<0.67	-	<0.22	-
cis-1,3-Dichloropropene	12	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<0.50	-	-	<0.40	-	<0.26	-
trans-1,3-Dichloropropene	12	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<0.50	-	-	<0.42	-	<0.23	-
Ethylbenzene	610	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<0.50	-	-	<0.33	-	<0.20	-
2-Hexanone	NA	ug/L	SW Cleanup Target Levels	ug/L	<10	<10	<10	-	-	-	<2.0	-	<3.2	-
Bromomethane	35	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<0.98	-	-	<2.5	-	<3.7	-
Chloromethane (methyl chloride)	470.8	ug/L	62-302.530 SW Quality Criteria	ug/L	<1	<1	<1	<0.52	-	-	<0.40	-	<0.54	-
Dibromomethane (EDB)	13	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<0.59	-	-	<0.35	-	<0.34	-
Methylene Chloride	1580	ug/L	62-302.530 SW Quality Criteria	ug/L	<5	<5	<5	<3.0	-	-	<2.5	-	<3.2	-
Methyl Ethyl Ketone (MEK)	120000	ug/L	SW Cleanup Target Levels	ug/L	<10	<10	<10	-	-	-	-	-	-	-
Iodomethane	-	-	No Standard	ug/L	<5	<5	<5	-	-	-	<5.0	-	<3.9	-
methyl isobutyl ketone	23000	ug/L	SW Cleanup Target Levels	ug/L	<10	<10	<10	-	-	-	-	-	-	-
Styrene	460	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<1.0	-	-	<0.27	-	<0.27	-
1,1,1,2-Tetrachloroethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<0.52	-	-	<0.37	-	<0.36	-
1,1,2,2-Tetrachloroethane	10.8	ug/L	62-302.530 SW Quality Criteria	ug/L	<1	<1	<1	<0.50	-	-	<0.62	-	<0.40	-
Tetrachloroethene (Tetrachloroethylene)	8.85	ug/L	62-302.530 SW Quality Criteria	ug/L	<1	<1	<1	<0.58	-	-	<0.74	-	<0.35	-
Toluene	480	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<0.70	-	-	<0.48	-	<0.25	-
1,1,1-Trichloroethane	270	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<0.50	-	-	<0.37	-	<0.21	-
1,1,2-Trichloroethane	16	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<0.50	-	-	<0.33	-	<0.32	-
Trichloroethene	80.7	ug/L	62-302.530 SW Quality Criteria	ug/L	<1	<1	<1	<0.50	-	-	<0.48	-	<0.20	-
Trichlorofluoromethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<0.52	-	-	<0.42	-	<0.33	-
1,2,3-Trichloropropane	0.2	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<0.84	-	-	<0.39	-	<0.48	-

Paramaters	Florida Clean up Standard Marine Surface Water Criteria			Reporting Unit	SW3	SW3	SW3	SW3	SW3	SW3	SW3	SW3	SW3	SW3
					2010	2011	2013	2015	2016	2019	2020	Jul-21	Dec-21	Jul-22
	MCL	Unit	Source		01/07/2010	01/07/2011	01/07/2013	15/04/2015	16/12/2016	28/08/2019	27/07/2020	14/07/2021	30/11/2021	01/07/2022
8260B Volatile Organic Compounds	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vinyl acetate	700	ug/L	SW Cleanup Target Levels	ug/L	<2	<2	<2	-	-	-	<0.81	-	<0.69	-
Vinyl chloride	2.4	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<0.50	-	-	<0.50	-	<0.40	-
Xylenes, Total	370	ug/L	SW Cleanup Target Levels	ug/L	<2	<2	<2	-	-	-	<0.23	-	<0.23	<0.00023
6010B Inductively Coupled Plasma - Atomic Emission Spectrometry- Total	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Antimony	4.3	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.02	<0.02	<0.02	-	<0.0005	-	<0.0005	-	<0.0005	<0.00052
Arsenic	0.05	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.02	<0.02	<0.02	-	0.0033	0.0031	0.0024	-	0.004	0.0016
Barium	N/A	mg/L	SW Cleanup Target Levels	mg/L	0.011	0.021	0.029	-	0.023	0.019	0.021	-	0.034	0.02
Beryllium	0.00013	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.0040	<0.004	<0.004	-	0.00023	-	<0.00017	-	<0.00017	0.00021
Cadmium	0.0088	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.005	<0.005	<0.005	-	<0.00015	-	<0.00015	-	<0.00015	<0.000078
Chromium (Hexavalent)	0.05	mg/L	SW Cleanup Target Levels	mg/L	<0.010	<0.01	<0.01	-	0.0035	0.003	0.0039	-	-	<0.0026
Cobalt	N/A	mg/L	SW Cleanup Target Levels	mg/L	<0.010	<0.01	<0.01	-	0.00018	0.00025	0.00022	-	0.00035	<0.00022
Copper	0.0037	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.020	<0.02	<0.02	-	<0.0017	-	<0.0017	-	<0.0017	<0.009
Iron	0.3	mg/L	62-302.530 SW Quality Criteria	mg/L	0.087	<0.05	<0.05	-	-	-	0.077	-	-	-
Lead	0.0085	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.010	<0.01	<0.01	-	<0.00096	-	<0.00098	-	<0.00098	<0.00034
Magnesium	-	-	No Standard	mg/L	370	660	860	-	-	1000	-	-	-	-
Nickel	0.0083	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.040	<0.04	<0.04	-	<0.0019	-	<0.0019	-	<0.0019	<0.0018
Selenium	71	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.020	<0.02	<0.04	-	<0.001	-	<0.001	-	0.0017	<0.0012
Silver	0.0004	mg/L	SW Cleanup Target Levels	mg/L	<0.010	<0.01	<0.01	-	<0.0001	-	<0.0001	-	<0.0001	<0.00039
Thallium	0.0063	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.025	<0.025	<0.025	-	<0.00049	-	<0.00049	-	<0.00049	<0.00026
Vanadium	N/A	mg/L	SW Cleanup Target Levels	mg/L	<0.010	<0.01	<0.01	-	<0.0053	-	<0.0053	-	<0.0053	<0.0018
Zinc	0.086	mg/L	SW Cleanup Target Levels	mg/L	<0.020	<0.02	<0.02	-	<0.0096	-	<0.0096	-	<0.0096	<0.010
7470A Mercury in Liquid Waste (Manual Cold Vapor Technique)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	0.000025	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.0002	<0.0002	<0.0002	-	-	-	<0.000080	-	<0.000080	-
PCBs	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB-1016	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.96	<19	-	-	-	<0.18	-	<3.0	-
PCB-1221	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<1.9	<37	-	-	-	<0.14	-	<2.4	-
PCB-1232	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.96	<19	-	-	-	<0.12	-	<2.1	-
PCB-1242	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.96	<19	-	-	-	<0.17	-	<2.9	-
PCB-1248	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.96	<19	-	-	-	<0.075	-	<1.3	-
PCB-1254	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.96	<19	-	-	-	<0.14	-	<2.4	-
PCB-1260	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.96	<19	-	-	-	<0.12	-	<2.1	-
Persticides	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4,4'-DDD	0.0003	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.94	-	-	-	<0.0072	-	<0.12	-
4,4'-DDE	0.0002	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.94	-	-	-	<0.0070	-	<0.12	-
4,4'-DDT	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.94	-	-	-	<0.0080	-	<0.14 *+	-
Aldrin	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.94	-	-	-	<0.0069	-	<0.12	-
alpha-BHC	0.005	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.94	-	-	-	<0.0073	-	<0.12	-
beta-BHC	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.94	-	-	-	<0.011	-	<0.19	-
Chlordane (technical)	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<9.4	-	-	-	<0.10	-	<1.7	-
delta-BHC	NA	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.94	-	-	-	<0.012	-	<0.21	-
Dieldrin	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.94	-	-	-	<0.0081	-	<0.14	-
Endosulfan I	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.94	-	-	-	<0.0077	-	<0.13	-
Endosulfan II	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.94	-	-	-	<0.0080	-	<0.14	-
Endosulfan sulfate	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.94	-	-	-	<0.0078	-	<0.13	-
Endrin	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.94	-	-	-	<0.0083	-	<0.14	-
Endrin aldehyde	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.94	-	-	-	<0.016	-	<0.27	-
Endrin ketone	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.94	-	-	-	<0.0084 *	-	<0.14	-
gamma-BHC (Lindane)	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.94	-	-	-	<0.0078	-	<0.13	<0.0000085
Heptachlor	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.94	-	-	-	<0.0074	-	<0.13	-
Heptachlor epoxide	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.94	-	-	-	<0.0076	-	<0.13	-
Methoxychlor	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.94	-	-	-	<0.0087	-	<0.15 *+	-
Toxaphene	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<94	-	-	-	<0.18	-	<3.0	-
Hydrocarbons	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diesel Range Organics [C10-C28]	-	-	No Standard	mg/L	-	-	-	0.05	0.64	-	-	-	-	-

Paramaters	Florida Clean up Standard Marine Surface Water Criteria			Reporting Unit	SW3 2010 01/07/2010	SW3 2011 01/07/2011	SW3 2013 01/07/2013	SW3 2015 15/04/2015	SW3 2016 16/12/2016	SW3 2019 28/08/2019	SW3 2020 27/07/2020	SW3 Jul-21 14/07/2021	SW3 Dec-21 30/11/2021	SW3 Jul-22 01/07/2022
	MCL	Unit	Source											
Gasoline Range Organics (GRO)-C6-C10	-	-	No Standard	mg/L	-	-	-	-	<0.05	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	NA	ug/L	Freshwater Surface Water Criteria	mg/L	-	3.2	3.7	-	-	-	-	-	-	-
Cyanide, Total	**	ug/L	Freshwater Surface Water Criteria	mg/L	-	<0.01	<0.01	<0.0035	-	-	-	-	-	-
Phenol	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	0.00026
Over C6-C8 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	<0.26
Over C5-C7 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	0.33
TPH	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	<2.7
Hardness as calcium carbonate	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	5400
Nitrogen, Total	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	4.4
Sulfate	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	2000
Total Non-purgeable Organic Carbon	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	22
Unionized Ammonia	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	0.0076
Chlorophyll A	-	mg/m3	-	-	-	-	-	-	-	-	-	-	-	120
Faecal Coliform	-	mpn/100ml	-	-	-	-	-	-	-	-	-	-	-	1553
Temperature	-	Degree	-	-	-	-	-	-	-	-	-	-	-	20.2
4-Methyl-2-pentanone	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Nitrate as N	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Nitrite as N	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Resistivity	-	ohm cm	-	-	-	-	-	-	-	-	-	-	-	-
1-Methylnaphthalene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
2-Methylnaphthalene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthylene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Anthracene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Benzo[a]anthracene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Benzo[a]pyrene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Benzo[b]fluoranthene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Benzo[g,h,i]perylene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Benzo[k]fluoranthene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Fluoranthene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Ideno[1,2,3-cd]pyrene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Napthalene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C10-C12 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C10-C12 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C12-C16 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C12-C16 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C16-C21 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C16-C35 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C21-C35 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C5-C6 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C5-C7 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C6-C8 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C7-C8 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C8-C10 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C8-C10 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sodium	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Paramaters	Florida Clean up Standard Marine Surface Water Criteria			Reporting Unit	SW12	SW12	SW12	SW12	SW12	SW12	SW12	SW12	SW12	SW12
					2010	2011	2013	2015	2016	2019	2020	Jul-21	Dec-21	Jul-22
	MCL	Unit	Source		01/07/2010	01/07/2011	01/07/2013	15/04/2015	16/12/2016	28/08/2019	27/07/2020	14/07/2021	30/11/2021	01/07/2022
Ammonia	N/A	mg/L	SW Cleanup Target Levels	mg/L	0.39	1.4	3.6	2	1.7	0.4	0.65	0.49	1.2	0.53
Nitrogen, Kjeldahl	-	mg/L	-	-	1.9	-	-	5.5	-	-	3.2	4.1	<0.010	2.6
Nitrate Nitrite as N	N/A	mg/L	SW Cleanup Target Levels	mg/L	<2.5	<0.05	0.067	<0.018	0.05	<0.010	<0.010	<0.010	2.1	<0.010
Orthophosphate	-	-	-	mg/L	<0.050	<0.05	<0.05	0.031	<0.016	<0.016	-	-	-	-
Phosphorus	-	-	-	mg/L	0.12	-	-	-	-	-	0.13	-	7.9	0.22
Chemical Oxygen Demand	-	-	-	mg/L	210	240	220	39	160	200	100	-	57	160
pH	-	-	-	-	7.93	8.02	8.12	-	8.1	1.4	8.1	8.00	<1.3	8.5
Specific Conductance	-	-	-	umhos/cm	7400	7200	15000	-	14000	4300	8800	-	170	11000
Total Dissolved Solids	N/A	mg/L	SW Cleanup Target Levels	mg/L	3200	4600	9300	7400	12000	6400	4100	-	<0.35	6600
Total Suspended Solids	-	-	-	mg/L	-	-	-	23	-	-	22	-	<0.25	18
Turbidity	29	NTU	62-302.530 SW Quality Criteria*	NTU	19	10	27	14	8.6	14	20	-	<0.23	22
Biochemical Oxygen Demand	-	-	-	mg/L	8.2	4.2	<2	10	8.5	650	<24	-	18 H	<24
8260B Volatile Organic Compounds by GC/MS	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acetone	1700	ug/L	SW Cleanup Target Levels	ug/L	<25	<25	<25	-	-	-	<7.0	-	<3.7	<0.0037
Acrylonitrile	0.2	ug/L	SW Cleanup Target Levels	ug/L	<20	<20	<20	-	-	-	<10	-	<5.5	-
Benzene	71.28	ug/L	62-302.530 SW Quality Criteria	ug/L	<1	<1	<1	-	-	-	<0.43	-	<0.27	-
Bromochloromethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	-	-	-	<0.45	-	<0.34	-
Bromodichloromethane	22	ug/L	62-302.530 SW Quality Criteria	ug/L	<1	<1	<1	-	-	-	<0.44	-	<0.25	-
Bromoform	360	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	-	-	-	<0.43	-	<0.59	-
Carbon disulfide	110	ug/L	SW Cleanup Target Levels	ug/L	<2	<2	<2	-	-	-	<1.0	-	<0.43	<0.00043
Carbon tetrachloride	4.42	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	-	-	-	<0.33	-	<0.30	-
Chlorobenzene	17	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	-	-	-	<0.26	-	-	-
Chloroethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	-	-	-	<2.5	-	<0.15	-
Chloroform	470.8	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	-	-	-	<0.50	-	<4.6	-
Dibromochloromethane	34	ug/L	62-302.530 SW Quality Criteria	ug/L	<1	<1	<1	-	-	-	<0.32	-	<0.22	-
1,2-Dibromo-3-Chloropropane	N/A	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	-	-	-	<1.1	-	<1.8	-
1,2-Dibromoethane (EDB)	13	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	-	-	-	<0.44	-	<0.33	-
1,2-Dichlorobenzene	99	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	-	-	-	<0.37	-	<0.31	-
1,4-Dichlorobenzene	3	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	-	-	-	<0.46	-	<0.31	<0.00031
trans-1,4-Dichloro-2-butene	-	-	No Standard	ug/L	<3	<2	<2	-	-	-	<0.51	-	7	-
1,1-Dichloroethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	-	-	-	<0.38	-	<0.33	-
1,2-Dichloroethane	37	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	-	-	-	<0.50	-	<0.25	-
1,1-Dichloroethene	3.2	ug/L	62-302.530 SW Quality Criteria	ug/L	<1	<1	<1	-	-	-	<0.36	-	<0.33	-
cis-1,2-Dichloroethene	N/A	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	-	-	-	<0.41	-	<0.045	-
trans-1,2-Dichloroethene	11000	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	-	-	-	<0.37	-	42	-
1,2-Dichloropropane	14	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	-	-	-	<0.67	-	<0.22	-
cis-1,3-Dichloropropene	12	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	-	-	-	<0.40	-	<0.25	-
trans-1,3-Dichloropropene	12	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	-	-	-	<0.42	-	<2.6	-
Ethylbenzene	610	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	-	-	-	<0.33	-	<0.28	-
2-Hexanone	NA	ug/L	SW Cleanup Target Levels	ug/L	<10	<10	<10	-	-	-	<2.0	-	<3.2	-
Bromomethane	35	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	-	-	-	<2.5	-	<3.7	-
Chloromethane (methyl chloride)	470.8	ug/L	62-302.530 SW Quality Criteria	ug/L	<1	<1	<1	-	-	-	<0.40	-	<0.27	-
Dibromomethane (EDB)	13	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	-	-	-	<0.35	-	<0.10	-
Methylene Chloride	1580	ug/L	62-302.530 SW Quality Criteria	ug/L	<5	<5	<5	-	-	-	<2.5	-	<0.080	-
Methyl Ethyl Ketone (MEK)	120000	ug/L	SW Cleanup Target Levels	ug/L	<10	<10	13	-	-	-	-	-	-	-
Iodomethane	-	-	No Standard	ug/L	<5	<5	<5	-	-	-	<5.0	-	<0.13	-
methyl isobutyl ketone	23000	ug/L	SW Cleanup Target Levels	ug/L	<10	<10	<10	-	-	-	-	-	-	-
Styrene	460	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	-	-	-	<0.27	-	<1.0	-
1,1,1,2-Tetrachloroethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	-	-	-	<0.37	-	<0.36	-
1,1,2,2-Tetrachloroethane	10.8	ug/L	62-302.530 SW Quality Criteria	ug/L	<1	<1	<1	-	-	-	<0.62	-	<0.40	-
Tetrachloroethene (Tetrachloroethylene)	8.85	ug/L	62-302.530 SW Quality Criteria	ug/L	<1	<1	<1	-	-	-	<0.74	-	<0.27	-
Toluene	480	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	-	-	-	<0.48	-	19.9	-
1,1,1-Trichloroethane	270	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	-	-	-	<0.37	-	<0.21	-
1,1,2-Trichloroethane	16	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	-	-	-	<0.33	-	<0.32	-
Trichloroethene	80.7	ug/L	62-302.530 SW Quality Criteria	ug/L	<1	<1	<1	-	-	-	<0.48	-	<3.1	-
Trichlorofluoromethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	-	-	-	<0.42	-	<0.34	-
1,2,3-Trichloropropane	0.2	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	-	-	-	<0.39	-	<0.48	-

	Florida Clean up Standard Marine Surface Water Criteria			Reporting	SW12	SW12	SW12	SW12	SW12	SW12	SW12	SW12	SW12	SW12
					2010	2011	2013	2015	2016	2019	2020	Jul-21	Dec-21	Jul-22
Paramaters	MCL	Unit	Source	Unit	01/07/2010	01/07/2011	01/07/2013	15/04/2015	16/12/2016	28/08/2019	27/07/2020	14/07/2021	30/11/2021	01/07/2022
8260B Volatile Organic Compounds	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vinyl acetate	700	ug/L	SW Cleanup Target Levels	ug/L	<2	<2	<2	-	-	-	<0.81	-	<0.33	-
Vinyl chloride	2.4	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	-	-	-	<0.50	-	10	-
Xylenes, Total	370	ug/L	SW Cleanup Target Levels	ug/L	<2	<2	<2	-	-	-	<0.23	-	0.00042	<0.00023
6010B Inductively Coupled Plasma - Atomic Emission Spectrometry- Total	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Antimony	4.3	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.0060	<0.02	<0.02	-	<0.0005	-	<0.0005	-	<0.0005	<0.00052
Arsenic	0.05	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.010	<0.02	<0.02	-	0.0033	-	0.002	-	0.0022	0.0015
Barium	N/A	mg/L	SW Cleanup Target Levels	mg/L	1.2	0.044	0.042	-	0.088	0.05	0.036	-	0.038	0.049
Beryllium	0.00013	mg/L	62-302.530 SW Quality Criteria	mg/L	-	<0.004	<0.004	-	<0.00017	-	<0.00017	-	<0.00017	<0.0002
Cadmium	0.0088	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.0050	<0.005	<0.005	-	<0.00015	-	<0.00015	-	<0.00015	<0.000078
Chromium (Hexavalent)	0.05	mg/L	SW Cleanup Target Levels	mg/L	3.4	<0.01	<0.01	-	0.0017	0.0024	0.0031	-	-	<0.0026
Cobalt	N/A	mg/L	SW Cleanup Target Levels	mg/L	<0.010	<0.01	<0.01	-	0.00024	0.00021	0.0002	-	<0.00026	0.0003
Copper	0.0037	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.020	<0.02	<0.02	-	<0.0017	-	0.0022	-	0.0004	0.0015
Iron	0.3	mg/L	62-302.530 SW Quality Criteria	mg/L	310	0.17	0.16	-	-	-	0.11	-	-	-
Lead	0.0085	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.0050	<0.01	<0.01	-	<0.00096	-	<0.00098	-	<0.00098	0.00054
Magnesium	-	-	No Standard	mg/L	67000	140	340	-	-	1800	-	-	-	-
Nickel	0.0083	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.04	<0.04	<0.04	-	<0.0019	-	<0.0019	-	<0.0019	<0.0018
Selenium	71	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.01	<0.02	<0.04	-	0.0032	0.0012	<0.001	-	<0.000041	<0.0012
Silver	0.0004	mg/L	SW Cleanup Target Levels	mg/L	<0.01	<0.01	<0.01	-	<0.0001	-	<0.0001	-	<0.0001	<0.00039
Thallium	0.0063	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.025	<0.025	<0.025	-	<0.00049	-	<0.00049	-	0.024	<0.00026
Vanadium	N/A	mg/L	SW Cleanup Target Levels	mg/L	2.1	<0.01	<0.01	-	0.0011	-	<0.0053	-	<0.00020	<0.0018
Zinc	0.086	mg/L	SW Cleanup Target Levels	mg/L	2.9	<0.02	<0.02	-	<0.0096	0.012	<0.0096	-	<0.0053	0.012
7470A Mercury in Liquid Waste (Manual Cold Vapor Technique)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	0.000025	mg/L	62-302.530 SW Quality Criteria	mg/L	-	<0.0002	<0.0002	-	-	-	<0.000080	-	<0.000080	-
PCBs	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB-1016	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.99	<0.95	-	-	-	<0.18	-	<0.33	-
PCB-1221	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<2	<1.9	-	-	-	<0.14	-	<0.33	-
PCB-1232	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.99	<0.95	-	-	-	<0.12	-	<0.33	-
PCB-1242	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.99	<0.95	-	-	-	<0.17	-	<3.1	-
PCB-1248	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.99	<0.95	-	-	-	<0.074	-	<2.5	-
PCB-1254	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.99	<0.95	-	-	-	<0.14	-	<2.2	-
PCB-1260	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.99	<0.95	-	-	-	<0.12	-	<3.0	-
Persticides	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4,4'-DDD	0.0003	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.047	-	-	-	<0.0071	-	<0.13	-
4,4'-DDE	0.0002	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.047	-	-	-	<0.0068	-	<0.12	-
4,4'-DDT	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.047	-	-	-	<0.0079	-	<0.14	-
Aldrin	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.047	-	-	-	<0.0067	-	<0.12	-
alpha-BHC	0.005	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.047	-	-	-	<0.0072	-	<0.13	-
beta-BHC	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.047	-	-	-	<0.011	-	<0.20	-
Chlordane (technical)	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.47	-	-	-	<0.10	-	<1.8	-
delta-BHC	NA	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.047	-	-	-	<0.012	-	<1.7	-
Dieldrin	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.047	-	-	-	<0.0079	-	<0.39	-
Endosulfan I	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.047	-	-	-	<0.0076	-	<0.34	-
Endosulfan II	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.047	-	-	-	<0.0079	-	<0.14	-
Endosulfan sulfate	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.047	-	-	-	<0.0077	-	<0.14	-
Endrin	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.047	-	-	-	<0.0081	-	<0.14	-
Endrin aldehyde	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.047	-	-	-	<0.016	-	<0.14	-
Endrin ketone	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.047	-	-	-	<0.0082	-	<0.15	-
gamma-BHC (Lindane)	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.047	-	-	-	<0.0077	-	<0.10	<0.0000079
Heptachlor	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.047	-	-	-	<0.0073	-	<0.14	-
Heptachlor epoxide	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.047	-	-	-	<0.0075	-	710	-
Methoxychlor	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.047	-	-	-	<0.0086	-	<0.98	-
Toxaphene	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<4.7	-	-	-	<0.18	-	3100	-
Hydrocarbons	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diesel Range Organics [C10-C28]	-	-	No Standard	mg/L	-	0.53	0.84	0.58	0.98	-	-	-	-	-

					SW12	SW12	SW12	SW12	SW12	SW12	SW12	SW12	SW12	SW12
	Florida Clean up Standard Marine Surface Water Criteria			Reporting	2010	2011	2013	2015	2016	2019	2020	Jul-21	Dec-21	Jul-22
Paramaters	MCL	Unit	Source	Unit	01/07/2010	01/07/2011	01/07/2013	15/04/2015	16/12/2016	28/08/2019	27/07/2020	14/07/2021	30/11/2021	01/07/2022
Gasoline Range Organics (GRO)-C6-C10	-	-	No Standard	mg/L	-	-	<0.05	-	<0.050	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	NA	ug/L	Freshwater Surface Water Criteria	mg/L	-	1100	1.9	-	-	-	-	-	-	-
Cyanide, Total	**	ug/L	Freshwater Surface Water Criteria	mg/L	-	<0.01	<0.01	<0.0035	-	0.5	-	-	-	-
Phenol	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	<0.00012
Over C6-C8 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	0.26
Over C5-C7 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	0.34
TPH	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	<2.7
Hardness as calcium carbonate	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	1400
Nitrogen, Total	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	2.6
Sulfate	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	480
Total Non-purgeable Organic Carbon	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	45
Unionized Ammonia	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	0.0017
Chlorophyll A	-	mg/m3	-	-	-	-	-	-	-	-	-	-	-	-
Faecal Coliform	-	mpn/100ml	-	-	-	-	-	-	-	-	-	-	-	299000
Temperature	-	Degree	-	-	-	-	-	-	-	-	-	-	-	23.3
4-Methyl-2-pentanone	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Nitrate as N	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Nitrite as N	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Resistivity	-	ohm cm	-	-	-	-	-	-	-	-	-	-	-	-
1-Methylnaphthalene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
2-Methylnaphthalene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthylene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Anthracene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Benzo[a]anthracene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Benzo[a]pyrene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Benzo[b]fluoranthene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Benzo[g,h,i]perylene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Benzo[k]fluoranthene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Fluoranthene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Ideno[1,2,3-cd]pyrene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Napthalene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C10-C12 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C10-C12 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C12-C16 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C12-C16 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C16-C21 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C16-C35 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C21-C35 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C5-C6 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C5-C7 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C6-C8 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C7-C8 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C8-C10 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C8-C10 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sodium	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Paramaters	Florida Clean up Standard Marine Surface Water Criteria			Reporting Unit	SW12	SW20	SW20	SW20	SW20	SW20	SW20	SW20	SW7	SW7	SW7
					Dec-22	2015	2016	2019	2020	Jul-21	Dec-21	Jul-22	2006	2007	2008
	MCL	Unit	Source		05/12/2022	15/04/2015	16/12/2016	28/08/2019	27/07/2020	14/07/2021	30/11/2021	01/07/2022	2006	2007	2008
Ammonia	N/A	mg/L	SW Cleanup Target Levels	mg/L	1.1	6.5	6.6	9.3	9.2	8.9	13	4.8	-	54	44
Nitrogen, Kjeldahl	-	mg/L	-	-	2.6	9.3	-	-	13	11	13	6.4	24	64	52
Nitrate Nitrite as N	N/A	mg/L	SW Cleanup Target Levels	mg/L	<0.023	<0.018	<0.010	0.049	<0.010	0.028	<0.010	<0.010	<0.050	0.16	0.3
Orthophosphate	-	-	-	mg/L	-	0.11	0.23	0.24	-	-	-	-	-	<0.050	<0.05
Phosphorus	-	-	-	mg/L	0.33	-	-	-	0.4	-	0.16	0.21	0.53	0.28	0.94
Chemical Oxygen Demand	-	-	-	mg/L	160	220	<25	100	250	-	170	<50	270	870	4300
pH	-	-	-	-	8.1	-	7.6	1.5	7.6	7.70	7.40	7.30	7.96	7.86	8.25
Specific Conductance	-	-	-	umhos/cm	1000	-	37000	44000	33000	-	32000	38000	12000	15000	12000
Total Dissolved Solids	N/A	mg/L	SW Cleanup Target Levels	mg/L	6000	28000	32000	250	18000	-	19000	25000	6300	7600	7000
Total Suspended Solids	-	-	-	mg/L	35	40	-	-	3.8	-	8.7	27	22	11	84
Turbidity	29	NTU	62-302.530 SW Quality Criteria*	NTU	38	10	39	150	91	-	70	23	10	34	5.8
Biochemical Oxygen Demand	-	-	-	mg/L	<24	13	300	16	<24	-	17	25	22	24	17
8260B Volatile Organic Compounds by GC/MS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acetone	1700	ug/L	SW Cleanup Target Levels	ug/L	<3.7	-	-	-	<7.0	-	<3.7	<0.0037	-	<25	<25
Acrylonitrile	0.2	ug/L	SW Cleanup Target Levels	ug/L	<5.5	-	-	-	<10	-	<5.5	-	-	<20	<20
Benzene	71.28	ug/L	62-302.530 SW Quality Criteria	ug/L	<0.27	-	-	-	<0.43	-	<0.27	-	-	<1	<1
Bromochloromethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	-	<0.45	-	<0.34	-	-	<1	<1
Bromodichloromethane	22	ug/L	62-302.530 SW Quality Criteria	ug/L	-	-	-	-	<0.44	-	<0.25	-	-	<1	<1
Bromoform	360	ug/L	SW Cleanup Target Levels	ug/L	<0.59	-	-	-	<0.43	-	<0.59	-	-	<1	<1
Carbon disulfide	110	ug/L	SW Cleanup Target Levels	ug/L	<0.43	-	-	-	<1.0	-	<0.43	0.00095	-	5.2	<2
Carbon tetrachloride	4.42	ug/L	SW Cleanup Target Levels	ug/L	<0.30	-	-	-	<0.33	-	<0.30	-	-	<1	<1
Chlorobenzene	17	ug/L	SW Cleanup Target Levels	ug/L	<0.15	-	-	-	<0.26	-	<0.15	-	-	<1	<1
Chloroethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	<4.6	-	-	-	<2.5	-	<4.6	-	-	<1	<1
Chloroform	470.8	ug/L	SW Cleanup Target Levels	ug/L	<0.27	-	-	-	<0.50	-	<0.27	-	-	<1	<1
Dibromochloromethane	34	ug/L	62-302.530 SW Quality Criteria	ug/L	-	-	-	-	-	-	-	-	-	-	-
1,2-Dibromo-3-Chloropropane	N/A	ug/L	SW Cleanup Target Levels	ug/L	<1.8	-	-	-	<0.32	-	<0.39	-	-	<1	<1
1,2-Dibromoethane (EDB)	13	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	-	<0.44	-	<0.33	-	-	<1	<1
1,2-Dichlorobenzene	99	ug/L	SW Cleanup Target Levels	ug/L	<0.31	-	-	-	<0.37	-	<0.31	-	-	<1	<1
1,4-Dichlorobenzene	3	ug/L	SW Cleanup Target Levels	ug/L	<0.31	-	-	-	<0.37	-	<0.31	-	-	<1	<1
trans-1,4-Dichloro-2-butene	-	-	No Standard	ug/L	<1.3	-	-	-	<0.51	-	<1.3	-	-	<2	<2
1,1-Dichloroethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	<0.33	-	-	-	<0.38	-	<0.33	-	-	<1	<1
1,2-Dichloroethane	37	ug/L	SW Cleanup Target Levels	ug/L	<0.25	-	-	-	<0.50	-	<0.25	-	-	<1	<1
1,1-Dichloroethene	3.2	ug/L	62-302.530 SW Quality Criteria	ug/L	<0.33	-	-	-	<0.38	-	<0.33	-	-	<1	<1
cis-1,2-Dichloroethene	N/A	ug/L	SW Cleanup Target Levels	ug/L	<0.25	-	-	-	<0.50	-	<0.25	-	-	<1	<1
trans-1,2-Dichloroethene	11000	ug/L	SW Cleanup Target Levels	ug/L	<0.34	-	-	-	<0.37	-	<0.34	-	-	<1	<1
1,2-Dichloropropane	14	ug/L	SW Cleanup Target Levels	ug/L	<0.26	-	-	-	<0.67	-	<0.22	-	-	<1	<1
cis-1,3-Dichloropropene	12	ug/L	SW Cleanup Target Levels	ug/L	<0.26	-	-	-	<0.67	-	<0.22	-	-	<1	<1
trans-1,3-Dichloropropene	12	ug/L	SW Cleanup Target Levels	ug/L	<0.23	-	-	-	<0.42	-	<0.23	-	-	<1	<1
Ethylbenzene	610	ug/L	SW Cleanup Target Levels	ug/L	<0.2	-	-	-	<0.33	-	<0.20	-	-	<1	<1
2-Hexanone	NA	ug/L	SW Cleanup Target Levels	ug/L	<3.2	-	-	-	<2.0	-	<3.2	-	-	<10	<10
Bromomethane	35	ug/L	SW Cleanup Target Levels	ug/L	<3.7	-	-	-	<2.5	-	<3.7	-	-	<1	<1
Chloromethane (methyl chloride)	470.8	ug/L	62-302.530 SW Quality Criteria	ug/L	<0.54	-	-	-	<0.40	-	<0.54	-	-	<1	<1
Dibromomethane (EDB)	13	ug/L	SW Cleanup Target Levels	ug/L	<0.34	-	-	-	<0.35	-	<0.34	-	-	<1	<1
Methylene Chloride	1580	ug/L	62-302.530 SW Quality Criteria	ug/L	<3.2	-	-	-	<2.5	-	<3.2	-	-	<5	<5
Methyl Ethyl Ketone (MEK)	120000	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	-	-	-	-	-	-	<10	<10
Iodomethane	-	-	No Standard	ug/L	<3.9	-	-	-	<5.0	-	<3.9	-	-	<5	<5
methyl isobutyl ketone	23000	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	-	-	-	-	-	-	<10	<10
Styrene	460	ug/L	SW Cleanup Target Levels	ug/L	<0.27	-	-	-	<0.27	-	<0.27	-	-	<1	<1
1,1,1,2-Tetrachloroethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	<0.36	-	-	-	<0.37	-	<0.36	-	-	<1	<1
1,1,2,2-Tetrachloroethane	10.8	ug/L	62-302.530 SW Quality Criteria	ug/L	<0.40	-	-	-	<0.62	-	<0.40	-	-	<1	<1
Tetrachloroethene (Tetrachloroethylene)	8.85	ug/L	62-302.530 SW Quality Criteria	ug/L	<0.35	-	-	-	<0.74	-	<0.35	-	-	<1	<1
Toluene	480	ug/L	SW Cleanup Target Levels	ug/L	<0.25	-	-	-	<0.48	-	<0.25	-	-	<1	<1
1,1,1-Trichloroethane	270	ug/L	SW Cleanup Target Levels	ug/L	<0.21	-	-	-	<0.37	-	<0.21	-	-	<1	<1
1,1,2-Trichloroethane	16	ug/L	SW Cleanup Target Levels	ug/L	<0.32	-	-	-	<0.33	-	<0.32	-	-	<1	<1
Trichloroethene	80.7	ug/L	62-302.530 SW Quality Criteria	ug/L	<0.20	-	-	-	<0.48	-	<0.20	-	-	<1	<1
Trichlorofluoromethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	<0.33	-	-	-	<0.42	-	<0.33	-	-	<1	<1
1,2,3-Trichloropropane	0.2	ug/L	SW Cleanup Target Levels	ug/L	<0.48	-	-	-	<0.39	-	<0.48	-	-	<1	<1

					SW12	SW20	SW20	SW20	SW20	SW20	SW20	SW20	SW7	SW7	SW7
	Florida Clean up Standard Marine Surface Water Criteria			Reporting	Dec-22	2015	2016	2019	2020	Jul-21	Dec-21	Jul-22	2006	2007	2008
Paramaters	**MCL**	**Unit**	**Source**	**Unit**	**05/12/2022**	**15/04/2015**	**16/12/2016**	**28/08/2019**	**27/07/2020**	**14/07/2021**	**30/11/2021**	**01/07/2022**	**2006**	**2007**	**2008**
8260B Volatile Organic Compounds	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vinyl acetate	700	ug/L	SW Cleanup Target Levels	ug/L	<0.69	-	-	-	<0.81	-	<0.69	-	-	<2	<2
Vinyl chloride	2.4	ug/L	SW Cleanup Target Levels	ug/L	<0.40	-	-	-	<0.50	-	<0.40	-	-	<1	<1
Xylenes, Total	370	ug/L	SW Cleanup Target Levels	ug/L	<0.23	-	-	-	<0.23	-	<0.23	<0.00023	-	<2	<2
6010B Inductively Coupled Plasma - Atomic Emission Spectrometry- Total	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Antimony	4.3	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.52	<0.010	<0.0005	-	<0.0005	-	<0.0005	<0.00052	<0.0060	<0.0060	<0.0060
Arsenic	0.05	mg/L	62-302.530 SW Quality Criteria	mg/L	2.5	<0.0040	0.0037	0.003	0.0032	-	0.0041	0.0021	0.026	0.027	0.015
Barium	N/A	mg/L	SW Cleanup Target Levels	mg/L	48	0.018	0.018	0.019	0.023	-	0.027	0.023	0.061	0.088	0.07
Beryllium	0.00013	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.20	<0.0010	<0.00017	-	<0.00017	-	<0.00017	<0.0002	<0.0030	<0.0030	<0.0030
Cadmium	0.0088	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.078	<0.0010	<0.00015	-	<0.00015	-	<0.00015	<0.000078	<0.0050	<0.0050	<0.0050
Chromium (Hexavalent)	0.05	mg/L	SW Cleanup Target Levels	mg/L	2.7	0.012	0.0031	0.0038	0.0073	-	-	0.0031	0.018	0.03	0.028
Cobalt	N/A	mg/L	SW Cleanup Target Levels	mg/L	0.23	<0.0030	0.00016	0.00032	0.0004	-	0.00038	<0.00022	<0.010	<0.010	<0.010
Copper	0.0037	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.90	<0.0020	<0.0017	-	<0.0017	-	<0.0017	-	<0.020	<0.020	<0.020
Iron	0.3	mg/L	62-302.530 SW Quality Criteria	mg/L	98	-	-	-	-	-	-	-	-	-	-
Lead	0.0085	mg/L	62-302.530 SW Quality Criteria	mg/L	0.51	J	0.49	J	<0.34	-	-	-	0.12	0.46	0.37
Magnesium	-	-	No Standard	mg/L	170	-	-	1100	-	-	-	-	170	250	210
Nickel	0.0083	mg/L	62-302.530 SW Quality Criteria	mg/L	<1.8	<0.0030	<0.0019	-	<0.0019	-	<0.0019	<0.0018	<0.040	<0.040	<0.040
Selenium	71	mg/L	62-302.530 SW Quality Criteria	mg/L	<1.2	0.0059	<0.001	-	<0.001	-	<0.001	<0.0012	<0.010	<0.010	<0.010
Silver	0.0004	mg/L	SW Cleanup Target Levels	mg/L	<0.39	<0.0020	<0.0001	-	<0.0001	-	<0.0001	<0.00039	<0.010	<0.010	<0.010
Thallium	0.0063	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.26	<0.0040	<0.00049	-	<0.00049	-	<0.00049	<0.00026	<0.025	<0.025	<0.025
Vanadium	N/A	mg/L	SW Cleanup Target Levels	mg/L	<1.8	<0.0030	<0.0053	-	0.0056	-	<0.0053	0.002	<0.010	<0.010	<0.010
Zinc	0.086	mg/L	SW Cleanup Target Levels	mg/L	<10	<0.0080	<0.0096	-	<0.0096	-	<0.0096	<0.010	0.02	0.0423	0.027
7470A Mercury in Liquid Waste (Manual Cold Vapor Technique)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	0.000025	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.080	-	-	0.000082	<0.000080	-	<0.000080	-	<0.0002	<0.0002	<0.0002
PCBs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB-1016	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.31	-	<0.31	-	<0.32	-	<0.15	-	-	-	-
PCB-1221	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.33	-	<0.33	-	<0.34	-	<0.12	-	-	-	-
PCB-1232	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.33	-	<0.33	-	<0.34	-	<0.10	-	-	-	-
PCB-1242	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.33	-	<0.33	-	<0.34	-	<0.14	-	-	-	-
PCB-1248	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.33	-	<0.33	-	<0.34	-	<0.063	-	-	-	-
PCB-1254	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.33	-	<0.33	-	<0.34	-	<0.12	-	-	-	-
PCB-1260	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.33	-	<0.33	-	<0.34	-	<0.10	-	-	-	-
Persticides	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4,4'-DDD	0.0003	ug/L	Freshwater Surface Water Criteria	ug/L	<0.0020	-	-	-	<0.0072	-	<0.0061	-	-	-	-
4,4'-DDE	0.0002	ug/L	Freshwater Surface Water Criteria	ug/L	<0.00098	-	-	-	<0.0069	-	<0.0058	-	-	-	-
4,4'-DDT	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.00098	-	-	-	<0.0079	-	<0.0067	-	-	-	-
Aldrin	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.0020	-	-	-	<0.0068	-	<0.0058	-	-	-	-
alpha-BHC	0.005	ug/L	Freshwater Surface Water Criteria	ug/L	<0.00098	-	-	-	<0.0073	-	<0.0062	-	-	-	-
beta-BHC	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.0020	-	-	-	<0.011	-	<0.0095	-	-	-	-
Chlordane (technical)	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	-	-	<0.10	-	<0.087	-	-	-	-
delta-BHC	NA	ug/L	Freshwater Surface Water Criteria	ug/L	<0.0020	-	-	-	<0.012	-	<0.010	-	-	-	-
Dieldrin	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.0020	-	-	-	<0.0080	-	<0.0068	-	-	-	-
Endosulfan I	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.0020	-	-	-	<0.0076	-	<0.0065	-	-	-	-
Endosulfan II	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.0020	-	-	-	<0.0079	-	<0.0067	-	-	-	-
Endosulfan sulfate	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.0020	-	-	-	<0.0077	-	<0.0065	-	-	-	-
Endrin	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.00098	-	-	-	<0.0082	-	<0.0069	-	-	-	-
Endrin aldehyde	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.0039	-	-	-	<0.016	-	<0.013	-	-	-	-
Endrin ketone	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.0039	-	-	-	<0.0083	-	<0.0070	-	-	-	-
gamma-BHC (Lindane)	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.00098	-	-	-	<0.0077	-	<0.0065	<0.0000080	-	-	-
Heptachlor	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.00098	-	-	-	<0.0073	-	<0.0062	-	-	-	-
Heptachlor epoxide	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.0020	-	-	-	<0.0075	-	<0.0064	-	-	-	-
Methoxychlor	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.0020	-	-	-	<0.0086	-	<0.0073	-	-	-	-
Toxaphene	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.3	-	-	-	<0.18	-	<0.15	-	-	-	-
Hydrocarbons	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diesel Range Organics [C10-C28]	-	-	No Standard	mg/L	-	0.046	0.49	-	-	-	-	-	-	-	-

					SW12	SW20	SW20	SW20	SW20	SW20	SW20	SW20	SW7	SW7	SW7
	Florida Clean up Standard Marine Surface Water Criteria			Reporting	Dec-22	2015	2016	2019	2020	Jul-21	Dec-21	Jul-22	2006	2007	2008
Paramaters	MCL	Unit	Source	Unit	05/12/2022	15/04/2015	16/12/2016	28/08/2019	27/07/2020	14/07/2021	30/11/2021	01/07/2022	2006	2007	2008
Gasoline Range Organics (GRO)-C6-C10	-	-	No Standard	mg/L	-	<0.047	<0.050	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	NA	ug/L	Freshwater Surface Water Criteria	mg/L	-	-	-	-	-	-	-	-	-	-	-
Cyanide, Total	**	ug/L	Freshwater Surface Water Criteria	mg/L	-	<0.0035	-	-	-	-	-	-	-	-	-
Phenol	-	ug/L	-	-	<1.5	-	-	-	-	-	-	0.00034	-	-	-
Over C6-C8 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-
Over C5-C7 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-
TPH	-	mg/L	-	-	-	-	-	-	-	-	-	<2.6	-	-	-
Hardness as calcium carbonate	-	mg/L	-	-	1000	-	-	-	-	-	-	5200	-	-	-
Nitrogen, Total	-	mg/L	-	-	2.6	-	-	-	-	-	-	6.4	-	-	-
Sulfate	-	mg/L	-	-	490	-	-	-	-	-	-	2000	-	-	-
Total Non-purgeable Organic Carbon	-	mg/L	-	-	-	-	-	-	-	-	-	24	-	-	-
Unionized Ammonia	-	mg/L	-	-	0.0015	-	-	-	-	-	-	0.0056	-	-	-
Chlorophyll A	-	mg/m3	-	-	92	-	-	-	-	-	-	100	-	-	-
Faecal Coliform	-	mpn/100ml	-	-	-	-	-	-	-	-	-	1300	-	-	-
Temperature	-	Degree	-	-	-	-	-	-	-	-	-	19.8	-	-	-
4-Methyl-2-pentanone	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrate as N	-	mg/L	-	-	<0.023	-	-	-	-	-	-	-	-	-	-
Nitrite as N	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-
Resistivity	-	ohm cm	-	-	-	-	-	-	-	-	-	-	-	-	-
1-Methylnaphthalene	-	ug/L	-	-	<0.018	-	-	-	-	-	-	-	-	-	-
2-Methylnaphthalene	-	ug/L	-	-	<0.011	-	-	-	-	-	-	-	-	-	-
Acenaphthene	-	ug/L	-	-	<0.041	-	-	-	-	-	-	-	-	-	-
Acenaphthylene	-	ug/L	-	-	<0.017	-	-	-	-	-	-	-	-	-	-
Anthracene	-	ug/L	-	-	<0.018	-	-	-	-	-	-	-	-	-	-
Benzo[a]anthracene	-	ug/L	-	-	<0.025	-	-	-	-	-	-	-	-	-	-
Benzo[a]pyrene	-	ug/L	-	-	<0.025	-	-	-	-	-	-	-	-	-	-
Benzo[b]fluoranthene	-	ug/L	-	-	<0.025	-	-	-	-	-	-	-	-	-	-
Benzo[g,h,i]perylene	-	ug/L	-	-	<0.025	-	-	-	-	-	-	-	-	-	-
Benzo[k]fluoranthene	-	ug/L	-	-	<0.028	-	-	-	-	-	-	-	-	-	-
Chrysene	-	ug/L	-	-	<0.022	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	-	ug/L	-	-	<0.023	-	-	-	-	-	-	-	-	-	-
Fluoranthene	-	ug/L	-	-	<0.026	-	-	-	-	-	-	-	-	-	-
Fluorene	-	ug/L	-	-	<0.024	-	-	-	-	-	-	-	-	-	-
Ideno[1,2,3-cd]pyrene	-	ug/L	-	-	<0.027	-	-	-	-	-	-	-	-	-	-
Napthalene	-	ug/L	-	-	<0.014	-	-	-	-	-	-	-	-	-	-
Over C10-C12 aliphatics	-	mg/L	-	-	<0.32	-	-	-	-	-	-	-	-	-	-
Over C10-C12 aromatics	-	mg/L	-	-	<0.32	-	-	-	-	-	-	-	-	-	-
Over C12-C16 aliphatics	-	mg/L	-	-	<0.32	-	-	-	-	-	-	-	-	-	-
Over C12-C16 aromatics	-	mg/L	-	-	<0.32	-	-	-	-	-	-	-	-	-	-
Over C16-C21 aromatics	-	mg/L	-	-	<0.32	-	-	-	-	-	-	-	-	-	-
Over C16-C35 aliphatics	-	mg/L	-	-	<0.32	-	-	-	-	-	-	-	-	-	-
Over C21-C35 aromatics	-	mg/L	-	-	<0.32	-	-	-	-	-	-	-	-	-	-
Over C5-C6 aliphatics	-	mg/L	-	-	<0.32	-	-	-	-	-	-	-	-	-	-
Over C5-C7 aromatics	-	mg/L	-	-	<0.32	-	-	-	-	-	-	-	-	-	-
Over C6-C8 aliphatics	-	mg/L	-	-	<0.32	-	-	-	-	-	-	-	-	-	-
Over C7-C8 aromatics	-	mg/L	-	-	<0.32	-	-	-	-	-	-	-	-	-	-
Over C8-C10 aliphatics	-	mg/L	-	-	<0.32	-	-	-	-	-	-	-	-	-	-
Over C8-C10 aromatics	-	mg/L	-	-	<0.32	-	-	-	-	-	-	-	-	-	-
Phenanthrene	-	-	-	-	<0.054	-	-	-	-	-	-	-	-	-	-
Pyrene	-	-	-	-	<0.026	-	-	-	-	-	-	-	-	-	-
Sodium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

					SW7	SW7	SW7	Drain	Drain 1	Drain 2	SWA1	SWA1	SWA2	SWA4	SWA6	NS #2	NS #2
	Florida Clean up Standard Marine Surface Water Criteria			Reporting	2010	2011	2013	2010	2011	2011	2007	2008	2006	2006	2008	2015	2016
Paramaters	MCL	Unit	Source	Unit	2010	2011	2013	2010	2011	2011	2007	2008	2006	2006	2008	15/04/2015	16/12/2016
Ammonia	N/A	mg/L	SW Cleanup Target Levels	mg/L	13	1.5	35	150	150	85	12	3	-	-	0.94	1.1	0.52
Nitrogen, Kjeldahl	-	mg/L	-	-	17	-	-	140	-	-	17	5.6	5.4	5.5	4.9	1.7	-
Nitrate Nitrite as N	N/A	mg/L	SW Cleanup Target Levels	mg/L	<0.05	<0.05	<0.05	2.9	0.066	<0.05	<0.050	<2.5	<0.050	<0.050	<2.5	0.044	0.18
Orthophosphate	-	-	-	mg/L	<0.05	<0.05	<0.05	<0.05	0.49	<0.05	<0.050	<0.050	-	-	<0.050	0.052	0.019
Phosphorus	-	-	-	mg/L	0.32	-	-	0.55	-	-	0.2	0.2	<0.10	<0.050	0.3	-	-
Chemical Oxygen Demand	-	-	-	mg/L	260	250	580	1100	1400	640	730	310	230	260	250	200	<25
pH	-	-	-	-	7.89	7.82	7.87	7.75	7.67	7.75	7.71	8.15	8.08	8.09	7.33	-	7.8
Specific Conductance	-	-	-	umhos/cm	6600	7600	16000	5700	6000	7100	16000	14000	13000	13000	3700	-	49000
Total Dissolved Solids	N/A	mg/L	SW Cleanup Target Levels	mg/L	4200	5000	10000	3900	4300	4200	8400	6300	6900	6900	3400	39000	46000
Total Suspended Solids	-	-	-	mg/L	-	-	-	-	-	-	7	17	<5.0	7	10	20	-
Turbidity	29	NTU	62-302.530 SW Quality Criteria*	NTU	7.1	16	180	23	61	91	18	11	3.7	4.8	13	4.1	8.3
Biochemical Oxygen Demand	-	-	-	mg/L	5.5	8.1	25	<2	33	23	15	8.8	4.2	6.8	12	3	<16.00
8260B Volatile Organic Compounds by GC/MS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acetone	1700	ug/L	SW Cleanup Target Levels	ug/L	<25	<25	<25	<25	<25	<25	<25	<25	-	-	<25	-	-
Acrylonitrile	0.2	ug/L	SW Cleanup Target Levels	ug/L	<20	<20	<20	<20	<20	<20	<20	<20	-	-	<20	-	-
Benzene	71.28	ug/L	62-302.530 SW Quality Criteria	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	-	-	<1	-	-
Bromochloromethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	-	-	<1	-	-
Bromodichloromethane	22	ug/L	62-302.530 SW Quality Criteria	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	-	-	<1	-	-
Bromoform	360	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	-	-	<1	-	-
Carbon disulfide	110	ug/L	SW Cleanup Target Levels	ug/L	<2	<2	<2	<2	<2	<2	5.5	<2	-	-	<2	-	-
Carbon tetrachloride	4.42	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	-	-	<1	-	-
Chlorobenzene	17	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	-	-	<1	-	-
Chloroethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	-	-	<1	-	-
Chloroform	470.8	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	-	-	<1	-	-
Dibromochloromethane	34	ug/L	62-302.530 SW Quality Criteria	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dibromo-3-Chloropropane	N/A	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	-	-	<1	-	-
1,2-Dibromoethane (EDB)	13	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	-	-	<1	-	-
1,2-Dichlorobenzene	99	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	-	-	<1	-	-
1,4-Dichlorobenzene	3	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	-	-	<1	-	-
trans-1,4-Dichloro-2-butene	-	-	No Standard	ug/L	<2	<2	<2	<2	<2	<2	<2	<2	-	-	<2	-	-
1,1-Dichloroethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	-	-	<1	-	-
1,2-Dichloroethane	37	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	-	-	<1	-	-
1,1-Dichloroethene	3.2	ug/L	62-302.530 SW Quality Criteria	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	-	-	<1	-	-
cis-1,2-Dichloroethene	N/A	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	-	-	<1	-	-
trans-1,2-Dichloroethene	11000	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	-	-	<1	-	-
1,2-Dichloropropane	14	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	-	-	<1	-	-
cis-1,3-Dichloropropene	12	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	-	-	<1	-	-
trans-1,3-Dichloropropene	12	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	-	-	<1	-	-
Ethylbenzene	610	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<1	2.3	<1	<1	<1	-	-	<1	-	-
2-Hexanone	NA	ug/L	SW Cleanup Target Levels	ug/L	<10	<10	<10	<10	<10	<10	<10	<10	-	-	<10	-	-
Bromomethane	35	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	-	-	<1	-	-
Chloromethane (methyl chloride)	470.8	ug/L	62-302.530 SW Quality Criteria	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	-	-	<1	-	-
Dibromomethane (EDB)	13	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	-	-	<1	-	-
Methylene Chloride	1580	ug/L	62-302.530 SW Quality Criteria	ug/L	<5	<5	<5	<5	<5	<5	<5	<5	-	-	<5	-	-
Methyl Ethyl Ketone (MEK)	120000	ug/L	SW Cleanup Target Levels	ug/L	<10	<10	<10	<10	<10	<10	<10	<10	-	-	<10	-	-
Iodomethane	-	-	No Standard	ug/L	<5	<5	<5	<5	<5	<5	<5	<5	-	-	<5	-	-
methyl isobutyl ketone	23000	ug/L	SW Cleanup Target Levels	ug/L	<10	<10	<10	<10	<10	<10	<10	<10	-	-	<10	-	-
Styrene	460	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	-	-	<1	-	-
1,1,1,2-Tetrachloroethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	-	-	<1	-	-
1,1,2,2-Tetrachloroethane	10.8	ug/L	62-302.530 SW Quality Criteria	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	-	-	<1	-	-
Tetrachloroethene (Tetrachloroethylene)	8.85	ug/L	62-302.530 SW Quality Criteria	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	-	-	<1	-	-
Toluene	480	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	-	-	<1	-	-
1,1,1-Trichloroethane	270	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	-	-	<1	-	-
1,1,2-Trichloroethane	16	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	-	-	<1	-	-
Trichloroethene	80.7	ug/L	62-302.530 SW Quality Criteria	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	-	-	<1	-	-
Trichlorofluoromethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	-	-	<1	-	-
1,2,3-Trichloropropane	0.2	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	-	-	<1	-	-

	Florida Clean up Standard Marine Surface Water Criteria			Reporting	SW7	SW7	SW7	Drain	Drain 1	Drain 2	SWA1	SWA1	SWA2	SWA4	SWA6	NS #2	NS #2
				Unit	2010	2011	2013	2010	2011	2011	2007	2008	2006	2006	2008	2015	2016
Paramaters	MCL	Unit	Source		2010	2011	2013	2010	2011	2011	2007	2008	2006	2006	2008	15/04/2015	16/12/2016
8260B Volatile Organic Compounds	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vinyl acetate	700	ug/L	SW Cleanup Target Levels	ug/L	<2	<2	<2	<2	<2	<2	<2	<2	-	-	<2	-	-
Vinyl chloride	2.4	ug/L	SW Cleanup Target Levels	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	-	-	<1	-	-
Xylenes, Total	370	ug/L	SW Cleanup Target Levels	ug/L	<2	<2	<2	<2	4.6	<2	<2	<2	-	-	<2	-	-
6010B Inductively Coupled Plasma - Atomic Emission Spectrometry- Total	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Antimony	4.3	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	-	<0.00050
Arsenic	0.05	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.02	<0.02	0.037	0.087	0.073	0.039	0.013	<0.010	0.011	0.014	<0.010	-	0.0031
Barium	N/A	mg/L	SW Cleanup Target Levels	mg/L	0.049	0.041	0.081	0.083	0.079	0.14	0.69	0.043	0.049	0.049	0.076	-	0.009
Beryllium	0.00013	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	-	0.00021
Cadmium	0.0088	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	-	<0.00015
Chromium (Hexavalent)	0.05	mg/L	SW Cleanup Target Levels	mg/L	0.018	<0.01	0.037	0.12	0.13	0.059	<0.010	<0.010	<0.010	<0.010	0.011	-	<0.0016
Cobalt	N/A	mg/L	SW Cleanup Target Levels	mg/L	<0.01	<0.01	<0.01	0.011	<0.01	<0.01	<0.010	<0.010	<0.010	<0.010	<0.010	-	<0.00012
Copper	0.0037	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.02	<0.02	<0.02	0.3	0.12	<0.02	<0.020	<0.020	<0.020	<0.020	0.026	-	<0.0017
Iron	0.3	mg/L	62-302.530 SW Quality Criteria	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead	0.0085	mg/L	62-302.530 SW Quality Criteria	mg/L	0.3	0.26	0.093	3.6	2.3	3	0.26	0.22	0.17	0.29	1.4	-	-
Magnesium	-	-	No Standard	mg/L	140	160	330	63	69	110	300	230	210	200	99	-	-
Nickel	0.0083	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.04	<0.04	<0.04	0.081	0.076	<0.04	<0.040	<0.040	<0.040	<0.040	<0.040	-	0.0069
Selenium	71	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.02	<0.02	<0.04	<0.02	<0.02	<0.02	<0.010	<0.010	<0.010	<0.010	<0.010	-	0.0044
Silver	0.0004	mg/L	SW Cleanup Target Levels	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	<0.010	<0.010	<0.010	<0.010	-	<0.0001
Thallium	0.0063	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	-	<0.00049
Vanadium	N/A	mg/L	SW Cleanup Target Levels	mg/L	<0.01	<0.01	<0.01	0.014	0.014	<0.01	<0.010	<0.010	<0.010	<0.010	<0.010	-	<0.0053
Zinc	0.086	mg/L	SW Cleanup Target Levels	mg/L	0.035	<0.02	<0.02	0.3	0.21	0.12	0.031	<0.020	<0.020	0.042	0.044	-	<0.0096
7470A Mercury in Liquid Waste (Manual Cold Vapor Technique)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	0.000025	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	-	-
PCBs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB-1016	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.98	<0.98	-	<1	<0.97	-	-	-	-	-	-	-
PCB-1221	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<2	<2	-	<2	<1.9	-	-	-	-	-	-	-
PCB-1232	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.98	<0.98	-	<1	<0.97	-	-	-	-	-	-	-
PCB-1242	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.98	<0.98	-	<1	<0.97	-	-	-	-	-	-	-
PCB-1248	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.98	<0.98	-	<1	<0.97	-	-	-	-	-	-	-
PCB-1254	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.98	<0.98	-	<1	<0.97	-	-	-	-	-	-	-
PCB-1260	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.98	<0.98	-	<1	<0.97	-	-	-	-	-	-	-
Persticides	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4,4'-DDD	0.0003	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.049	-	-	-	-	-	-	-	-	-	-
4,4'-DDE	0.0002	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.049	-	-	-	-	-	-	-	-	-	-
4,4'-DDT	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.049	-	-	-	-	-	-	-	-	-	-
Aldrin	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.049	-	-	-	-	-	-	-	-	-	-
alpha-BHC	0.005	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.049	-	-	-	-	-	-	-	-	-	-
beta-BHC	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.049	-	-	-	-	-	-	-	-	-	-
Chlordane (technical)	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.49	-	-	-	-	-	-	-	-	-	-
delta-BHC	NA	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.049	-	-	-	-	-	-	-	-	-	-
Dieldrin	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.049	-	-	-	-	-	-	-	-	-	-
Endosulfan I	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.049	-	-	-	-	-	-	-	-	-	-
Endosulfan II	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.049	-	-	-	-	-	-	-	-	-	-
Endosulfan sulfate	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.049	-	-	-	-	-	-	-	-	-	-
Endrin	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.049	-	-	-	-	-	-	-	-	-	-
Endrin aldehyde	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.049	-	-	-	-	-	-	-	-	-	-
Endrin ketone	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.049	-	-	-	-	-	-	-	-	-	-
gamma-BHC (Lindane)	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.049	-	-	-	-	-	-	-	-	-	-
Heptachlor	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.049	-	-	-	-	-	-	-	-	-	-
Heptachlor epoxide	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.049	-	-	-	-	-	-	-	-	-	-
Methoxychlor	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<0.049	-	-	-	-	-	-	-	-	-	-
Toxaphene	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-	<4.9	-	-	-	-	-	-	-	-	-	-
Hydrocarbons	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diesel Range Organics [C10-C28]	-	-	No Standard	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	0.088

					SW7	SW7	SW7	Drain	Drain 1	Drain 2	SWA1	SWA1	SWA2	SWA4	SWA6	NS #2	NS #2
	Florida Clean up Standard Marine Surface Water Criteria			Reporting	2010	2011	2013	2010	2011	2011	2007	2008	2006	2006	2008	2015	2016
Paramaters	MCL	Unit	Source	Unit	2010	2011	2013	2010	2011	2011	2007	2008	2006	2006	2008	15/04/2015	16/12/2016
Gasoline Range Organics (GRO)-C6-C10	-	-	No Standard	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	<0.05
Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	NA	ug/L	Freshwater Surface Water Criteria	mg/L	-	1.4	3.5	-	6.1	4	-	-	-	-	-	-	-
Cyanide, Total	**	ug/L	Freshwater Surface Water Criteria	mg/L	-	<0.01	<0.01	-	0.017	<0.01	-	-	-	-	-	-	-
Phenol	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Over C6-C8 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Over C5-C7 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TPH	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hardness as calcium carbonate	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrogen, Total	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulfate	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Non-purgeable Organic Carbon	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Unionized Ammonia	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chlorophyll A	-	mg/m3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Faecal Coliform	-	mpn/100ml	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Temperature	-	Degree	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Methyl-2-pentanone	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrate as N	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrite as N	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Resistivity	-	ohm cm	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1-Methylnaphthalene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Methylnaphthalene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthylene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Anthracene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo[a]anthracene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo[a]pyrene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo[b]fluoranthene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo[g,h,i]perylene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo[k]fluoranthene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluoranthene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ideno[1,2,3-cd]pyrene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Napthalene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Over C10-C12 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Over C10-C12 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Over C12-C16 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Over C12-C16 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Over C16-C21 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Over C16-C35 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Over C21-C35 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Over C5-C6 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Over C5-C7 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Over C6-C8 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Over C7-C8 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Over C8-C10 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Over C8-C10 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sodium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Paramaters	Florida Clean up Standard Marine Surface Water Criteria MCL	Unit	Source	Reporting Unit	NS #2 2019 28/08/2019	NS #2 2020 27/07/2020	NS #2 Jul-21 14/07/2021	NS #2 Dec-21 30/11/2021	NS #2 Jul-22 01/07/2022	NS #3 2015 15/04/2015	NS #3 2016 16/12/2016	NS #3 2019 28/08/2019	NS #3 2020 27/07/2020	NS #3 Jul-21 14/07/2021
Ammonia	N/A	mg/L	SW Cleanup Target Levels	mg/L	0.36	4.3	0.84	0.88	1.5	0.51	0.46	1.3	0.36	<0.1
Nitrogen, Kjeldahl	-	mg/L	-	-	-	6.1	1.6	1.1	3.1	1	-	-	1	0.35
Nitrate Nitrite as N	N/A	mg/L	SW Cleanup Target Levels	mg/L	0.08	<0.010	<0.010	0.045	<0.01	0.087	0.17	<0.010	0.099	<0.010
Orthophosphate	-	-	-	mg/L	<0.016	-	-	-	-	0.025	0.017	<0.016	-	-
Phosphorus	-	-	-	mg/L	-	0.33	-	0.092	0.18	-	-	-	<0.041	-
Chemical Oxygen Demand	-	-	-	mg/L	<50	260	-	<50	250	200	<25	62	200	-
pH	-	-	-	-	1.4	7.7	7.59	7.6	7.6	-	7.8	1.5	7.9	8.06
Specific Conductance	-	-	-	umhos/cm	60000	41000	-	48000	49000	-	49000	60000	48000	-
Total Dissolved Solids	N/A	mg/L	SW Cleanup Target Levels	mg/L	43000	28000	-	33000	32000	43000	42000	40000	32000	-
Total Suspended Solids	-	-	-	mg/L	-	9.3	-	9.6	12	12	-	-	6	-
Turbidity	29	NTU	62-302.530 SW Quality Criteria*	NTU	0.99	19	-	4	5.3	2	2.9	0.41	3.3	-
Biochemical Oxygen Demand	-	-	-	mg/L	<24	<240	-	<240	26	<2.0	<16.00	<24	<24	-
8260B Volatile Organic Compounds by GC/MS	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acetone	1700	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<3.7	<0.0037	-	-	-	-	-
Acrylonitrile	0.2	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<5.5	-	-	-	-	-	-
Benzene	71.28	ug/L	62-302.530 SW Quality Criteria	ug/L	-	-	-	<0.27	-	-	-	-	-	-
Bromochloromethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.34	-	-	-	-	-	-
Bromodichloromethane	22	ug/L	62-302.530 SW Quality Criteria	ug/L	-	-	-	<0.25	-	-	-	-	-	-
Bromoform	360	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.59	-	-	-	-	-	-
Carbon disulfide	110	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.43	<0.00043	-	-	-	-	-
Carbon tetrachloride	4.42	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.30	-	-	-	-	-	-
Chlorobenzene	17	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.15	-	-	-	-	-	-
Chloroethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<4.6	-	-	-	-	-	-
Chloroform	470.8	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.27	-	-	-	-	-	-
Dibromochloromethane	34	ug/L	62-302.530 SW Quality Criteria	ug/L	-	-	-	-	-	-	-	-	-	-
1,2-Dibromo-3-Chloropropane	N/A	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.39	-	-	-	-	-	-
1,2-Dibromoethane (EDB)	13	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.33	-	-	-	-	-	-
1,2-Dichlorobenzene	99	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.31	-	-	-	-	-	-
1,4-Dichlorobenzene	3	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.31	-	-	-	-	-	-
trans-1,4-Dichloro-2-butene	-	-	No Standard	ug/L	-	-	-	<1.3	-	-	-	-	-	-
1,1-Dichloroethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.33	-	-	-	-	-	-
1,2-Dichloroethane	37	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.25	-	-	-	-	-	-
1,1-Dichloroethene	3.2	ug/L	62-302.530 SW Quality Criteria	ug/L	-	-	-	<0.33	-	-	-	-	-	-
cis-1,2-Dichloroethene	N/A	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.25	-	-	-	-	-	-
trans-1,2-Dichloroethene	11000	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.34	-	-	-	-	-	-
1,2-Dichloropropane	14	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.22	-	-	-	-	-	-
cis-1,3-Dichloropropene	12	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.22	-	-	-	-	-	-
trans-1,3-Dichloropropene	12	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.23	-	-	-	-	-	-
Ethylbenzene	610	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.20	-	-	-	-	-	-
2-Hexanone	NA	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<3.2	-	-	-	-	-	-
Bromomethane	35	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<3.7	-	-	-	-	-	-
Chloromethane (methyl chloride)	470.8	ug/L	62-302.530 SW Quality Criteria	ug/L	-	-	-	<0.54	-	-	-	-	-	-
Dibromomethane (EDB)	13	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.34	-	-	-	-	-	-
Methylene Chloride	1580	ug/L	62-302.530 SW Quality Criteria	ug/L	-	-	-	<3.2	-	-	-	-	-	-
Methyl Ethyl Ketone (MEK)	120000	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	-	-	-	-	-	-	-
Iodomethane	-	-	No Standard	ug/L	-	-	-	<3.9	-	-	-	-	-	-
methyl isobutyl ketone	23000	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	-	-	-	-	-	-	-
Styrene	460	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.27	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.36	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	10.8	ug/L	62-302.530 SW Quality Criteria	ug/L	-	-	-	<0.40	-	-	-	-	-	-
Tetrachloroethene (Tetrachloroethylene)	8.85	ug/L	62-302.530 SW Quality Criteria	ug/L	-	-	-	<0.35	-	-	-	-	-	-
Toluene	480	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.25	-	-	-	-	-	-
1,1,1-Trichloroethane	270	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.21	-	-	-	-	-	-
1,1,2-Trichloroethane	16	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.32	-	-	-	-	-	-
Trichloroethene	80.7	ug/L	62-302.530 SW Quality Criteria	ug/L	-	-	-	<0.20	-	-	-	-	-	-
Trichlorofluoromethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.33	-	-	-	-	-	-
1,2,3-Trichloropropane	0.2	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.48	-	-	-	-	-	-

Paramaters	Florida Clean up Standard Marine Surface Water Criteria			Reporting Unit	NS #2	NS #2	NS #2	NS #2	NS #2	NS #3	NS #3	NS #3	NS #3	NS #3
					2019	2020	Jul-21	Dec-21	Jul-22	2015	2016	2019	2020	Jul-21
	MCL	Unit	Source		28/08/2019	27/07/2020	14/07/2021	30/11/2021	01/07/2022	15/04/2015	16/12/2016	28/08/2019	27/07/2020	14/07/2021
8260B Volatile Organic Compounds	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vinyl acetate	700	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.69	-	-	-	-	-	-
Vinyl chloride	2.4	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.40	-	-	-	-	-	-
Xylenes, Total	370	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	<0.23	<0.00023	-	-	-	-	-
6010B Inductively Coupled Plasma - Atomic Emission Spectrometry- Total	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Antimony	4.3	mg/L	62-302.530 SW Quality Criteria	mg/L	-	<0.00050	-	<0.0005	<0.00052	-	<0.00050	-	<0.00050	-
Arsenic	0.05	mg/L	62-302.530 SW Quality Criteria	mg/L	0.0025	0.0026	-	0.0027	0.0021	-	0.003	0.0027	0.0022	-
Barium	N/A	mg/L	SW Cleanup Target Levels	mg/L	0.0092	0.012	-	0.0083	0.011	-	0.0097	0.0087	0.0076	-
Beryllium	0.00013	mg/L	62-302.530 SW Quality Criteria	mg/L	-	<0.00017	-	<0.00017	<0.0002	-	<0.00017	-	<0.00017	-
Cadmium	0.0088	mg/L	62-302.530 SW Quality Criteria	mg/L	-	<0.00015	-	<0.00015	<0.000078	-	0.0016	-	<0.00015	-
Chromium (Hexavalent)	0.05	mg/L	SW Cleanup Target Levels	mg/L	0.0035	0.0044	-	-	0.0026	-	<0.0016	0.0032	0.004	-
Cobalt	N/A	mg/L	SW Cleanup Target Levels	mg/L	0.00019	0.00022	-	<0000.12	<0.00022	-	<0.00012	0.00022	0.00021	-
Copper	0.0037	mg/L	62-302.530 SW Quality Criteria	mg/L	-	<0.0017	-	<0.0017	<0.0009	-	<0.0017	-	<0.0017	-
Iron	0.3	mg/L	62-302.530 SW Quality Criteria	mg/L	-	-	-	-	-	-	-	-	-	-
Lead	0.0085	mg/L	62-302.530 SW Quality Criteria	mg/L	-	0.027	-	-	-	-	-	-	0.039	-
Magnesium	-	-	No Standard	mg/L	1400	-	-	-	-	-	-	1400	-	-
Nickel	0.0083	mg/L	62-302.530 SW Quality Criteria	mg/L	-	<0.0019	-	<0.0019	<0.0018	-	<0.0019	-	<0.0019	-
Selenium	71	mg/L	62-302.530 SW Quality Criteria	mg/L	0.0026	<0.001	-	0.0019	<0.0012	-	0.003	0.0026	<0.001	-
Silver	0.0004	mg/L	SW Cleanup Target Levels	mg/L	0.00017	<0.0001	-	<0.0001	<0.00039	-	<0.0001	-	<0.00049	-
Thallium	0.0063	mg/L	62-302.530 SW Quality Criteria	mg/L	-	<0.00049	-	<0.00049	<0.00026	-	<0.00049	-	<0.0053	-
Vanadium	N/A	mg/L	SW Cleanup Target Levels	mg/L	-	<0.0053	-	<0.0053	<0.0018	-	<0.0053	-	<0.0096	-
Zinc	0.086	mg/L	SW Cleanup Target Levels	mg/L	-	<0.0096	-	<0.0096	<0.010	-	<0.0096	-	<0.0096	-
7470A Mercury in Liquid Waste (Manual Cold Vapor Technique)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	0.000025	mg/L	62-302.530 SW Quality Criteria	mg/L	-	<0.000080	-	<0.000080	-	-	-	-	<0.000080	-
PCBs	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB-1016	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.18	-	<0.14	-	-	-	-	<0.17	-
PCB-1221	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.14	-	<0.11	-	-	-	-	<0.14	-
PCB-1232	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.12	-	<0.096	-	-	-	-	<0.12	-
PCB-1242	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.17	-	<0.13	-	-	-	-	<0.16	-
PCB-1248	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.074	-	<0.059	-	-	-	-	<0.073	-
PCB-1254	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.14	-	<0.11	-	-	-	-	<0.14	-
PCB-1260	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.12	-	<0.096	-	-	-	-	<0.12	-
Persticides	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4,4'-DDD	0.0003	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.0071	-	<0.0057	-	-	-	-	<0.0070	-
4,4'-DDE	0.0002	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.0068	-	<0.0054	-	-	-	-	<0.0068	-
4,4'-DDT	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.0078	-	<0.0063	-	-	-	-	<0.0078	-
Aldrin	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.0067	-	<0.0054	-	-	-	-	<0.0067	-
alpha-BHC	0.005	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.0072	-	<0.0057	-	-	-	-	<0.0071	-
beta-BHC	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.011	-	<0.0088	-	-	-	-	<0.011	-
Chlordane (technical)	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.10	-	<0.081	-	-	-	-	<0.10	-
delta-BHC	NA	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.012	-	<0.0096	-	-	-	-	<0.012	-
Dieldrin	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.0079	-	<0.0063	-	-	-	-	<0.0079	-
Endosulfan I	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.0076	-	<0.0060	-	-	-	-	<0.0075	-
Endosulfan II	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.0078	-	<0.0063	-	-	-	-	<0.0078	-
Endosulfan sulfate	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.0077	-	<0.0061	-	-	-	-	<0.0076	-
Endrin	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.0081	-	<0.0065	-	-	-	-	<0.0080	-
Endrin aldehyde	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.016	-	<0.013	-	-	-	-	<0.016	-
Endrin ketone	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.0082	-	<0.0065	-	-	-	-	<0.0081	-
gamma-BHC (Lindane)	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.0077	-	<0.0061	<0.0000079	-	-	-	<0.0076	-
Heptachlor	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.0073	-	<0.0058	-	-	-	-	<0.0072	-
Heptachlor epoxide	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.0075	-	<0.0060	-	-	-	-	<0.0074	-
Methoxychlor	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.0086	-	<0.0068	-	-	-	-	<0.0085	-
Toxaphene	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.18	-	<0.14	-	-	-	-	<0.17	-
Hydrocarbons	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diesel Range Organics [C10-C28]	-	-	No Standard	mg/L	-	-	-	-	-	0.048	0.09	-	-	-

Paramaters	Florida Clean up Standard Marine Surface Water Criteria			Reporting Unit	NS #2 2019 28/08/2019	NS #2 2020 27/07/2020	NS #2 Jul-21 14/07/2021	NS #2 Dec-21 30/11/2021	NS #2 Jul-22 01/07/2022	NS #3 2015 15/04/2015	NS #3 2016 16/12/2016	NS #3 2019 28/08/2019	NS #3 2020 27/07/2020	NS #3 Jul-21 14/07/2021
	MCL	Unit	Source											
Gasoline Range Organics (GRO)-C6-C10	-	-	No Standard	mg/L	-	-	-	-	-	-	<0.05	-	-	-
Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	NA	ug/L	Freshwater Surface Water Criteria	mg/L	-	-	-	-	-	-	-	-	-	-
Cyanide, Total	**	ug/L	Freshwater Surface Water Criteria	mg/L	-	-	-	-	-	<0.0035	-	-	-	-
Phenol	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C6-C8 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C5-C7 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
TPH	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Hardness as calcium carbonate	-	mg/L	-	-	-	-	-	-	7200	-	-	-	-	-
Nitrogen, Total	-	mg/L	-	-	-	-	-	-	3.1	-	-	-	-	-
Sulfate	-	mg/L	-	-	-	-	-	-	2600	-	-	-	-	-
Total Non-purgeable Organic Carbon	-	mg/L	-	-	-	-	-	-	7.7	-	-	-	-	-
Unionized Ammonia	-	mg/L	-	-	-	-	-	-	0.0059	-	-	-	-	-
Chlorophyll A	-	mg/m3	-	-	-	-	-	-	19	-	-	-	-	-
Faecal Coliform	-	mpn/100ml	-	-	-	-	-	-	261	-	-	-	-	-
Temperature	-	Degree	-	-	-	-	-	-	19.7	-	-	-	-	-
4-Methyl-2-pentanone	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Nitrate as N	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Nitrite as N	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Resistivity	-	ohm cm	-	-	-	-	-	-	-	-	-	-	-	-
1-Methylnaphthalene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
2-Methylnaphthalene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthylene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Anthracene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Benzo[a]anthracene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Benzo[a]pyrene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Benzo[b]fluoranthene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Benzo[g,h,i]perylene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Benzo[k]fluoranthene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Fluoranthene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Ideno[1,2,3-cd]pyrene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Napthalene	-	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C10-C12 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C10-C12 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C12-C16 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C12-C16 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C16-C21 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C16-C35 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C21-C35 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C5-C6 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C5-C7 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C6-C8 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C7-C8 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C8-C10 aliphatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Over C8-C10 aromatics	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sodium	-	-	-	-	-	-	-	-	-	-	-	-	-	-

	Florida Clean up Standard Marine Surface Water Criteria			Reporting	NS #3	NS #3	NS #4	SW21	SW21	SW22	SW22	SW22	Leachate	Leachate
					Dec-21	Jul-22	2015	Jul-22	Dec-22	Dec-21	Jul-22	Dec-22	Jul-20	Dec-21
Paramaters	MCL	Unit	Source	Unit	30/11/2021	01/07/2022	15/04/2015	01/07/2022	05/12/2022	30/11/2021	01/07/2022	05/12/2022	27/07/2020	30/11/2021
Ammonia	N/A	mg/L	SW Cleanup Target Levels	mg/L	0.12	0.26	<0.020	7.3	4.2	6.1	2.6	8.5	350	280
Nitrogen, Kjeldahl	-	mg/L	-	-	0.57	0.88	0.38	9.3	6.9	10	4.2	9.4	490	430
Nitrate Nitrite as N	N/A	mg/L	SW Cleanup Target Levels	mg/L	0.034	0.04	0.059	0.014	<0.023	<0.01	<0.01	<0.023	16	0.12
Orthophosphate	-	-	-	mg/L	-	-	<0.015	-	-	-	-	-	-	-
Phosphorus	-	-	-	mg/L	<0.041	0.17	-	0.27	0.13	<0.041	0.12	0.34	1.9	4.6
Chemical Oxygen Demand	-	-	-	mg/L	340	250	200	190	150	220	230	170	1300	7200
pH	-	-	-	-	8.00	8.30	-	8.5	8	7.2	7.3	7.6	8.1	7.1
Specific Conductance	-	-	-	umhos/cm	50000	52000	-	15000	9000	32000	34000	37000	17000	27000
Total Dissolved Solids	N/A	mg/L	SW Cleanup Target Levels	mg/L	33000	35000	40000	7300	5100	21000	18000	24000	9100	21000
Total Suspended Solids	-	-	-	mg/L	3.9	9.3	11	27	41	14	19	18	20	580
Turbidity	29	NTU	62-302.530 SW Quality Criteria*	NTU	0.65	2.1	0.8	10	16	120	21	10	27	500
Biochemical Oxygen Demand	-	-	-	mg/L	<240	<24	<2.0	<24	<24	26	25	35	240	5500
8260B Volatile Organic Compounds by GC/MS	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acetone	1700	ug/L	SW Cleanup Target Levels	ug/L	<3.7	<0.0037	-	<0.0037	<3.7	<0.0037	<0.0037	<3.7	<0.0097	0.59
Acrylonitrile	0.2	ug/L	SW Cleanup Target Levels	ug/L	<5.5	-	-	-	<5.5	<0.0055	-	<5.5	<0.001	<0.055
Benzene	71.28	ug/L	62-302.530 SW Quality Criteria	ug/L	<0.27	-	-	-	<0.27	<0.00027	-	<0.27	<0.00043	<0.0027
Bromochloromethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	<0.34	-	-	-	-	<0.00034	-	-	<0.00045	<0.0034
Bromodichloromethane	22	ug/L	62-302.530 SW Quality Criteria	ug/L	<0.25	-	-	-	-	<0.00025	-	-	<0.00044	<0.0025
Bromoform	360	ug/L	SW Cleanup Target Levels	ug/L	<0.59	-	-	-	<0.59	<0.00059	-	<0.59	<0.00043	<0.0059
Carbon disulfide	110	ug/L	SW Cleanup Target Levels	ug/L	<0.43	<0.00043	-	<0.00043	<0.43	<0.00043	0.00082	<0.43	<0.001	0.0081
Carbon tetrachloride	4.42	ug/L	SW Cleanup Target Levels	ug/L	<0.30	-	-	-	<0.30	<0.00030	-	<0.30	<0.00033	<0.003
Chlorobenzene	17	ug/L	SW Cleanup Target Levels	ug/L	<0.15	-	-	-	<0.15	<0.00015	-	<0.15	<0.00026	<0.0015
Chloroethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	<4.6	-	-	-	<4.6	<0.0046	-	<4.6	<0.0025	<0.046
Chloroform	470.8	ug/L	SW Cleanup Target Levels	ug/L	<0.27	-	-	-	<0.27	<0.00027	-	<0.27	<0.0005	<0.0027
Dibromochloromethane	34	ug/L	62-302.530 SW Quality Criteria	ug/L	-	-	-	-	-	-	-	-	-	-
1,2-Dibromo-3-Chloropropane	N/A	ug/L	SW Cleanup Target Levels	ug/L	<0.39	-	-	-	<1.8	<0.00039	-	<1.8	<0.00032	<0.0039
1,2-Dibromoethane (EDB)	13	ug/L	SW Cleanup Target Levels	ug/L	<0.33	-	-	-	-	<0.00033	-	-	<0.00044	<0.0033
1,2-Dichlorobenzene	99	ug/L	SW Cleanup Target Levels	ug/L	<0.31	-	-	-	<0.31	<0.00031	-	<0.31	<0.00037	<0.0031
1,4-Dichlorobenzene	3	ug/L	SW Cleanup Target Levels	ug/L	<0.31	-	-	-	<0.31	<0.00031	-	<0.31	<0.00037	<0.0031
trans-1,4-Dichloro-2-butene	-	-	No Standard	ug/L	<1.3	-	-	-	<1.3	<0.0013	-	<1.3	<0.00051	<0.013
1,1-Dichloroethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	<0.33	-	-	-	<0.33	<0.00033	-	<0.33	<0.00038	<0.0033
1,2-Dichloroethane	37	ug/L	SW Cleanup Target Levels	ug/L	<0.25	-	-	-	<0.25	<0.00025	-	<0.25	<0.0005	<0.0025
1,1-Dichloroethene	3.2	ug/L	62-302.530 SW Quality Criteria	ug/L	<0.33	-	-	-	<0.33	<0.00033	-	<0.33	<0.00038	<0.0033
cis-1,2-Dichloroethene	N/A	ug/L	SW Cleanup Target Levels	ug/L	<0.25	-	-	-	<0.25	<0.00025	-	<0.25	<0.0005	<0.0025
trans-1,2-Dichloroethene	11000	ug/L	SW Cleanup Target Levels	ug/L	<0.34	-	-	-	<0.34	<0.00034	-	<0.34	<0.00037	<0.0034
1,2-Dichloropropane	14	ug/L	SW Cleanup Target Levels	ug/L	<0.22	-	-	-	<0.26	<0.00022	-	<0.26	<0.00067	<0.0025
cis-1,3-Dichloropropene	12	ug/L	SW Cleanup Target Levels	ug/L	<0.22	-	-	-	<0.26	<0.00022	-	<0.26	<0.00067	<0.0025
trans-1,3-Dichloropropene	12	ug/L	SW Cleanup Target Levels	ug/L	<0.23	-	-	-	<0.23	<0.00023	-	<0.23	<0.00042	<0.0023
Ethylbenzene	610	ug/L	SW Cleanup Target Levels	ug/L	<0.20	-	-	-	<0.2	<0.0002	-	<0.2	0.00054	-
2-Hexanone	NA	ug/L	SW Cleanup Target Levels	ug/L	<3.2	-	-	-	<3.2	-	-	<3.2	<0.002	<0.032
Bromomethane	35	ug/L	SW Cleanup Target Levels	ug/L	<3.7	-	-	-	<3.7	-	-	<3.7	<0.025	<0.037
Chloromethane (methyl chloride)	470.8	ug/L	62-302.530 SW Quality Criteria	ug/L	<0.54	-	-	-	<0.54	-	-	<0.54	<0.0004	<0.0054
Dibromomethane (EDB)	13	ug/L	SW Cleanup Target Levels	ug/L	<0.34	-	-	-	<0.34	<0.00034	-	<0.34	<0.00035	<0.0034
Methylene Chloride	1580	ug/L	62-302.530 SW Quality Criteria	ug/L	<3.2	-	-	-	<3.2	<0.0032	-	<3.2	<0.0025	<0.032
Methyl Ethyl Ketone (MEK)	120000	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	-	-	<0.0064	-	-	<0.0034	0.26
Iodomethane	-	-	No Standard	ug/L	<3.9	-	-	-	<3.9	<0.0039	-	<3.9	<0.005	<0.039
methyl isobutyl ketone	23000	ug/L	SW Cleanup Target Levels	ug/L	-	-	-	-	-	-	-	-	-	-
Styrene	460	ug/L	SW Cleanup Target Levels	ug/L	<0.27	-	-	-	<0.27	<0.00027	-	<0.27	<0.00027	<0.0027
1,1,1,2-Tetrachloroethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	<0.36	-	-	-	<0.36	<0.00036	-	<0.36	<0.00037	<0.0036
1,1,2,2-Tetrachloroethane	10.8	ug/L	62-302.530 SW Quality Criteria	ug/L	<0.40	-	-	-	<0.40	<0.0004	-	<0.40	<0.00062	<0.004
Tetrachloroethene (Tetrachloroethylene)	8.85	ug/L	62-302.530 SW Quality Criteria	ug/L	<0.35	-	-	-	<0.35	<0.00035	-	<0.35	<0.00074	<0.0035
Toluene	480	ug/L	SW Cleanup Target Levels	ug/L	<0.25	-	-	-	<0.25	<0.00025	-	<0.25	<0.001	0.0057
1,1,1-Trichloroethane	270	ug/L	SW Cleanup Target Levels	ug/L	<0.21	-	-	-	<0.21	<0.00021	-	<0.21	<0.00037	<0.0021
1,1,2-Trichloroethane	16	ug/L	SW Cleanup Target Levels	ug/L	<0.32	-	-	-	<0.32	<0.00032	-	<0.32	<0.00033	<0.0032
Trichloroethene	80.7	ug/L	62-302.530 SW Quality Criteria	ug/L	<0.20	-	-	-	<0.20	<0.0002	-	<0.20	<0.00048	<0.002
Trichlorofluoromethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	<0.33	-	-	-	<0.33	<0.00033	-	<0.33	<0.00042	<0.0033
1,2,3-Trichloropropane	0.2	ug/L	SW Cleanup Target Levels	ug/L	<0.48	-	-	-	<0.48	<0.00048	-	<0.48	<0.00039	<0.0048

	Florida Clean up Standard Marine Surface Water Criteria			Reporting	NS #3	NS #3	NS #4	SW21	SW21	SW22	SW22	SW22	Leachate	Leachate
					Dec-21	Jul-22	2015	Jul-22	Dec-22	Dec-21	Jul-22	Dec-22	Jul-20	Dec-21
Paramaters	**MCL**	**Unit**	**Source**	**Unit**	30/11/2021	01/07/2022	15/04/2015	01/07/2022	05/12/2022	30/11/2021	01/07/2022	05/12/2022	27/07/2020	30/11/2021
8260B Volatile Organic Compounds	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vinyl acetate	700	ug/L	SW Cleanup Target Levels	ug/L	<0.69	-	-	-	<0.69	<0.00069	-	<0.69	<0.00081	<0.0069
Vinyl chloride	2.4	ug/L	SW Cleanup Target Levels	ug/L	<0.40	-	-	-	<0.40	<0.0004	-	<0.40	<0.0005	<0.004
Xylenes, Total	370	ug/L	SW Cleanup Target Levels	ug/L	<0.23	<0.00023	-	<0.00023	<0.23	<0.00023	<0.00023	<0.23	0.00082	<0.0023
6010B Inductively Coupled Plasma - Atomic Emission Spectrometry- Total	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Antimony	4.3	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.0005	<0.00052	-	0.00098	0.75	<0.0005	<0.00052	<0.52	<0.0081	0.023
Arsenic	0.05	mg/L	62-302.530 SW Quality Criteria	mg/L	0.0025	0.0018	-	0.064	4.9	0.0031	0.0018	2.5	<0.09	0.13
Barium	N/A	mg/L	SW Cleanup Target Levels	mg/L	0.0069	0.0077	-	0.1	83	0.038	0.023	22	<0.16	0.57
Beryllium	0.00013	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.00017	<0.0002	-	<0.0002	<0.20	<0.00017	<0.0002	<0.20	<0.00017	0.00026
Cadmium	0.0088	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.00015	<0.000078	-	<0.000078	<0.078	<0.00015	<0.000078	<0.078	<0.0003	0.00085
Chromium (Hexavalent)	0.05	mg/L	SW Cleanup Target Levels	mg/L	-	<0.0026	-	0.0073	7.4	0.0029	<0.0026	3.9	<0.12	0.36
Cobalt	N/A	mg/L	SW Cleanup Target Levels	mg/L	<0000.12	<0.00022	-	0.00034	0.28	0.00019	<0.00022	0.25	<0.0094	0.0085
Copper	0.0037	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.0017	<0.0009	-	0.0029	<0.90	<0.0017	<0.0009	<0.90	<0.11	0.2
Iron	0.3	mg/L	62-302.530 SW Quality Criteria	mg/L	-	-	-	-	150	-	-	43	-	-
Lead	0.0085	mg/L	62-302.530 SW Quality Criteria	mg/L	-	-	-	-	0.49	-	-	<0.34	3.3	-
Magnesium	-	-	No Standard	mg/L	-	-	-	-	170	-	-	900	-	-
Nickel	0.0083	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.0019	<0.0018	-	0.0021	2.4	<0.0019	<0.0018	<1.8	<0.057	0.061
Selenium	71	mg/L	62-302.530 SW Quality Criteria	mg/L	0.0015	<0.0012	-	<0.0012	<1.2	<0.0016	<0.0012	<1.2	<0.001	0.0032
Silver	0.0004	mg/L	SW Cleanup Target Levels	mg/L	<0.0001	<0.00039	-	<0.00039	<0.39	<0.0001	<0.00039	<0.39	0.00015	0.00036
Thallium	0.0063	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.00049	<0.00026	-	<0.00026	<0.26	<0.00049	<0.00026	<0.26	<0.00049	<0.00049
Vanadium	N/A	mg/L	SW Cleanup Target Levels	mg/L	<0.0053	<0.0018	-	<0.0018	<1.8	<0.053	<0.0018	2.7	<0.0015	0.036
Zinc	0.086	mg/L	SW Cleanup Target Levels	mg/L	<0.0096	<0.010	-	<0.01	<10	<0.0096	<0.01	<10	0.2	0.86
7470A Mercury in Liquid Waste (Manual Cold Vapor Technique)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	0.000025	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.000080	-	-	-	<0.080	<0.00008	-	<0.080	<0.00008	<0.00008
PCBs	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB-1016	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.14	-	-	-	<0.31	<0.00031	-	<0.32	<0.00018	<0.0015
PCB-1221	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.11	-	-	-	<0.33	<0.00024	-	<0.34	<0.00014	<0.0012
PCB-1232	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.098	-	-	-	<0.33	<0.00021	-	<0.34	<0.00012	<0.001
PCB-1242	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.14	-	-	-	<0.33	<0.00029	-	<0.34	<0.00017	<0.0014
PCB-1248	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.060	-	-	-	<0.33	<0.00013	-	<0.34	<0.000074	<0.00062
PCB-1254	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.11	-	-	-	<0.33	<0.00024	-	<0.34	<0.00014	<0.0012
PCB-1260	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.098	-	-	-	<0.33	<0.00021	-	<0.34	<0.00012	<0.001
Persticides	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4,4'-DDD	0.0003	ug/L	Freshwater Surface Water Criteria	ug/L	<0.0058	-	-	-	<0.0019	<0.00012	-	<0.0020	<0.0000071	<0.000059
4,4'-DDE	0.0002	ug/L	Freshwater Surface Water Criteria	ug/L	<0.0056	-	-	-	<0.00097	<0.00012	-	<0.0010	<0.0000069	<0.000057
4,4'-DDT	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.0064	-	-	-	<0.00097	<0.00014	-	<0.0010	<0.0000079	<0.000065
Aldrin	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.0055	-	-	-	<0.0019	<0.00012	-	<0.0020	<0.0000068	<0.000056
alpha-BHC	0.005	ug/L	Freshwater Surface Water Criteria	ug/L	<0.0059	-	-	-	<0.00097	<0.00013	-	<0.0010	<0.0000072	<0.00006
beta-BHC	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.0090	-	-	-	<0.0019	<0.00019	-	<0.0020	<0.000011	0.00015
Chlordane (technical)	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.083	-	-	-	-	<0.0018	-	-	<0.0001	<0.00085
delta-BHC	NA	ug/L	Freshwater Surface Water Criteria	ug/L	<0.0098	-	-	-	<0.0019	<0.00021	-	<0.0020	<0.000025	<0.0001
Dieldrin	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.0065	-	-	-	<0.0019	<0.00014	-	<0.0020	<0.000008	<0.000066
Endosulfan I	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.0062	-	-	-	<0.0019	<0.00013	-	<0.0020	0.000042	<0.000063
Endosulfan II	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.0064	-	-	-	<0.0019	<0.00014	-	<0.0020	<0.0000079	<0.000065
Endosulfan sulfate	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.0062	-	-	-	<0.0019	<0.00013	-	<0.0020	<0.0000077	<0.000064
Endrin	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.0066	-	-	-	<0.00097	<0.00014	-	<0.0010	<0.0000082	<0.000068
Endrin aldehyde	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.013	-	-	-	<0.0039	<0.00027	-	<0.0040	<0.000016	<0.00013
Endrin ketone	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.0067	-	-	-	<0.0039	<0.00014	-	<0.0040	<0.0000083	<0.000069
gamma-BHC (Lindane)	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.0062	<0.0000080	-	<0.0000082	<0.00097	<0.00013	<0.0000085	<0.0010	<0.0000077	<0.000064
Heptachlor	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.0059	-	-	-	<0.00097	<0.00013	-	<0.0010	<0.0000073	<0.000061
Heptachlor epoxide	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.0061	-	-	-	<0.0019	<0.00013	-	<0.0020	<0.0000075	<0.000062
Methoxychlor	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.0070	-	-	-	<0.0019	<0.00015	-	<0.0020	<0.0000086	<0.000072
Toxaphene	**	ug/L	Freshwater Surface Water Criteria	ug/L	<0.14	-	-	-	<0.3	<0.0031	-	<0.31	-	<0.0015
Hydrocarbons	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diesel Range Organics [C10-C28]	-	-	No Standard	mg/L	-	-	-	-	-	-	-	-	-	-

	Florida Clean up Standard Marine Surface Water Criteria			Reporting	NS #3	NS #3	NS #4	SW21	SW21	SW22	SW22	SW22	Leachate	Leachate
				Unit	Dec-21	Jul-22	2015	Jul-22	Dec-22	Dec-21	Jul-22	Dec-22	Jul-20	Dec-21
Paramaters	MCL	Unit	Source		30/11/2021	01/07/2022	15/04/2015	01/07/2022	05/12/2022	30/11/2021	01/07/2022	05/12/2022	27/07/2020	30/11/2021
Gasoline Range Organics (GRO)-C6-C10	-	-	No Standard	mg/L	-	-	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	NA	ug/L	Freshwater Surface Water Criteria	mg/L	-	-	-	-	-	-	-	-	-	-
Cyanide, Total	**	ug/L	Freshwater Surface Water Criteria	mg/L	-	-	-	-	-	-	-	-	-	-
Phenol	-	ug/L	-	-	-	-	-	<0.00012	<1.5	-	0.00031	-	0.003	4.4
Over C6-C8 aliphatics	-	mg/L	-	-	-	-	-	0.36	<0.32	-	-	<0.32	-	-
Over C5-C7 aromatics	-	mg/L	-	-	-	-	-	0.42	<0.32	-	-	<0.32	-	-
TPH	-	mg/L	-	-	-	-	-	<2.6	<2.7	-	<2.7	<2.6	-	-
Hardness as calcium carbonate	-	mg/L	-	-	-	7500	-	1800	1100	4600	5100	4500	1800	6100
Nitrogen, Total	-	mg/L	-	-	-	0.92	-	9.3	6.9	10	4.2	9.4	510	430
Sulfate	-	mg/L	-	-	-	2600	-	6.3	7.7	1700	1700	2000	5.5	2000
Total Non-purgeable Organic Carbon	-	mg/L	-	-	-	3.7	-	53	-	24	31	-	-	2200
Unionized Ammonia	-	mg/L	-	-	-	0.0031	-	0.024	0.006	0.056	0.026	0.011	25	0.53
Chlorophyll A	-	mg/m3	-	-	-	8	-	-	45	-	79	110	-	-
Faecal Coliform	-	mpn/100ml	-	-	-	52	-	>2419.6	-	-	>2419.6	-	-	-
Temperature	-	Degree	-	-	-	23	-	23.5	-	19.9	19.9	-	22.9	20.3
4-Methyl-2-pentanone	-	ug/L	-	-	-	-	-	-	-	<0.0027	-	-	<0.0021	<0.0027
Nitrate as N	-	mg/L	-	-	-	-	-	-	<0.023	0.018	-	<0.023	-	0.67
Nitrite as N	-	mg/L	-	-	-	-	-	-	-	0.018	-	-	11	0.43
Resistivity	-	ohm cm	-	-	-	-	-	-	-	31	-	-	-	36
1-Methylnaphthalene	-	ug/L	-	-	-	-	-	-	<0.018	-	-	-	<0.004	<0.02
2-Methylnaphthalene	-	ug/L	-	-	-	-	-	-	<0.011	-	-	-	<0.001	<0.0049
Acenaphthene	-	ug/L	-	-	-	-	-	-	<0.042	-	-	-	<0.001	<0.0049
Acenaphthylene	-	ug/L	-	-	-	-	-	-	<0.017	-	-	-	<0.001	<0.0049
Anthracene	-	ug/L	-	-	-	-	-	-	<0.018	-	-	-	<0.001	<0.049
Benzo[a]anthracene	-	ug/L	-	-	-	-	-	-	<0.026	-	-	-	<0.001	<0.049
Benzo[a]pyrene	-	ug/L	-	-	-	-	-	-	<0.026	-	-	-	<0.001	<0.049
Benzo[b]fluoranthene	-	ug/L	-	-	-	-	-	-	<0.026	-	-	-	<0.001	<0.049
Benzo[g,h,i]perylene	-	ug/L	-	-	-	-	-	-	<0.026	-	-	-	<0.001	<0.049
Benzo[k]fluoranthene	-	ug/L	-	-	-	-	-	-	<0.029	-	-	-	<0.001	<0.049
Chrysene	-	ug/L	-	-	-	-	-	-	<0.023	-	-	-	<0.00045	<0.0022
Dibenz(a,h)anthracene	-	ug/L	-	-	-	-	-	-	<0.024	-	-	-	<0.001	<0.0049
Fluoranthene	-	ug/L	-	-	-	-	-	-	<0.027	-	-	-	<0.001	<0.0049
Fluorene	-	ug/L	-	-	-	-	-	-	<0.025	-	-	-	<0.001	<0.0049
Ideno[1,2,3-cd]pyrene	-	ug/L	-	-	-	-	-	-	<0.028	-	-	-	<0.001	<0.0049
Napthalene	-	ug/L	-	-	-	-	-	-	<0.014	-	-	-	<0.002	<0.0049
Over C10-C12 aliphatics	-	mg/L	-	-	-	-	-	-	<0.32	-	-	-	<0.29	-
Over C10-C12 aromatics	-	mg/L	-	-	-	-	-	-	<0.32	-	-	-	<0.29	-
Over C12-C16 aliphatics	-	mg/L	-	-	-	-	-	-	<0.32	-	-	-	<0.29	-
Over C12-C16 aromatics	-	mg/L	-	-	-	-	-	-	<0.32	-	-	-	<0.29	-
Over C16-C21 aromatics	-	mg/L	-	-	-	-	-	-	<0.32	-	-	-	<0.29	-
Over C16-C35 aliphatics	-	mg/L	-	-	-	-	-	-	<0.32	-	-	-	<0.29	-
Over C21-C35 aromatics	-	mg/L	-	-	-	-	-	-	<0.32	-	-	-	<0.29	-
Over C5-C6 aliphatics	-	mg/L	-	-	-	-	-	-	<0.32	-	-	-	<0.29	-
Over C5-C7 aromatics	-	mg/L	-	-	-	-	-	-	<0.32	-	-	-	<0.29	-
Over C6-C8 aliphatics	-	mg/L	-	-	-	-	-	-	<0.32	-	-	-	<0.29	-
Over C7-C8 aromatics	-	mg/L	-	-	-	-	-	-	<0.32	-	-	-	<0.29	-
Over C8-C10 aliphatics	-	mg/L	-	-	-	-	-	-	<0.32	-	-	-	<0.29	-
Over C8-C10 aromatics	-	mg/L	-	-	-	-	-	-	<0.32	-	-	-	<0.29	-
Phenanthrene	-	-	-	-	-	-	-	-	<0.056	-	-	-	<0.001	<0.0049
Pyrene	-	-	-	-	-	-	-	-	<0.027	-	-	-	<0.001	<0.0049
Sodium	-	-	-	-	-	-	-	-	-	-	-	-	2200	-

Paramaters	Florida Clean up Standard Marine Surface Water Criteria			Reporting Unit	Leachate Jul-22 01/07/2022	Leachate Dec-22 05/12/2022
	MCL	Unit	Source			
Ammonia	N/A	mg/L	SW Cleanup Target Levels	mg/L	300	300
Nitrogen, Kjeldahl	-	mg/L	-	-	360	370
Nitrate Nitrite as N	N/A	mg/L	SW Cleanup Target Levels	mg/L	0.18	<0.23
Orthophosphate	-	-	-	mg/L	-	-
Phosphorus	-	-	-	mg/L	1	2.3
Chemical Oxygen Demand	-	-	-	mg/L	1500	2100
pH	-	-	-	-	8.5	8.2
Specific Conductance	-	-	-	umhos/cm	13000	15000
Total Dissolved Solids	N/A	mg/L	SW Cleanup Target Levels	mg/L	8000	8100
Total Suspended Solids	-	-	-	mg/L	19	160
Turbidity	29	NTU	62-302.530 SW Quality Criteria*	NTU	19	170
Biochemical Oxygen Demand	-	-	-	mg/L	52	100
8260B Volatile Organic Compounds by GC/MS	-	-	-	-	-	-
Acetone	1700	ug/L	SW Cleanup Target Levels	ug/L	0.025	<37
Acrylonitrile	0.2	ug/L	SW Cleanup Target Levels	ug/L	-	<55
Benzene	71.28	ug/L	62-302.530 SW Quality Criteria	ug/L	-	<2.7
Bromochloromethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	-	-
Bromodichloromethane	22	ug/L	62-302.530 SW Quality Criteria	ug/L	-	-
Bromoform	360	ug/L	SW Cleanup Target Levels	ug/L	-	<5.9
Carbon disulfide	110	ug/L	SW Cleanup Target Levels	ug/L	<0.0022	<4.3
Carbon tetrachloride	4.42	ug/L	SW Cleanup Target Levels	ug/L	-	<3.0
Chlorobenzene	17	ug/L	SW Cleanup Target Levels	ug/L	-	<1.5
Chloroethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	-	<46
Chloroform	470.8	ug/L	SW Cleanup Target Levels	ug/L	-	<2.7
Dibromochloromethane	34	ug/L	62-302.530 SW Quality Criteria	ug/L	-	-
1,2-Dibromo-3-Chloropropane	N/A	ug/L	SW Cleanup Target Levels	ug/L	-	<18
1,2-Dibromoethane (EDB)	13	ug/L	SW Cleanup Target Levels	ug/L	-	-
1,2-Dichlorobenzene	99	ug/L	SW Cleanup Target Levels	ug/L	-	<3.1
1,4-Dichlorobenzene	3	ug/L	SW Cleanup Target Levels	ug/L	-	<3.1
trans-1,4-Dichloro-2-butene	-	-	No Standard	ug/L	-	<13
1,1-Dichloroethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	-	<3.3
1,2-Dichloroethane	37	ug/L	SW Cleanup Target Levels	ug/L	-	<2.5
1,1-Dichloroethene	3.2	ug/L	62-302.530 SW Quality Criteria	ug/L	-	<3.3
cis-1,2-Dichloroethene	N/A	ug/L	SW Cleanup Target Levels	ug/L	-	<2.5
trans-1,2-Dichloroethene	11000	ug/L	SW Cleanup Target Levels	ug/L	-	<3.4
1,2-Dichloropropane	14	ug/L	SW Cleanup Target Levels	ug/L	-	<2.6
cis-1,3-Dichloropropene	12	ug/L	SW Cleanup Target Levels	ug/L	-	<2.6
trans-1,3-Dichloropropene	12	ug/L	SW Cleanup Target Levels	ug/L	-	<2.3
Ethylbenzene	610	ug/L	SW Cleanup Target Levels	ug/L	-	<2.0
2-Hexanone	NA	ug/L	SW Cleanup Target Levels	ug/L	-	<32
Bromomethane	35	ug/L	SW Cleanup Target Levels	ug/L	-	<37
Chloromethane (methyl chloride)	470.8	ug/L	62-302.530 SW Quality Criteria	ug/L	-	<5.4
Dibromomethane (EDB)	13	ug/L	SW Cleanup Target Levels	ug/L	-	<3.4
Methylene Chloride	1580	ug/L	62-302.530 SW Quality Criteria	ug/L	-	<32
Methyl Ethyl Ketone (MEK)	120000	ug/L	SW Cleanup Target Levels	ug/L	-	-
Iodomethane	-	-	No Standard	ug/L	-	<39
methyl isobutyl ketone	23000	ug/L	SW Cleanup Target Levels	ug/L	-	-
Styrene	460	ug/L	SW Cleanup Target Levels	ug/L	-	<2.7
1,1,1,2-Tetrachloroethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	-	<3.6
1,1,2,2-Tetrachloroethane	10.8	ug/L	62-302.530 SW Quality Criteria	ug/L	-	<4.0
Tetrachloroethene (Tetrachloroethylene)	8.85	ug/L	62-302.530 SW Quality Criteria	ug/L	-	<3.5
Toluene	480	ug/L	SW Cleanup Target Levels	ug/L	-	<2.5
1,1,1-Trichloroethane	270	ug/L	SW Cleanup Target Levels	ug/L	-	<2.1
1,1,2-Trichloroethane	16	ug/L	SW Cleanup Target Levels	ug/L	-	<3.2
Trichloroethene	80.7	ug/L	62-302.530 SW Quality Criteria	ug/L	-	<2.0
Trichlorofluoromethane	N/A	ug/L	SW Cleanup Target Levels	ug/L	-	<3.3
1,2,3-Trichloropropane	0.2	ug/L	SW Cleanup Target Levels	ug/L	-	<4.8

Paramaters	Florida Clean up Standard Marine Surface Water Criteria			Reporting Unit	Leachate Jul-22 01/07/2022	Leachate Dec-22 05/12/2022
	MCL	Unit	Source			
8260B Volatile Organic Compounds	-	-	-	-	-	-
Vinyl acetate	700	ug/L	SW Cleanup Target Levels	ug/L	-	<6.9
Vinyl chloride	2.4	ug/L	SW Cleanup Target Levels	ug/L	-	<4.0
Xylenes, Total	370	ug/L	SW Cleanup Target Levels	ug/L	<0.0012	<2.3
6010B Inductively Coupled Plasma - Atomic Emission Spectrometry- Total	-	-	-	-	-	-
Antimony	4.3	mg/L	62-302.530 SW Quality Criteria	mg/L	0.0063	5.6
Arsenic	0.05	mg/L	62-302.530 SW Quality Criteria	mg/L	0.054	61
Barium	N/A	mg/L	SW Cleanup Target Levels	mg/L	0.12	110
Beryllium	0.00013	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.0002	0.21
Cadmium	0.0088	mg/L	62-302.530 SW Quality Criteria	mg/L	0.00016	0.34
Chromium (Hexavalent)	0.05	mg/L	SW Cleanup Target Levels	mg/L	0.018	270
Cobalt	N/A	mg/L	SW Cleanup Target Levels	mg/L	0.2	18
Copper	0.0037	mg/L	62-302.530 SW Quality Criteria	mg/L	0.075	39
Iron	0.3	mg/L	62-302.530 SW Quality Criteria	mg/L	-	11000
Lead	0.0085	mg/L	62-302.530 SW Quality Criteria	mg/L	-	29
Magnesium	-	-	No Standard	mg/L	-	160
Nickel	0.0083	mg/L	62-302.530 SW Quality Criteria	mg/L	0.09	85
Selenium	71	mg/L	62-302.530 SW Quality Criteria	mg/L	0.002	1.7
Silver	0.0004	mg/L	SW Cleanup Target Levels	mg/L	<0.00039	<0.39
Thallium	0.0063	mg/L	62-302.530 SW Quality Criteria	mg/L	<0.00026	<0.26
Vanadium	N/A	mg/L	SW Cleanup Target Levels	mg/L	0.039	39
Zinc	0.086	mg/L	SW Cleanup Target Levels	mg/L	0.17	160
7470A Mercury in Liquid Waste (Manual Cold Vapor Technique)	-	-	-	-	-	-
Mercury	0.000025	mg/L	62-302.530 SW Quality Criteria	mg/L	-	<0.080
PCBs	-	-	-	-	-	-
PCB-1016	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.32
PCB-1221	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.34
PCB-1232	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.34
PCB-1242	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.34
PCB-1248	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.34
PCB-1254	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.34
PCB-1260	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.34
Persticides	-	-	-	-	-	-
4,4'-DDD	0.0003	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.0020
4,4'-DDE	0.0002	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.00099
4,4'-DDT	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.00099
Aldrin	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.0020
alpha-BHC	0.005	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.00099
beta-BHC	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.0020
Chlordane (technical)	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	-
delta-BHC	NA	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.0020
Dieldrin	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.0020
Endosulfan I	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.0020
Endosulfan II	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.0020
Endosulfan sulfate	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.0020
Endrin	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.00099
Endrin aldehyde	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.0040
Endrin ketone	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.0040
gamma-BHC (Lindane)	**	ug/L	Freshwater Surface Water Criteria	ug/L	0.000062	<0.00099
Heptachlor	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.00099
Heptachlor epoxide	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.0020
Methoxychlor	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.0020
Toxaphene	**	ug/L	Freshwater Surface Water Criteria	ug/L	-	<0.31
Hydrocarbons	-	-	-	-	-	-
Diesel Range Organics [C10-C28]	-	-	No Standard	mg/L	-	-

Paramaters	Florida Clean up Standard Marine Surface Water Criteria			Reporting Unit	Leachate Jul-22 01/07/2022	Leachate Dec-22 05/12/2022
	MCL	Unit	Source			
Gasoline Range Organics (GRO)-C6-C10	-	-	No Standard	mg/L	-	-
Other	-	-	-	-	-	-
Boron	NA	ug/L	Freshwater Surface Water Criteria	mg/L	-	-
Cyanide, Total	**	ug/L	Freshwater Surface Water Criteria	mg/L	-	-
Phenol	-	ug/L	-	-	<0.00064	<1.5
Over C6-C8 aliphatics	-	mg/L	-	-	-	-
Over C5-C7 aromatics	-	mg/L	-	-	-	-
TPH	-	mg/L	-	-	<2.9	-
Hardness as calcium carbonate	-	mg/L	-	-	600	1400
Nitrogen, Total	-	mg/L	-	-	360	370
Sulfate	-	mg/L	-	-	480	<2.5
Total Non-purgeable Organic Carbon	-	mg/L	-	-	480	-
Unionized Ammonia	-	mg/L	-	-	10	8.2
Chlorophyll A	-	mg/m3	-	-	-	45
Faecal Coliform	-	mpn/100ml	-	-	290900	-
Temperature	-	Degree	-	-	19.8	-
4-Methyl-2-pentanone	-	ug/L	-	-	-	-
Nitrate as N	-	mg/L	-	-	-	<0.23
Nitrite as N	-	mg/L	-	-	-	-
Resistivity	-	ohm cm	-	-	-	-
1-Methylnaphthalene	-	ug/L	-	-	-	<0.0018
2-Methylnaphthalene	-	ug/L	-	-	-	<0.011
Acenaphthene	-	ug/L	-	-	-	<0.042
Acenaphthylene	-	ug/L	-	-	-	<0.017
Anthracene	-	ug/L	-	-	-	<0.018
Benzo[a]anthracene	-	ug/L	-	-	-	<0.026
Benzo[a]pyrene	-	ug/L	-	-	-	<0.026
Benzo[b]fluoranthene	-	ug/L	-	-	-	<0.026
Benzo[g,h,i]perylene	-	ug/L	-	-	-	<0.026
Benzo[k]fluoranthene	-	ug/L	-	-	-	<0.029
Chrysene	-	ug/L	-	-	-	<0.023
Dibenz(a,h)anthracene	-	ug/L	-	-	-	<0.024
Fluoranthene	-	ug/L	-	-	-	<0.027
Fluorene	-	ug/L	-	-	-	<0.025
Ideno[1,2,3-cd]pyrene	-	ug/L	-	-	-	<0.028
Napthalene	-	ug/L	-	-	-	<0.014
Over C10-C12 aliphatics	-	mg/L	-	-	-	-
Over C10-C12 aromatics	-	mg/L	-	-	-	-
Over C12-C16 aliphatics	-	mg/L	-	-	-	-
Over C12-C16 aromatics	-	mg/L	-	-	-	-
Over C16-C21 aromatics	-	mg/L	-	-	-	-
Over C16-C35 aliphatics	-	mg/L	-	-	-	-
Over C21-C35 aromatics	-	mg/L	-	-	-	-
Over C5-C6 aliphatics	-	mg/L	-	-	-	-
Over C5-C7 aromatics	-	mg/L	-	-	-	-
Over C6-C8 aliphatics	-	mg/L	-	-	-	-
Over C7-C8 aromatics	-	mg/L	-	-	-	-
Over C8-C10 aliphatics	-	mg/L	-	-	-	-
Over C8-C10 aromatics	-	mg/L	-	-	-	-
Phenanthrene	-	-	-	-	-	<0.055
Pyrene	-	-	-	-	-	<0.027
Sodium	-	-	-	-	-	-

Appendix B

Hydrogeological Report – R.C. Minnings & Associates Inc (2023)

HYDROGEOLOGICAL INVESTIGATION

REGEN GEOTHERMAL SYSTEM

GRAND CAYMAN ISLAND,

GRAND CAYMAN

HYDROGEOLOGICAL INVESTIGATION

REGEN GEOTHERMAL SYSTEM

GRAND CAYMAN ISLAND,

GRAND CAYMAN

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Water Authority-Cayman July 14, 2020 Letter Re: Major Groundwater Projects for Dart. Letter to Dart and APEC teams

APPENDIX C

Analyses of Pumping Test Data

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Jones, B., 2020. Subsurface geology, Dart Laundry Site, Grand Cayman. Report prepared for Apec Engineering Ltd., Grand Cayman. November 24, 2020.

Jones, B., 2023. Geological attributes of the Regen site, Grand Cayman. Report prepared for Apec Engineering Ltd., Grand Cayman. March 29, 2023

0.0 EXECUTIVE SUMMARY

DART is advancing the design of the ReGen facility on Grand Cayman. A portion of the ReGen project requires the abstraction and injection of 11,000 gallons per minute (gpm) of cooling water. Hydrogeological desk top review and modelling (Task 1) were initiated to investigate the impacts of placing the proposed geothermal installations at the ReGen site. The aim of Task 1, as set forth in the ReGen Project, Grand Cayman - Geological and Hydrological Study and Investigation in Support of Proposed Geothermal Cooling System. Method Statement – September 6, 2021, (Method Statement) located in Appendix A was to investigate the potential impacts of the new wells relative to each other and existing groundwater users in proximity of the developments. The conclusions from Task 1 work were favorable for the continuation of Task 2 in the Method Statement.

Task 2 hydrogeologic investigation (presented herein) concludes the proposed ReGen geothermal system will be able to abstract the needed 11,000 gpm of groundwater for cooling. The injection of a like amount of heated water into the underlying bedrock formation Layer 5 (~-250 ft to ~-400 ft BGS) will have no impact on the Caribbean Sea, no impact on the residential canals or North Sound, no impact on any adjacent RO or geothermal facility considering the most-likely model scenarios **(MAX Khor – MIN Kvert),** and negligible / minimal temperature rise (0.1ºC to 0.6ºC) in abstraction zone water at the ReGen facility, in part due to migration of heated water from adjacent facilities.

1.0 INTRODUCTION

DART is advancing the design of the ReGen facility on Grand Cayman. A portion of the ReGen project requires the construction of a geothermal system consisting of abstraction and injection wells to supply and dispose of 11,000 gpm of cooling water. Investigation and analysis of the geologic and hydrogeologic aspects of the project were outlined in the Method Statement. Task 1 of the Method Statement called for a hydrogeological desk top review and use of a slightly modified existing computer model to investigate the potential impacts of placing the new wells relative to each other and existing groundwater users in proximity of the development. The conclusions from Task 1 work were favorable for the continuation of Task 2 in the Method Statement. This report presents the findings and conclusions based on completion of those tasks.

Task 2 of the Method Statement comprised research and compilation of available data, reports, and information regarding the proposed ReGen project and nearby water users. Much of this information was provided by The Water Authority – Cayman (WAC) in its letter dated 14 July, 2020 (presented in Appendix B). This information was reviewed and relied upon for the conclusions of this report.

Task 2 of the Method Statement also consisted of the construction of an updated numerical computer model of the groundwater flow system using the most recent Modflow and MT3D code.

Finally, Task 2 of the Method Statement included this report presenting all data, calculations, model inputs/outputs, potential impacts, future development, summary and conclusions and recommendations.

Figure 1 illustrates the general setting, project location, and other pertinent details.

2.0 GEOLOGY / HYDROGEOLOGY

2.1 Geologic Framework

In addition to several historic studies, the subsurface geology of the ReGen site and in general, the western peninsula has been well documented and reported on by Dr. Brian Jones. Dr. Jones has considerable experience in investigating, analyzing and reporting on the geology of the Cayman Islands over the past 20+ years. In addition to some historical sources, five (5) of his more recent papers were reviewed for this project.

1.) Jones, B. 2013. Subsurface geology in area around the Georgetown Landfill Site, Grand Cayman. Report prepared for Apec Engineering Ltd., Grand Cayman. February 8, 2013.

2.) Jones, B., 2014. Geological attributes of the proposed Kimpton Hotel site, Grand Cayman. Report prepared for Apec Engineering Ltd., Grand Cayman. April 11, 2014

3.) Jones, B., 2020. Review of subsurface geology, central part of the western peninsula, Grand Cayman. Report prepared for Apec Engineering Ltd., Grand Cayman. May 28, 2020.

4.) Jones, B., 2020. Subsurface geology, Dart Laundry Site, Grand Cayman. Report prepared for Apec Engineering Ltd., Grand Cayman. November 24, 2020.

5.) Jones, B., 2023. Geological attributes of the Regen site, Grand Cayman. Report prepared for Apec Engineering Ltd., Grand Cayman. March 29, 2023

Jones, 2020, comments on the formations underlying the proposed ReGen site, the shallowest of which is the Ironshore followed by the Pedro Castle, the Cayman and the Brac. Regarding vertical isolation within the Cayman Formation, Jones opines: "*The uppermost Cap Rock is a very hard, finely crystalline dolostone that has porosity values of < 10% (Fig. 9). Although there is some lateral permeability, the* ***vertical permeability is very low****.* ***In contrast, the underlying Porous Unit is formed of finely crystalline dolostones that are less competent than those in the Cap Rock and have high porosities and high lateral permeabilities but low vertical permeability*****."** (Emphasis added). The layers/zones used in this report as well as the material's properties and depths were delineated based on laboratory testing (Core Laboratories, Inc., Houston, Texas) of selected rock cores from the on-site test wells DUM-1, DUM-2 and DUM-3.

Previous laboratory testing of rock cores was completed for the Kimpton Test Well TW-2 and Wastewater Treatment site SHT#4 wells. The horizontal and vertical permeability and porosity data have been combined and are presented as Table 1. Note that while the permeability / porosity data for the cores from the Kimpton Test Well #2 are shown in Table 1, they were not used in calculating the maximum, average and minimum permeability values. Similar data from the SHT#4 well were used as that well is near the ReGen site. The layer boundaries are somewhat arbitrary with respect to exact depths, however, the overall permeabilities lend themselves to grouping into Layers 1, 2, 3, 4 and 5. The horizontal and vertical permeabilities for the Layer 3 cores are a good example. The designated layer boundaries do not necessarily coincide with formational boundaries as described by Jones, 2023.

Previous studies in this area and on Grand Cayman overall indicate that the formations may contain fractures that are not apparent in cores. Jones, 2023, states that:

"Assessment of the cores from wells DUM-1, DUM-2 and DUM-3, however, indicates that some fractures are present (Fig. 19B). Downhole videos of well DUM-1, which reached a depth of -406 ft, showed that fractures are common between -350 ft and -406 ft (Fig. 20). These are treated as natural fractures because it is readily apparent that they penetrate into the wall of the borehole. ***Such fractures were rarely evident in the strata above -350 ft."*** *(emphasis added).*

RCMA's review of those borehole video surveys lead to those same conclusions. The import for this project is that groundwater flow is primarily horizontal via intra formational pathways such as fissures, joint systems and solution channels.

2.2 Hydrogeology and Well Capacity

The hydrogeologic framework for the aquifer underlying the site and the entire Grand Cayman Island is based on the predominately carbonate bedrock. The groundwater flow system is located within the bedrock aquifer and exists under unconfined or water table conditions, i.e., the groundwater surface is open to the atmosphere. The flow system is also in direct contact with the Caribbean Sea and the North Sound, and the water table elevation fluctuates in response to the local tidal cycles. This has been demonstrated during several studies on the island during which pressure transducers were placed in the monitor wells. The recorded data showed the tidal fluctuations although there was some lag time between tidal periods in the ocean and those in the monitor wells. Given the saltwater nature of the surrounding water bodies, there is no permanent freshwater lens, at least in this portion of the Island.

The input for the ReGen cooling water supply is to be furnished from four (4) abstraction wells pumping at 2,750 gpm/well. Disposal of the heated water is to be accomplished using three (3) injection (disposal) wells pumping at 3,667 gpm/well. Previous studies and operational histories of facilities such as the Kimpton/Seafire Hotel and the Hotel Indigo have shown the Cayman and Brac formations capable of meeting such demands. Verification of those conditions for this project was accomplished by conducting pumping tests using the DUM-1 (open borehole in the injection zone -250 ft to -407 ft bgl), and DUM-3 (open borehole in the abstraction zone -50 to -150 ft bgl) test wells. The abstraction (pumping) rate for each test was ~356 gpm. Water levels were monitored during each test using an electric tape and a pressure transducer was placed in DUM-1. The drawdown due to pumping stabilized relatively quickly (5 to 10 minutes), however, continued response was observed due to tidal influence. The pressure transducer in DUM-1 provided pre-test, intra-test, and post-test water level data which were then plotted against the corresponding tidal stage as shown on Graphs in Appendix C. Such tidal influences will need to be considered when planning the long-term pump settings. Analyses of the pumping test data presented in Appendix C show that the abstraction zone (DUM-3) had a specific capacity of ~213 gpm / foot of drawdown which equates to a pumping level of about -13 feet below static water level at an abstraction rate of 2,750 gpm. The injection zone (DUM-1) had a specific capacity of ~237 gpm / foot of drawdown which equates to a mounding (reverse of drawdown since this is the injection zone) of ~ +15.5 feet. RCMA advises that caution should be exercised when extrapolating a test conducted at 356 gpm to a sustainable yield of 2,750 gpm per well. Additional aquifer testing (pump testing) at a minimum rate of 1,500 gpm is warranted.

2.3 Summary of Geology and Hydrogeology

Historical studies and ongoing investigation and research in this part of the island continue to support the overall carbonate layer framework consisting of the Ironshore, Pedro Castle, Cayman, and Brac formations. In addition, the presence of the more-competent Cap Rock zone has been identified in all study areas, suggesting its regional presence, and influence on vertical flow. Although porosity and permeability of fractured carbonate rocks is generally elevated compared to other rock types, the high horizontal transmissive capacity of the Cayman and Brac formations are generally supportive of larger capacity injection and abstraction wells.

These conclusions may be absent (or short-circuited) in localized places due to micro geologic conditions, poor well construction, or lack of equipment maintenance. In review of the WAC water user table information, RCMA notes that several users are reported to have constructed boreholes/wells in which the abstraction and injection zones overlap. As such, they provide "holes / conduits" for vertical groundwater movement through the lower permeability layers. Should those conditions exist, they could lead to unforeseen consequences whereby water mixing/short-circuiting occurs.

3.0 CONCEPTUAL MODEL

Pertinent details regarding the hydrogeological conditions on Grand Cayman are presented earlier in this Hydrogeological Investigation. The conceptual model for this portion of Grand Cayman consists of features presented graphically on Figure 2.

As indicated, the proposed ReGen area occupies a portion of an island bounded on the east by a shallow sound, to the west by the Caribbean Sea, and to the north and south by adjacent areas of Grand Cayman Island, i.e., above sea level land mass. Outside of the model domain area precipitation falls on the island, some of which returns to the atmosphere through evaporation and/or transpiration. There is a small portion of the precipitation that migrates as surface water runoff into the sound and/or Caribbean Sea. A portion of the precipitation infiltrates through the fractured and porous limestone and mixes with the saltwater aquifer system.

The aquifer beneath this portion of the island consists of several zones (or layers) with varying hydraulic properties. Permeability and porosity vary within these zones both vertically and horizontally. Definition of these properties is based on work completed on this project plus several historic studies including Dr. Jones' work referenced in this report.

The geothermal system concept consists of a well (or series of wells) used to abstract groundwater, which is warmed as part of a heat-exchange process, and then injected back into the subsurface. Theoretically, the warm water injected into the subsurface will be absorbed into the aquifer and the heat will be dissipated at a rate determined by the thermal properties of the bedrock aquifer and groundwater flow.

4.0 COMPUTER MODELING

Groundwater modeling was used in this study to describe and simulate the groundwater flow system and to simulate future heat and groundwater transport scenarios. In particular to this study, groundwater modeling was used to simulate the installation and operation of the geothermal system discussed in this report. RCMA utilized the USGS Modflow Code to simulate the groundwater flow portion of the simulation and MT3D to simulate the heat transport.

The following tasks were completed with respect to groundwater modeling for this study:

- Review of existing hydrogeological data and geothermal system data;
- Development of a conceptual model for the area and conversion of the conceptual model into model code (working simulation);
- Adjustments to the model based on published empirical and site-specific hydrogeological parameters and calibration to the existing hydrogeological conditions;
- Injection/abstraction of groundwater based on a variety of potential geothermal system configurations; and,
- Various sensitivity analyses.

Further details are presented below.

4.1 Model Description

4.1.1 Computer Code

RCMA utilized the USGS model code MODFLOW to simulate groundwater flow in this study.

MODFLOW is the industry-standard model used to simulate groundwater flow in three dimensions. This code has been used to construct thousands of simulations since it was first introduced in 1984. MODFLOW was also used by Bender (2004) in its simulation of the West Indian Club Geothermal Feasibility Study and by RCMA in the Kimpton/Seafire (KGC) study (2014) and the Hotel Indigo study (2022).

The MODFLOW code simulates groundwater flow by solving the groundwater flow equation at each cell, assuming that flow is homogeneous and isotropic within that cell. In this way, it is possible to simulate groundwater flow in porous media. Discussion earlier in this report indicated that although the aquifer materials are carbonates (usually associated with fracture flow) the materials are porous enough and have a high enough degree of secondary/dual porosity to behave like standard porous media. This makes the use of the MODFLOW code valid.

Model code MT3D was used for the heat transport portion of the simulations. MT3D was developed to simulate contaminant movement in groundwater (solute transport), however, the heat transport and the solute transport equations are analogous. MT3D is routinely used for heat transport in groundwater systems by substituting thermal properties for the solute transport properties commonly input. In these simulations, temperature was input as “concentration” and thermal dispersivity for “hydraulic” dispersivity.

4.1.2 Model Construction

The MODFLOW flow model was constructed once the conceptual model was developed and reviewed. RCMA utilized Groundwater Vistas, a pre- and post-processing software package to assist in the development of the model and its population with data variables.

The modeled area is illustrated on Figure 3 and consists of 128 rows, 108 columns and 5 layers (~69,000 cells). Finite difference models use rectilinear cells to overlay the simulated area. These square and rectangular cells are placed over the area to be simulated and the groundwater flow equation is solved for the center of each cell. Cell sizes and shapes are refined to reach a balance between an appropriate number of cells for the simulation and a simulation that is not overly cumbersome to solve.

The edges of the model domain are represented by constant head cells which represent the water level and temperature of the Caribbean Sea (ocean) as it surrounds the island. Care is generally exercised in the use of constant head cells; however, the ocean is perhaps the finest example of a "constant head" found in nature. Therefore, RCMA believes its use in this simulation is appropriate. Cells outside of the constant head cells are represented by no-flow cells and no simulation is completed in these areas.

Input parameters were based on data from published and unpublished documents/reports, drilling logs from three (3) test wells (DUM-1, DUM-2 and DUM-3), review of borehole video surveys, information from Dr. Jones assessment of the geology/lithology; and laboratory testing of the permeabilities, porosity and thermal conductivity of rock cores from selected subsurface layers. These are further described below.

4.1.3 Layers and Other Properties

The layers were assigned and developed based primarily on the hydrogeological information, predominantly vertical and horizontal permeabilities discussed in this report. The layer elevations and thicknesses are illustrated on Table 1 and generally represent the different facies described by Jones 2014, 2022, 2023. Hydraulic and other properties assigned to these layers and the cells within each layer are also presented in Table 2 and are described below. These "base values" were used at the start of the model simulations and were subsequently varied and/or refined as the simulations were refined.

Model inputs consist of various parameters such as: permeabilities, storage, porosity, recharge, temperature, thermal conductivity, and dispersivity. Model input parameters were determined based on field collected data within the study area, regional observations, and empirical published values. In the end, ranges of these properties were utilized to calibrate the model to the quasi-equilibrium status of the system and all were subjected to sensitivity analyses.

Permeability

The permeability (K) values of the model were varied within the ranges presented in Tables 1 and 2. The layers/zones as well as the material's properties and depths were delineated based on laboratory testing of selected rock cores from the on-site test wells DUM-1, DUM-2 and DUM3 in combination with historic results. This current testing was performed by Core Laboratories of Houston, Texas who have also conducted similar tests on test well cores from the Kimpton/Seafire and Indigo Hotel projects. Historic values of permeability were based on testing performed by Jones, 2014 as well as field testing performed by APEC personnel and calculations performed by RCMA, 2014, in the Kimpton/Seafire (KGC) report.

Values of permeability had a significant effect on the model output. Additional discussion is presented in the sensitivity analyses section below.

Storage

Values of storage and effective porosity were varied based on available published information. Values of porosity used in scenarios ranged from 7 % to 25% and were based on core testing reported by Jones, 2014, 2023. Values of storativity were based on empirical values and were varied from $5x10^{-3}$ to $5x10^{-5}$. Varying the values of storativity did not have significant effects on the model output.

Recharge

Recharge is that component of the hydrogeologic cycle that actually enters the groundwater flow system. Recharge rates for the Caribbean islands vary greatly from season to season depending on climatic factors and also tropical storms and hurricanes. A value of eight (8) inches per year was used in the simulations. Varying the recharge rate did not have significant effect on the simulations unless an abnormally high (i.e., greater than the actual rate of precipitation) value was used.

Dispersivity

Dispersivity is a measure of the amount of solute mixing (heat in this study) in groundwater and is composed of two terms; dispersion and diffusion. Attempts have been made in the lab and field to quantify values of this parameter for various locations and hydraulic materials, but generally, its value is determined during the modeling process. Values between 0.3 ft and 30 ft were used in the scenarios. Varying values of dispersivity did not have a significant effect on the model.

Constant Head and Heat Source Temperature

The simulations utilized heat concentrations of the Caribbean Sea and the North Sound areas coupled with constant water surface elevations along these margins. The constant elevation heads were maintained to simulate average elevations of the water (approximately mean sea level). In the Kimpton/Seafire (KGC) model, 2014, groundwater temperatures at depth were based on borehole fluid temperature log of TW#1 performed by Mundell, 2014 and varied from approximately 28.5°C (83.3°F) at a depth of 50 ft BGS to 28.0°C (82.4°F) at 150 ft BGS. The temperature in TW#2 at 380 ft BGS was about 27.7°C (81.9°F). The Indigo Hotel model, 2022, used these temperatures as a basis and incorporated some site-specific measurements from that project site.

At the ReGen project site, temperature surveys were completed on test wells DUM-1, DUM-2 and DUM-3 from the water's surface to the borehole bottom: DUM-1 was surveyed on 30 November 2022 to a depth of ~ -251 ft and again on 12 April, 2023 to a depth of -412 ft; DUM-2 was surveyed on 12 December 2022 to a bottom hole depth of -207 ft; and, DUM-3 was surveyed on 12 April, 2023 to a bottom hole depth of ~ -141 ft. The results have been used to assign the groundwater temperatures at the tops and bottoms of each layer used in the computer modeling as presented Table 2. Bottom hole temperature in DUM-3, which represents the abstraction zone, was 81.15°F although DUM-1 and DUM-2 had temperatures of 80.38°F and 80.76°F at -150 ft, respectively. The bottom hole temperature in DUM-1 at -412 ft (injection zone) was 76.08°F. These available temperature data indicate that the initial temperature values used in the Kimpton/Seafire (KGC) and Indigo Hotel models were valid and remain within expected ranges.

Furthermore, these data suggest that the hydraulic separation provided by the lower permeability materials exists, at least on a regional scale in this part of the island.

As described by Jones,2014, 2022 and 2023, solution channels and fractures in these materials may exist locally in this part of the island. Such conditions have been confirmed through the examination of bedrock cores and borehole video surveys. While they exist, the degree of interconnectivity both horizontally and vertically is unknown. The borehole video surveys show these solution channels and fractures to have limited vertical extent. Jones, 2023, states: "*Assessment of the cores from wells DUM-1, DUM-2 and DUM-3, however, indicates that some fractures are present (Fig. 19B). Downhole videos of well DUM-1, which reached a depth of 406 ft, showed that fractures are common between 350 and 406 ft (Fig. 20). These are treated as natural fractures because it is readily apparent that they penetrate into the wall of the borehole.* ***Such fractures were rarely evident in the strata above 350 ft." (emphasis added).***

These data provide empirical support for the simulations incorporating the minimum vertical permeabilities of these materials as being more representative of actual bedrock characteristics than those considering higher vertical permeabilities.

<u>Thermal Conductivity</u>

Thermal conductivity was determined through testing completed by Core Labs, 2023, and their report shows a thermal conductivity value of 1.089 Btu/hr-ft-F for a sample from ~118-128 ft BGS, a value of 0.918 Btu/hr-ft-F for a sample from ~145-155 ft and a value of 1.125 Btu/hr-ft-F for a sample from ~160-170 ft BGS. RCMA coupled these values with values on tests completed by Core Lab, 2014, for the Kimpton/Seafire project as follows: a thermal conductivity value of 1.24 Btu/hr-ft-F for a sample from ~151 ft BGS and a value of 1.024 Btu/hr-ft-F for a sample from ~240 ft BGS. These values of thermal conductivity are in line with published values for limestone/dolostone.

The model can be made sensitive to this parameter, but only when it was varied outside of the range of expected actual values. This outside the range response is similar to variances in the recharge input and abnormally high values of thermal conductivity.

Water Input and Extraction - ReGen

The geothermal system demands for the ReGen were provided by APEC and incorporated into the project are as follows:

- The ReGen total demand of 11,000 gallons per minute (gpm). Four (4) abstraction wells pumping at 2,750 gpm/well and three (3) injection (disposal) wells pumping at 3,667 gpm/well.

A long-term temperature differential (ΔT) of +18°F (+10.08°C) was provided and used in the Task 1 modeling as discussed in the preliminary modeling report. Additionally, an intermittent temperature rise of +22°F (+12.22°C) for up to four (4) month intervals was also reviewed and modeled in the Task 1 work. A base groundwater temperature of 82.94°F (28.3°C) was used in the modeling. Two simulations were run – one considering Max Khor and Min Kvert and the other considering the Max Khor and Ave Kvert The Min Kvert allowed less vertical expansion of heated water and so the temperature in Layer 2 (the abstraction layer) rose by ~0.2-0.4°C after 4 months.

All final simulations of the model assumed abstraction from wells in Layer 2 (open borehole from ~-51ft to ~-149ft BGS) and injection into wells in Layer 5 (open borehole from ~-270ft to ~-400ft BGS).

Water Input and Extraction - Other Users

The WAC, 2020, provided a figure, list, and summary description of major water users in its letter and suggested that consideration be given to such users in future modeling efforts. As illustrated on the WAC figure and table, there are a number of major water users in this portion of the island. Planned or future systems were not considered in these simulations.

RCMA utilized this information to input these water users into the model. This information is provided in Table 3. As appropriate, RCMA summarized and simplified this information. In all cases however, the following data were not changed from the WAC information: general location of the water user; total volume/rate of water abstracted or injected; approximate depth/zone of abstraction and/or injection; temperature of heated water (as applicable to some systems). For a more-efficient model, RCMA combined wells/locations/flow rates on a specific property; estimated the locations of wells on a particular parcel; and generalized pumping periods. An example of this simplification is seen at the User 3 facility in the WAC letter. That facility consists of eight abstraction wells removing a total of ~5,000 GPM of water from the 100-150 ft BGS interval and three injection wells inputting a total of ~3,350 GPM of water into the 200-250 ft BGS interval. According to WAC, these wells do not all operate continuously – rather operating based on need, maintenance, and repair schedule. Rather than consider many different potential pumping cycles/scenarios, RCMA chose to model the system with one injection well and one abstraction well as follows: one injection well injecting ~3,350 GPM of water into Layer 5 and one abstraction well removing ~5,000 GPM from Layer 2 which equaled the total "in" and total "out" for that system. These adjustments allowed the model simulations to be constructed and run in a more efficient manner.

4.2 Sensitivity Analyses

The previous section presented the hydraulic and other properties that are input to the model. Each of these variables is important to the overall representation of the hydrogeologic system. In addition, each variable has the potential to affect the results of the model. For this reason, the inputs are varied in order to determine which item(s) has/have the potential to significantly affect the output. The model is said to be "sensitive" to these input variables. A general practice of variance is to adjust each property by an order of magnitude (up and down) and observe the effects on the model output.

Some properties cannot be varied much due to the absolute/exact value required for the simulation. A good example of this type of variable in this project would be the abstraction/injection rates. Changing these rates would likely have a great effect on the model output, however, these pumping rates are known and must be present at the determined rate, otherwise the systems would not work as designed. These properties are generally not varied in a sensitivity analysis.

Other properties can be varied, but significant variability is not possible in a natural system. Recharge is a good example of this type of property. Increasing the recharge rate from 10 inches per year to 100 inches per year would be a standard part of a sensitivity analysis, however, 100 inches of recharge per year far exceeds the precipitation for the area. These types of properties are generally varied a realistic amount depending on the specific property and conditions/location of the model.

Finally, some properties can exist in certain areas at values that span several orders of magnitude. Permeability is one of these parameters. The testing of bedrock cores from the project area has documented values of permeability ranging from less than 1 ft/day to >10,000 ft/day. These properties are varied within (and slightly outside) of that range to determine sensitivity.

Results of modeling for this project indicated that the model appears most sensitive to the ratio of horizontal and vertical permeabilities. Further discussion of this is presented in the modeling results section below.

4.3 Model Input/Output

Several model runs were simulated once the parameter values were collected and established. Several dozen runs were completed to establish selected parameter values and determine preliminary sensitivity analyses. Once complete, the final modeling consisted of 4 separate simulations:

- Average horizontal and vertical hydraulic conductivity **(AVG Khor – AVG Kvert)** – a simulation used to represent "average" hydraulic conditions measured at the property coupled with regional understandings (The output from these model runs is considered possible of actual conditions).

- Minimum horizontal and vertical permeability **(MIN Khor – MIN Kvert)** – a simulation used to represent conditions of low horizontal and low vertical flow. Although the framework for these simulations provides the lowest vertical permeability (and therefore the lowest chance of heated water migration through the layers) the minimum horizontal permeability does not appear to represent regional values. The output from these model runs is considered best case for vertical protection but not likely due to the limited amount of injected water available for cooling.

- Maximum horizontal and vertical permeability **(MAX Khor – MAX Kvert)** – a simulation used to represent significant vertical and horizontal flow. This is not a likely condition, but this simulation is used to represent a worst-case hydraulic scenario. Similar to the MIN Khor – MIN Kvert scenarios above, the higher values of vertical permeability do not appear to accurately represent the actual measured conditions of the formations described by Jones and measured in the studies noted in this report.

- Maximum horizontal and minimum vertical permeability **(MAX Khor – MIN Kvert)** – a simulation representing high horizontal flow coupled with low potential for vertical flow. This would represent the best-case scenario and, based on collected data, these conditions appear most likely even on a regional scale.

In reality, the most likely case of permeability would consider the potential for higher horizontal flow in certain areas, but average horizontal flow in most areas. This would be coupled with low vertical flow potential where short circuiting or cross-layer open boreholes are not present.

The existence of this condition is supported by the core testing data and visual inspections presented by Jones, 2014,2022, 2023 and hydrograph discussions in RCMA-KGC, 2014, borehole temperature surveys of KIM-TW-2, the out-of-service Kimpton/Seafire abstraction well and test wells IND-TW-1 and IND-TW-2, and DUM-1, DUM-2, and DUM-3, the operational experience at the ACWW and Kimpton/Seafire facilities.

Each of these simulations was tested using the pumping rates noted above.

4.4 Model Output Results

Simulations were run to establish a steady-state flow solution for each model. Once this was complete, a transport simulation was run for each model simulation for periods of 1, 5, and 10 years as requested by the WAC. RCMA noted that a quasi-equilibrium of the temperature readings was often reached after between 5 and 10 years of operation, meaning that the rate of increase in the temperature approached zero at this point.

Results of the increase in groundwater temperature (if present) and model discussion are presented on Table 4 and on Figures 5A, 5B, 6A, 6B, 7A, 7B, 8A, and 8B.

The figures all utilize a similar data presentation. Graphical "color floods" of water temperature are superimposed over the model grid in plan view illustrating the results of the 1- 5- and 10-year simulation times. Dark blue/purple colors are colder (25+°C) green is moderate (32°C) and yellow is warm (greater than 38°C). A cross section of each simulation is presented above the plan view and is centered on the ReGen abstraction wells.

Additional discussion is presented for each of the simulations noted below.

- <u>Average horizontal and vertical permeability (**AVG Khor – AVG Kvert**) – (Figures 5A and 5B)</u>

These simulations illustrate a rise of up to 0.3°C at the DART Laundry facility and a rise of up to 3.3°C in the groundwater at the ReGen plant. This rise in temperature appears to be caused by migration of heated water from Layer 1 and Layer 5 and injection of warm water by the Government Administration Building and other users into Layer 2 of the model. Other nearby users do not appear affected by the ReGen injection of the warm water into Layer 5. These temperature increases are among the highest observed in these simulations and illustrate the effect that a moderate horizontal K coupled with a moderate vertical K could have on the movement of groundwater and heat.

The output from these model runs is considered **Worst Case and Not Likely**.

- Minimum horizontal and vertical permeability **(MIN Khor – MIN Kvert)** – (Figures 6A and 6B)

These simulations illustrate no rise in temperature at the DART Laundry facility and a rise of up to 1.0°C in the groundwater at the ReGen plant. This rise in temperature appears to be caused by migration of heated water from Layer 5 and injection of warm water from other geothermal system users into Layer 2 of the model. It should be noted that this simulation causes areas of Layer 1 to "dry" due to the pumping of the Regen wells. As noted earlier in this report, the formation hydraulic conditions do not support this. Rather, the findings of this study indicate there is ample water available for the planned pumping.

The output from these model runs is considered **a Good Case but Unlikely**.

- Maximum horizontal and vertical permeability **(MAX Khor – MAX Kvert)**- (Figures 7A and 7B)

These simulations illustrate essentially no temperature rise at the DART Laundry facility and a rise of up to 2.6°C in the groundwater at the ReGen plant. This rise in temperature appears to be caused by migration of heated water from Layer 1 and Layer 5 and injection of warm water by the Government Administration Building and other users into Layer 2 of the model. Other nearby users do not appear affected by the ReGen injection of the warm water into Layer 5. These temperature increases are among the highest observed in these simulations and illustrate the effect that a high horizontal K coupled with a high vertical K could have on the movement of groundwater and heat.

The output from these model runs is considered **Worst Case and Not Likely**.

- Maximum horizontal and minimum vertical permeability **(MAX Khor – MIN Kvert)** – (Figures 8A and 8B)

These simulations illustrate essentially no temperature rise at the DART Laundry facility and small rises of 0.1°C after 1 year, 0.3°C after 5 years and 0.6°C after 10 years in the abstracted groundwater at the Regen plant. This rise in temperature appears to be, at least, partly caused by injection of warm water from other geothermal system users into Layer 2 of the model. Other nearby users do not appear affected by the Regen injection of the warm water into Layer 5. The output from these model runs is considered **Most Likely in Localized Areas and Possibly Regionally**.

5.0 DISCUSSION

5.1 Sustainable Yield

Results of the model simulations indicate that the aquifer system is capable of providing the 11,000-GPM input to the ReGen geothermal system.

The areally- and vertically extensive aquifer will be able to provide the required abstraction with minimal drawdown as evidenced by the operations at nearby systems and pumping tests already completed (See Section 2.0). The abstracted volume will be recharged via horizontal groundwater flow from the ocean, periodic discharge from storm water drains into the abstraction zone and areal recharge (precipitation) to the system.

The injection of warm water into the deeper aquifer (injection zone) is another point to consider in the sustainability of the system. As indicated, the simulations indicate that a quasi-equilibrium condition will form in the aquifer system whereby the heat added by the injected warm water will be dissipated into the system.

These items considered, the volume of water required and the adjustment to the aquifer system by the warm water injection is a sustainable use of this resource.

5.2 Impact on the Environment

Testing performed during this study and the simulations discussed above show that minimal, if any, impact to the environment will occur due to this system. In particular:

- Limited drawdown of the groundwater levels will occur when the system is in operation;
- Limited warming of the groundwater in the abstraction zone (model Layer 2), principally beneath the property will occur due to the operation of this system, i.e., low vertical permeability and injection into Layer 5 (~-270 and ~-400 ft BGS); and
- None of the injected warm water from the ReGen facility will reach the Caribbean Sea, North Sound, the residential canals or nearby water users based on in situ conditions being similar to the MAX K hor and MIN Kvert permeabilities and other inputs to the model.

5.3 Potential for Short Circuiting

There are two (2) forms of short circuiting that need to be considered. The first is vertical migration from the injection zone Layer 5 (~-270 – ~-400 ft BGS) upward into the abstraction zone Layer 2 (~-51 – ~-149 ft BGS) via joint and fracture systems, i.e., high vertical permeabilities. Previous studies in this area and on Grand Cayman overall indicate that the formations may contain fractures that are not apparent in cores. Jones, 2023, states: *"Assessment of the cores from wells DUM-1, DUM-2 and DUM-3, however, indicates that some fractures are present (Fig. 19B). Downhole videos of well DUM-1, which reached a depth of -406 ft, showed that fractures are common between -350 ft and -406 ft (Fig. 20). These are treated as natural fractures because* *it is readily apparent that they penetrate into the wall of the borehole.* ***Such fractures were rarely evident in the strata above -350 ft. "*** *(emphasis added).*

RCMA's review of those borehole video surveys lead to those same conclusions. The import for this project is that groundwater flow is primarily horizontal via intra formational pathways such as fractures, fissures and solution channels. Empirical support for minimal vertical hydraulic communication between these zones comes from the operation of the Abel Costello Water Works (ACWW) facility, the hydrographs in RCMA, 2014, and temperature measurements completed in the noted studies. The ACWW withdraws approximately 5,000 gpm from wells with open boreholes between 100 – 150 ft BGS which is the equivalent to Layer 2 in this study. It then injects about 3,350 GPM of high salinity brine (RO effluent) into a zone between 200 – 250 ft BGS. Both the abstraction and injection wells are located on facility property in relatively close proximity. The continued operation of the ACWW indicates that the vertical permeability of the 150 – 200 ft BGS layer is sufficiently low to prevent short circuiting. Empirical Information for the Kimpton/Seafire site also indicates that a low permeability zone exists between Layer 2 and the deeper layers. See discussion in Section 4.1.3 – Layers and Other Properties above. As shown in RCMA, 2014, the hydrographs for TW#1 and TW#2, as presented in Graph 4 of that report show that the water level in TW#1 is consistently higher than in TW#2. TW#1 is open borehole from 50 – 150 ft BGS whereas TW#2 is open borehole from 50 – 380 ft BGS. Were there good hydraulic communication between the 50 – 150 ft zone and the deeper formation the water levels would be expected to be in close agreement. The deeper flow zone in TW#2 appears to control the head. Note the hydrographs for TW#2 and Lobster Pot (Caribbean Sea) are almost identical.

The second form of short circuiting relates to well construction, particularly that of the injection wells. Care must be taken to assure that the grout seal in the annulus between the well casing and the surrounding rock is continuous. Proper grouting will preclude the potential for vertical migration via the annulus.

It should be noted that several of the wells/well systems identified by WAC have boreholes that are open to several of the formations (Cayman and Brac). These have been used in the modeling as presented. The model simulations illustrate that these structures are providing pathways for such short circuiting to occur. Future use of such WAC information should be field verified.

6.0 CONCLUSIONS

1. Pumping tests DUM-1 and DUM-3 demonstrated that the ReGen system demand of 11,000 GPM, (2,750 GPM per well), can be met with four abstraction wells. The abstraction zone is Layer 2 (~-51ft to ~-149ft BGS).

2. The discharge from the system can be injected via three injection wells at the northwestern portion of the site at a rate of 3,667 GPM each. The injection zone is Layer 5 (~-270 to ~-400 BGS. The design criteria are 2,750 GPM abstraction and 3,667 GPM injection with injected water at a delta-temperature of +10.08°C.

3. Computer modeling of the proposed abstraction/injection well design and layout demonstrates:

· No impact on the Caribbean Sea due to the ReGen system;

· No impact on the residential canals or North Sound due to the ReGen system; and,

· No impact on any adjacent RO or Geothermal facility due to the ReGen system, considering the most-likely model scenarios **(MAX Khor – MIN Kvert).**

· Negligible / minimal temperature rise (0.1°C to 0.6°C) in abstraction zone water at the ReGen facility in part due to migration of heated water from adjacent geothermal facilities considering the most-likely model scenarios **(MAX Khor – MIN Kvert).**

7.0 LIMITATIONS

The groundwater user information provided in the WAC, 2020, spreadsheet was relied upon for the modeling conducted as part of this project. Modeling suggests that groundwater temperature changes may be occurring within the various formations at some locations in this part of the island. Some of these temperature changes are potentially due to injection/abstraction well boreholes being open over several depth/layer intervals and other changes appear due to the layer utilized for abstraction/injection. These changes should be confirmed/validated through additional data gathering, verification and modeling.

APPENDICES

TABLES

TABLE 1
SUMMARY OF LAB/CORE RESULTS FROM BOREHOLE AND WELL SAMPLES
HYDROGEOLOGICAL STUDY - ISWMS-REGEN GEOTHERMAL SYSTEM
GRAND CAYMAN

CORE Mid-Depth (ft)	PERMEABILITY (m/d) Kmax	Kvert	K90	POROSITY %	
30.5	379	0.06	1.83	9.1	
35.5	650	183	275	27.7	
38	2220	74	0.122	24.2	
48.9	0.74	0.1	0.22	3.4	
50	82.8	7.66	2.64	18.5	
50.1	3920	0.03	519	5.1	
55	7590	2170	4550	23.8	
62.2	2930	0.04	2440	12.4	
65	116	6.34	83.1	22.2	*~Pedro Castle Formation*
66.5	2780	0.02	518	8.1	
72	0.014	0.028	0.014	13.4	*~Cayman Formation*
74.5	2340	39.7	1360	25.4	
81.2	348	0.01	0.05	2.5	
88	23.5	4.96	3.86	15.8	
92.5	3870	1950	3320	39.7	
95.9	2190	0.01	0.01	6	
103	102	93.3	23.5	21.6	
107	442	36	11.1	27.7	
112.3	2250	0.01	821	10.7	
113	15800	17	6770	21.2	
115	678	0.01	313	4.1	
123	1400	165	20.4	14.4	
123	9680	4790	6050	10.5	
127	247	77.1	80.6	20.2	
133	5300	1840	1160	12.5	
137	11700	4660	20.8	14.5	
141.2	1710	1150	1710	8.9	
143.5	91.1	67.4	13.1	13.3	
147	23800	11900	6990	26	
150	166	67.4	13.1	13.3	
150	305	6.83	174	11.5	
151	2710	0.03	2390	4.9	
155.9	110	11.9	48.7	14.8	
156.7	416	373	412	28.7	
159.8	4.76	1.22	3.97	9.1	
160	5	0.007	2.87	11.4	
165	315	55.6	163	14.4	
164.5	124	47	91	17.5	
168	497	161	376	41	
175.1	619	524	537	11	
179.3	58.3	55.6	58.3	15.2	
185	1250	81	341	9	
200.9	1860	4.36	889	8.6	
204	5890	53.6	134	17.3	
217.8	2190	1630	2070	46.1	
220.9	5400	4560	5220	37.3	
222	4190	1420	2090	35.2	
233	3000	1390	2840	17.1	
236.3	1970	914	1670	37.5	
238.7	1410	1420	1420	36.8	
239.5	5130	6.63	5130	13.2	
244.5	1064	0.01	874	6.5	
249.6	991	330	645	25.4	
252.4	956	103	492	17.3	
254	281	212	79.7	21.3	
268.3	4.49	0.1	3.76	13.4	*~Cayman Formation*
272.8	2770	2050	1950	10.9	*~Brac Formation*
283.3	1050	0.09	839	8.4	
292	485	0.03	402	5.4	
300.4			*10240#*	21.9	
307.5	930	10	560	10.7	
310	23,800	0.237	15,900	13.4	
316	2540	0.01	2540	12.4	
332.2	1240	6.4	741	7.9	
340	5330	824	7.99	10.1	
344	933	0.01	42	7.9	
347.3	809	0.01	489	6.6	
375	236	0.03	7	2.7	
379	7670	6580	3990	18.9	
418.2	24.1	0.02	2.07	6.2	
419	1690	0.01	795	2.8	
438.8	18.4	0.01	15.8	5.7	

COMBINED PERMEBILITIES / LAYER

		HORIZONTAL K-MAX	K-MEAN	K-MIN	VERTICAL K-MAX	K-MEAN	K-MIN		POROSITY
LAYER 1	**0 to -50 ft**	**2220**	**666.5**	**0.74**	**183**	**53**	**0.74**		
29.6									
	m/day	2,220	666.508	0.74	183	53	0.06	without Kimpton	16.6
	ft/day	7282	2186	2.43	600	174	0.20		
LAYER 2	**-51 to -149 ft**	**23800**	**3837.6**	**0.014**	**11900**	**1117**	**0.01**		
28									
		23,800	4,138	0.014	11,900	1,207	0.01	with Kimpton	15.8
	m/day	23800	4203	0.014	11900	1317	0.01	without Kimpton	16.5
	ft/day	78064	13785	0.05	39032	4319	0.03		
LAYER 3	**-150ft to -204ft**	**5890**	**1358.9**	**5**	**524**	**136.8**	**0.007**		
26.6									
		5,890	955	4.8	524	96	0.007	with Kimpton	15.2
	m/day	5890	968	4.76	67.4	28.5	0.007	without Kimpton	12.8
	ft/day	19319	3176	16	221	93	0.02		
LAYER 4	**-205 to -249ft**	**5400**	**2658.2**	**956**	**4560**	**1177.4**	**0.01**		
26.1									
		5,400	2,216	4	4,560	999	0.01	with Kimpton	25.6
	m/day	5400	1670	4.49	4560	1201.5	0.1	without Kimpton	27.3
	ft/day	17712	5478	15	14957	3941	0.33		
LAYER 5	**-250 to -400ft**	**23800**	**2767**	**4.49**	**6850**	**543.6**	**0.01**		
25.2									
		23,800	3,302	18.40	6,580	570	0.010	with Kimpton	9.5
	m/day	23,800	4,267	18	6580	860.1	0.01	without Kimpton	10.4
	ft/day	78064	13997	60	21582	2821	0.03		

(#) Value not used.

YELLOW Highlighted values are from the KIM-TW-2 Test Well Cores
NON-highlighted values are from Wastewater Treatment Test Well SHT#4 Cores
BLUE Highlighted values are from the DUM-2 Test Well Cores
GREEN Highlighted values are from the DUM-3 Test Well Cores
ORANGE Highlighted values are from the DUM-1 Test Well Cores

TABLE 2
SUMMARY OF MODEL INPUT PARAMETERS
HYDROGEOLOGICAL STUDY - ISWMS-REGEN GEOTHERMAL SYSTEM
GRAND CAYMAN

Layer	Interval (bgs)	No. of cores	MAX-Kmax		AVG-Kmax		Min-Kmax		MAX-Kvert		AVG-Kvert		Min-Kvert	
			mD	ft/day	mD	ft/day	mD	ft/day	mD	ft/day	mD	ft/day	mD	ft/day
1	10 - 50'	5	2220	7282	666.5	2186	0.74	2.43	183	600	53	174	0.06	0.20
2	51 - 149'	24	23800	78064	4203	13786	0.014	0.05	11900	39032	1317	4319	0.01	0.03
3	150 - 204'	15	5890	19319	968	3175	4.76	16	67.4	221	28.5	93	0.007	0.02
4	205 - 249'	12	5400	17712	1670	5478	4.49	15	4560	14957	1201.5	3941	0.10	0.33
5	250 - 400'	16	23800	78064	4267	13996	18	60	6580	21582	860.1	2821	0.01	0.03

Layer	Interval(bgs)	Input Temperature °C	Storativity	Porosity*	Thermal Cond
1	10 - 50'	29.6	5.00E-05	0.17	1.2
2	51 - 149'	28	5.00E-05	0.17	1.01
3	150 - 204'	26.6	5.00E-05	0.13	1.2
4	205 - 249'	26.1	5.00E-05	0.27	1.024
5	250 - 400'	25.2	5.00E-05	0.1	1.024

°C

Dispersivity 4 longitudinal, 1 transverse
Reaction Linear, first order
Recharge 8 in/yr
Const Head Ocean - 0ft

*- POR He, Ambient Meas Grn Vol % of BV

TABLE 2
SUMMARY OF MODEL INPUT PARAMETERS
HYDROGEOLOGICAL STUDY - ISWMS-REGEN GEOTHERMAL SYSTEM
GRAND CAYMAN

Layer	Interval (bgs)	No. of cores	MAX-Kmax		AVG-Kmax		Min-Kmax		MAX-Kvert		AVG-Kvert		Min-Kvert	
			mD	ft/day	mD	ft/day	mD	ft/day	mD	ft/day	mD	ft/day	mD	ft/day
1	10 - 50'	5	2220	6	666.5	2	0.74	0.0020	183	0.50	53.0	0.145	0.06	0.00016
2	51 - 149'	24	23800	65	4203	12	0.014	0.0000	11900	32.59	1317.0	3.607	0.01	0.00003
3	150 - 204'	15	5890	16	968	3	4.76	0.0130	67.4	0.18	28.5	0.078	0.007	0.00002
4	205 - 249'	12	5400	15	1670	5	4.49	0.0123	4560	12.49	1201.5	3.291	0.10	0.00027
5	250 - 400'	16	23800	65	4267	12	18	0.0493	6580	18.02	860.1	2.356	0.01	0.00003

Layer	Interval(bgs)	Input Temperature °C	Storativity	Porosity*	Thermal Cond
1	10 - 50'	29.6	5.00E-05	0.17	1.2
2	51 - 149'	28	5.00E-05	0.17	1.01
3	150 - 204'	26.6	5.00E-05	0.13	1.2
4	205 - 249'	26.1	5.00E-05	0.27	1.024
5	250 - 400'	25.2	5.00E-05	0.1	1.024

Dispersivity	4 longitudinal, 1 transverse
Reaction	Linear, first order
Recharge	8 in/yr
Const Head	Ocean - 0ft

mD to ft/day conversion - 1mD=2.739x10-3 ft/day

*- POR He, Ambient Meas Grn Vol % of BV

TABLE 3 (PAGE 1 of 2)
SUMMARY OF WELLS USED IN MODEL SIMULATIONS
HYDROGEOLOGICAL STUDY - ISWMS-REGEN GEOTHERMAL SYSTEM
GRAND CAYMAN

WAC Number and Name (Data from WAC letter - July 14, 2020)		Well(s) used in Model	Pumping Rate (ft3/day)	Well Diameter (in)	Top of Screen (ft BGS)	Bottom of Screen (ft BGS)	Injected Temperature (deg C)	Comments
1	Kimpton-Seafire	1AB-A	-173,300	12	-50	-151		
1	Kimpton-Seafire	1AB-B	-173,300	12	-50	-151		
1	Kimpton-Seafire	1AB-C	-173,300	12	-50	-151		
1	Kimpton-Seafire	1INJ-A	260,000	12	-251	-380	34.11	
1	Kimpton-Seafire	1INJ-B	260,000	12	-251	-380	34.11	
2	Indigo-Dart	2AB-A	-259,200	12	-50	-151		
2	Indigo-Dart	2AB-B	-259,200	12	-50	-151		
2	Indigo-Dart	2INJ-A	259,200	12	-251	-380	37.8	
2	Indigo-Dart	2INJ-B	259,200	12	-251	-380	37.8	
3	Able-Costello Gov	3AB-A	-1170400	12	-100	-150		
3	Able-Costello Gov	3INJ-A	702674	12	-201	-250	26.6	
5	Ritz-Carlton	AB-A	-1056000	12	-50	-151		Future-Did not simulate
5	Ritz-Carlton	AB-B	-1056000	12	-50	-151		Future-Did not simulate
5	Ritz-Carlton	INJ-A	1056000	12	-251	-380	38.38	Future-Did not simulate
5	Ritz-Carlton	INJ-B	1056000	12	-251	-380	38.38	Future-Did not simulate
4	Dragon Bay	4AB-A	-41,772	8	-75	-100		RO-Brine Disp
4	Dragon Bay	4INJ-A	41,772	8	-100	-200	26.6	
6	Ritz-Carlton	6AB-A	-74,857	8	-60	-85		RO-Brine Disp
6	Ritz-Carlton	6INJ-A	74,857	10	-130	-150	28	
7	Fosters Food (Strand Store)	7AB-A	-96,220	8	-130	-150		
7	Fosters Food (Strand Store)	7INJ-A	96,220	8	-60	-80	31.4	
8	Fosters IGA (Camana Bay)	8AB-A	-96,220	14	-95	-275		
8	Fosters IGA (Camana Bay)	8INJ-A	96,220	14	-60	-160	31	
9	Cayman Water -Brittania Plant	9AB-A	-288,695	8	-50	-70		RO-Brine Disp
9	Cayman Water -Brittania Plant	9INJ-A	288,695	8	-150	-180	26.6	
10	Camana Bay-AC Makeup	10AB-A	-16,702	unknown - did not simulate				RO-Brine Disp
	Camana Bay-AC Makeup	10INJ-A	10,028	unknown - did not simulate				
10	Camana Bay-Geothermal	10AB-B	unknown	unknown - did not simulate				
11	Marriot Resort	11AB-A	-16,702	unknown - did not simulate				RO-Brine Disp
	Marriot Resort	11INJ-A	10,028	unknown - did not simulate				
12	Cayman Water Company-New Plant	12AB-A	unknown	unknown - did not simulate				
	Cayman Water Company-New Plant	12-INJA	unknown	unknown - did not simulate				
13	Margaritaville	13AB-A	-24,046	unknown - did not simulate				RO-Brine Disp
	Margaritaville	13INJ-A	14,442	unknown - did not simulate				
14	NCB Hotel	14AB-A	-103,917	8	-150	-200		Geothermal Cooling
	NCB Hotel	14INJ-A	103,917	8	-200	-250	31.7	
15	Government Administration	15AB-A	-404,158	16	-280	-361		Geothermal Cooling
	Government Administration	15AINJ-A	404,158	12	-40	-80	33	
16	WA - WWTP Current	16AB-A						WW Disposal-Injection only
	WA - WWTP Current	16INJ-A	334,139	12	-150	-225	27	
16	WA - WWTP Additional	16AB-B						Future-Did not simulate
	WA - WWTP Additional	16INJ-B	334,139					Future-Did not simulate
16	WA - WWTP Full Buildout	16AB-C						Future-Did not simulate
	WA - WWTP Full Buildout	16INJ-C	688,242					Future-Did not simulate

TABLE 3 (PAGE 2 of 2)
SUMMARY OF WELLS USED IN MODEL SIMULATIONS
HYDROGEOLOGICAL STUDY - ISWMS-REGEN GEOTHERMAL SYSTEM
GRAND CAYMAN

WAC Number and Name (Data from WAC letter - July 14, 2020)		Well(s) used in Model	Pumping Rate (ft3/day)	Well Diameter (in)	Top of Screen (ft BGS)	Bottom of Screen (ft BGS)	Injected Temperature (deg C)	Comments
17	DART Laundry	17AB-A	-6,016		-50	-120		RO-Brine Disp
	DART Laundry	17INJ-A	3,430		-150	-200	28	
17	ISWMS-Regen	17AB-B	-529,375	12	-51	-149		Abstraction at 2750gpm each well - 4 wells
	ISWMS-Regen	17AB-C	-529,375	12	-51	-149		Abstraction at 2750gpm each well - 4 wells
	ISWMS-Regen	17AB-D	-529,375	12	-51	-149		Abstraction at 2750gpm each well - 4 wells
	ISWMS-Regen	17AB-E	-529,375	12	-51	-149		Abstraction at 2750gpm each well - 4 wells
	ISWMS-Regen	17INJ-B	705,898	12	-270	-400	38.08	Injection 3667 gpm each well - 3 wells
	ISWMS-Regen	17INJ-C	705,898	12	-270	-400	38.08	Injection 3667 gpm each well - 3 wells
	ISWMS-Regen	17INJ-D	705,898	12	-270	-400	38.08	Injection 3667 gpm each well - 3 wells
18	Progressive Distributors	18AB-A	-96,220	8	-200	-250		Geothermal Cooling
	Progressive Distributors	18INJ-A	96,220	8	-80	-130	33	
19	CUC-Feed Water Cooling water for distiller and disposa	19AB-A	-182,835	12	-80	-100		Cooling Water
	CUC-Feed Water Cooling water for distiller and disposa	19INJ-A	182,835	12	-150	-200	28	
	CUC Power Plant	19AB-B	-808,500	12	-330	-500		A28.1 and A28.2 wells 2100 GPM each - total of 4200 GPM
	CUC Power Plant	19AB-C	-1,435,665	12	-330	-500		A30 and A31 wells 2100 GPM each plus A35 and A36 wells 1629GPM each - total 7458 GPM
	CUC Power Plant	19AB-D	-1,135,558		-330	-400		A30 and A32 wells 2135 GPM each and A34 well 1629 GPM - Total 5899 GPM
	CUC Power Plant	19AB-E	-238,700		-70	-110		A3 and A4 wells620 GPM each - total 1240GPM
20	Water Authority-Red Gate - Red Gate RO Plant	20AB-A	-441,375	10	-100	-150		RO-Brine Disp
	Water Authority-Red Gate - Red Gate RO Plant	20INJ-A	264,825	12	-200	-250	28	
20	Water Authority-Red Gate - North Sound RO Plant	20AB-B	-529,650	14	-100	-160		RO-Brine Disp
	Water Authority-Red Gate - North Sound RO Plant	20INJ-B	317,790	14	-211	-300	28	
20	Water Authority-Red Gate - Future RO Plant	20AB-C	-441,375					Future-Did not simulate
	Water Authority-Red Gate - Future RO Plant	20INJ-C	264,825					Future-Did not simulate
21	Mikes Ice and Refrigeration	21AB-A	-57,732	12	-160	-200		Geothermal Cooling
	Mikes Ice and Refrigeration	21INJ-A	57,732	12	-60	-80	32.2	
22	Fosters Food Fare (Distribution)	22AB-A	-96,220	8	-160	-210		Geothermal Cooling
	Fosters Food Fare (Distribution)	22INJ-A	96,220	8	-60	-80	31	
23	Fosters Food Fare (Airport Store)	23AB-A	-96,220	14	-150	-275		Geothermal Cooling
	Fosters Food Fare (Airport Store)	23INJ-A	96,220	14	-60	-125	31	
24	Cayman Islands Airport Auth	24AB-A	-346,426	12	-120	-300		Geothermal Cooling
	Cayman Islands Airport Auth	24INJ-A	346,426	12	-150	-250	30	

Data from WAC letter July 14, 2000

TABLE 4
SUMMARY OF SIMULATED TEMPERATURE CHANGES AT ABSTRACTION WELLS
HYDROGEOLOGICAL STUDY - ISWMS-REGEN GEOTHERMAL SYSTEM
GRAND CAYMAN

Location/Well Name		**MAX Khor-MIN Kvert**			**AVG Khor-AVGKvert**			**MAX Khor-MAX Kvert**			**MIN Khor-MIN Kvert**		
		1 year	5 year	10 year	1 year	5 year	10 year	1 year	5 year	10 year	1 year	5 year	10 year
17	DART Laundry	0.1	0.1	0	NR	NR	0.3	NR	NR	NR	NR	NR	NR
17	ISWMS-Regen	0.1	0.3	0.6	NR	1.0	3.3	NR	0.5	2.6	NR	NR	1.0
19	CUC-Power Plant	0.1	0.2	0.3	NR	0.7	1.6	NR	0.1	0.1	NR	NR	NR

Temperature in degrees C
NR - No Simulated Temperature Rise

FIGURES

0 2000 4000

SCALE

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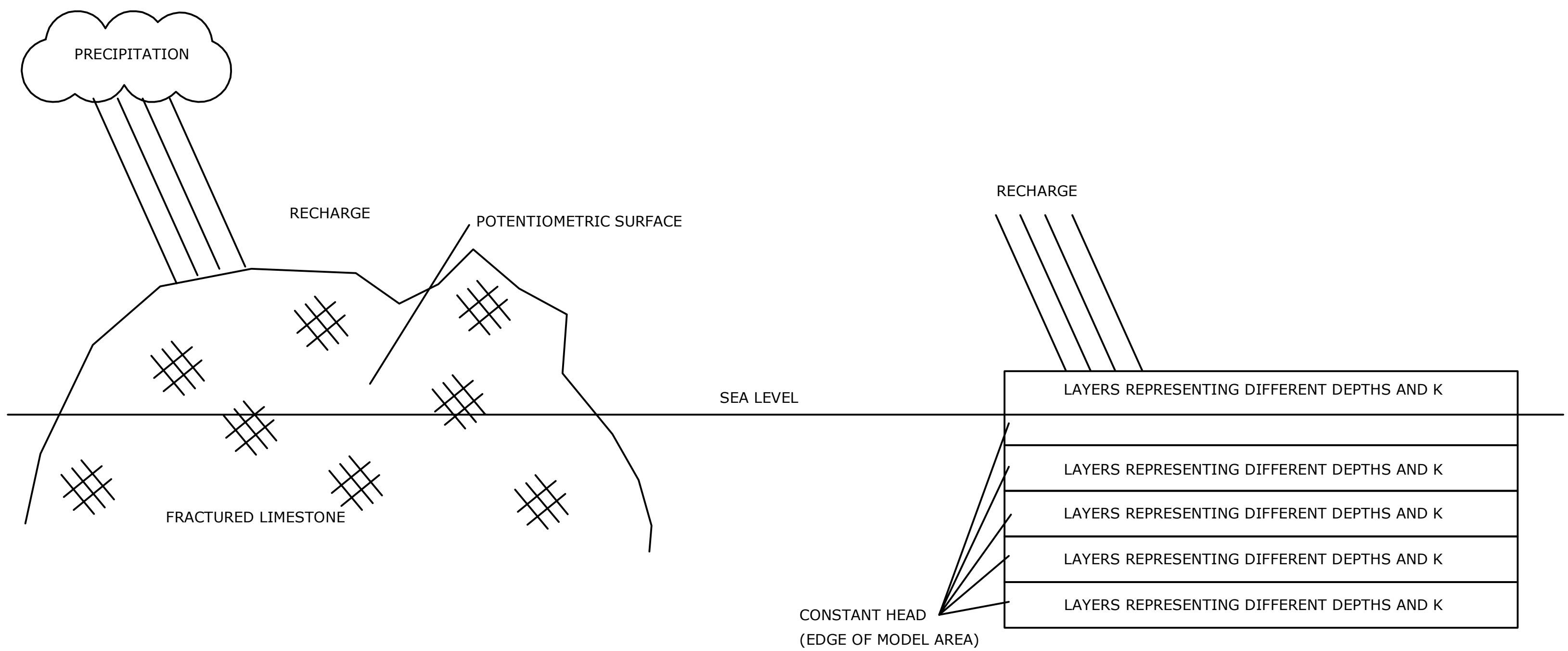
FIGURE 1

SITE PLAN AND STUDY AREA

Hydrogeological Study
ISWMS - Regen - Geothermal System
Grand Cayman



GRAND CAYMAN

CONCEPTUAL MODEL

FIGURE 2

CONCEPTUAL MODEL

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ISWMS - Regen Geothermal System
Grand Cayman

DRAWING NOT TO SCALE

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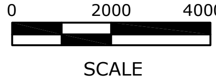
FIGURE 3

MODEL DOMAIN AND GRID OVER STUDY AREA



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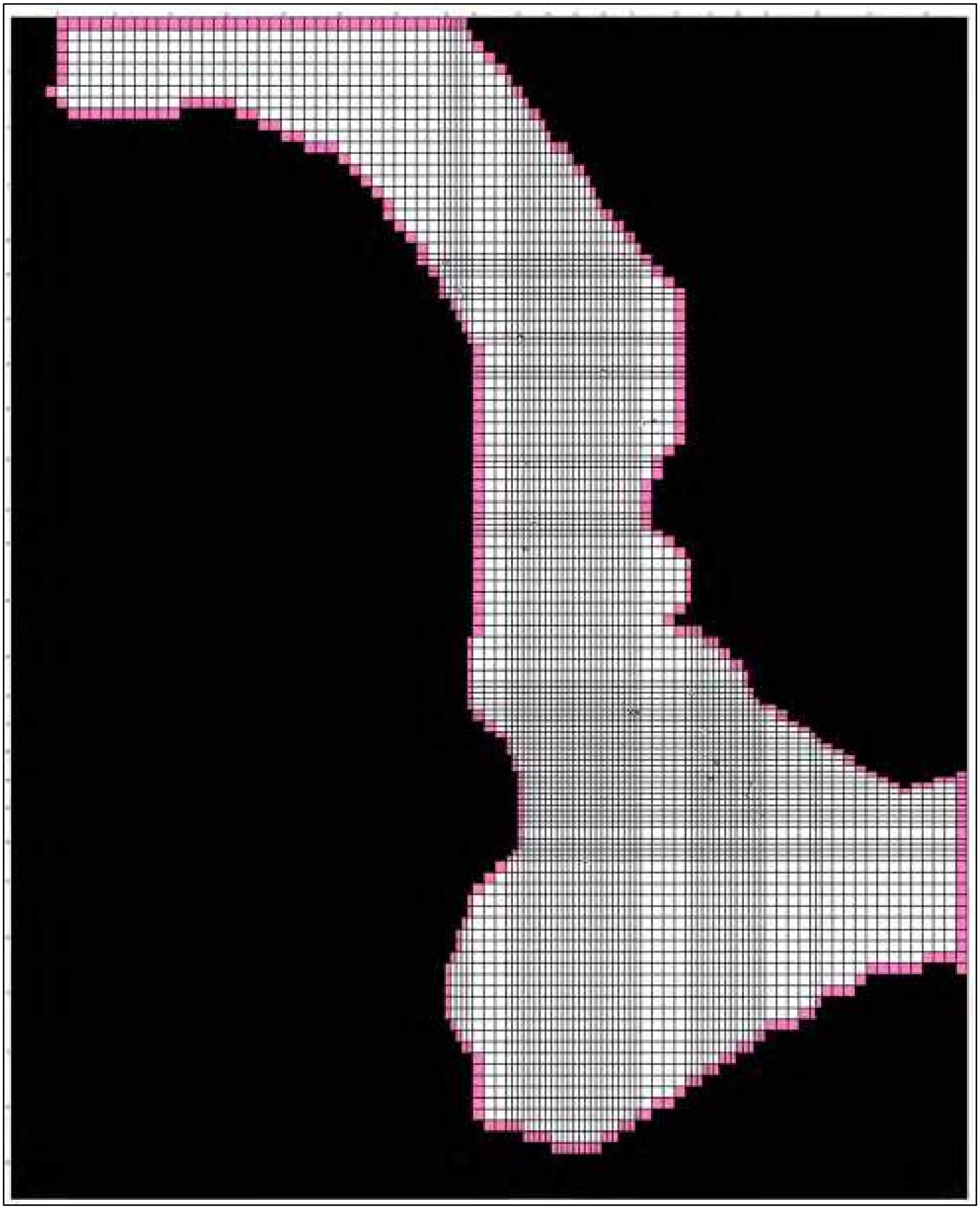

0 2000 4000

SCALE

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FIGURE 4

MODEL DOMAIN AND GRID
BOUNDARY CONDITIONS AND WELLS
LAYER 2

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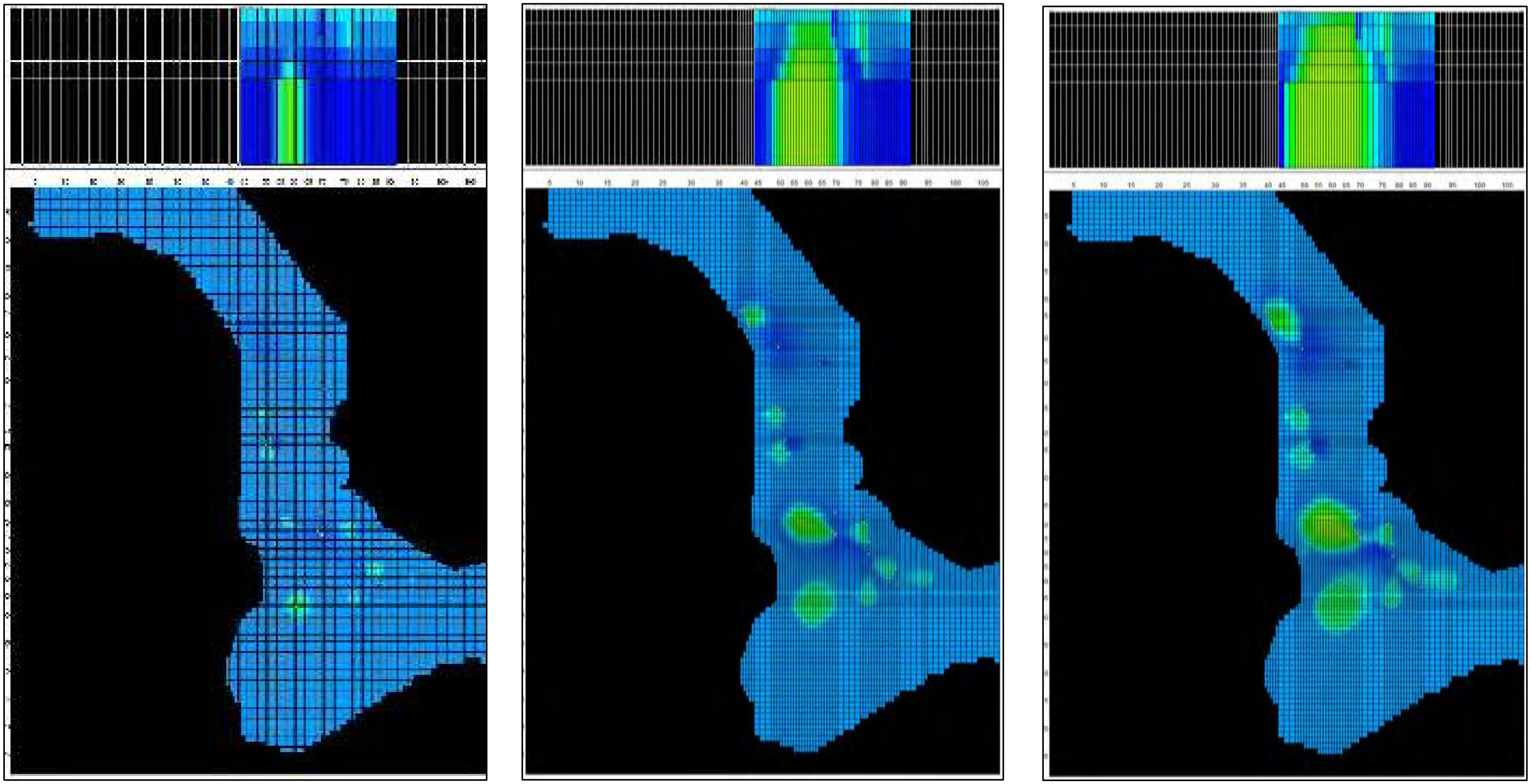
ISWMS - Regen - Geothermal System
Grand Cayman

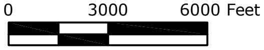


1-YEAR SIMULATION

5-YEAR SIMULATION

10-YEAR SIMULATION

SIMULATED TEMPERATURE



SCALE

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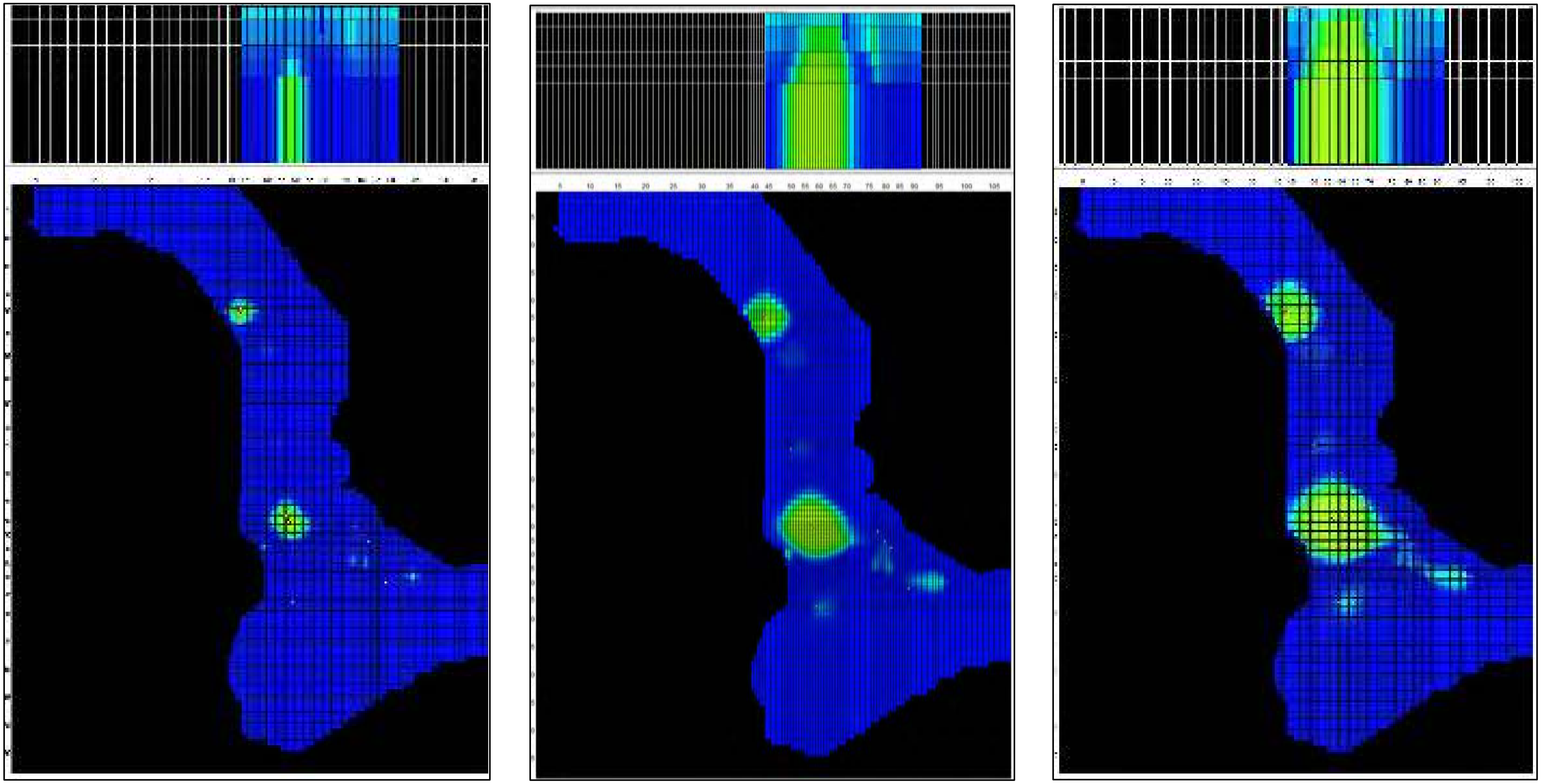
FIGURE 5A

MODEL OUTPUT - 1, 5, & 10-YEAR
TEMPERATURE ISOCONTOURS-LAYER 2
AVG Khor - AVG Kvert

Hydrogeological Study
ISWMS - Regen - Geothermal System
Grand Cayman



1-YEAR SIMULATION

5-YEAR SIMULATION

10-YEAR SIMULATION

SIMULATED TEMPERATURE

SCALE

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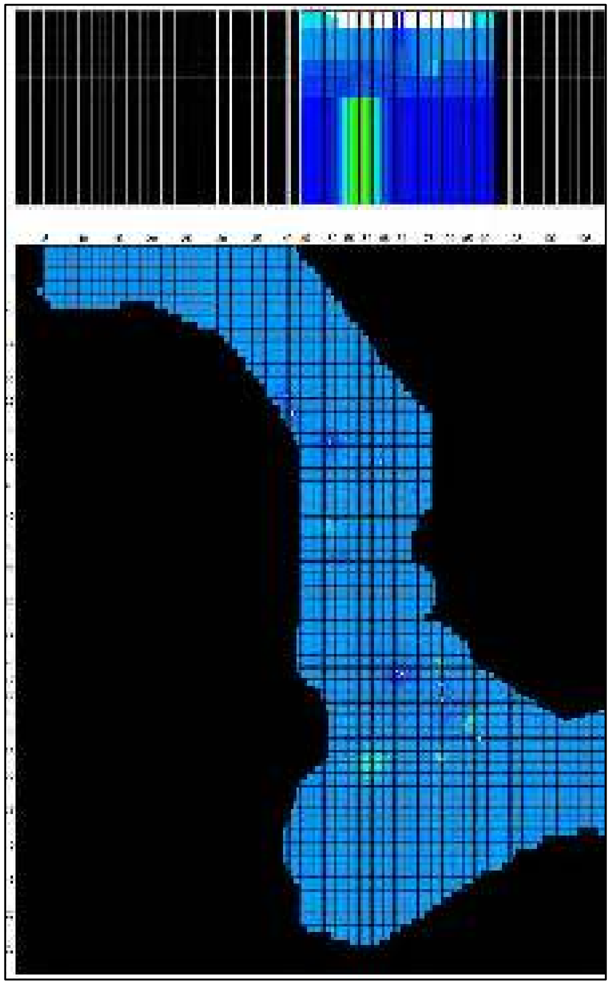
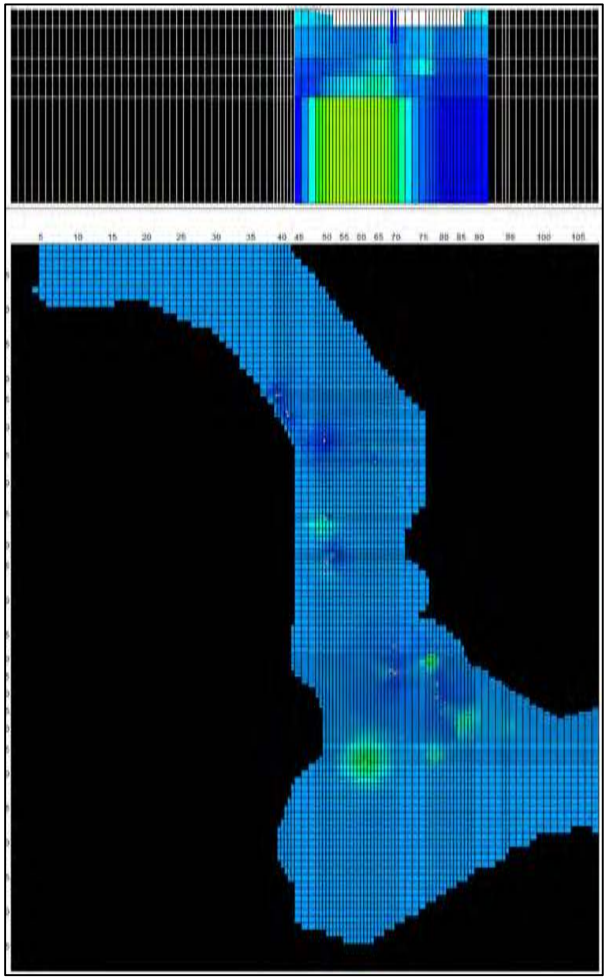
FIGURE 5B

MODEL OUTPUT - 1, 5, & 10-YEAR
TEMPERATURE ISOCONTOURS-LAYER 5
AVG Khor - AVG Kvert

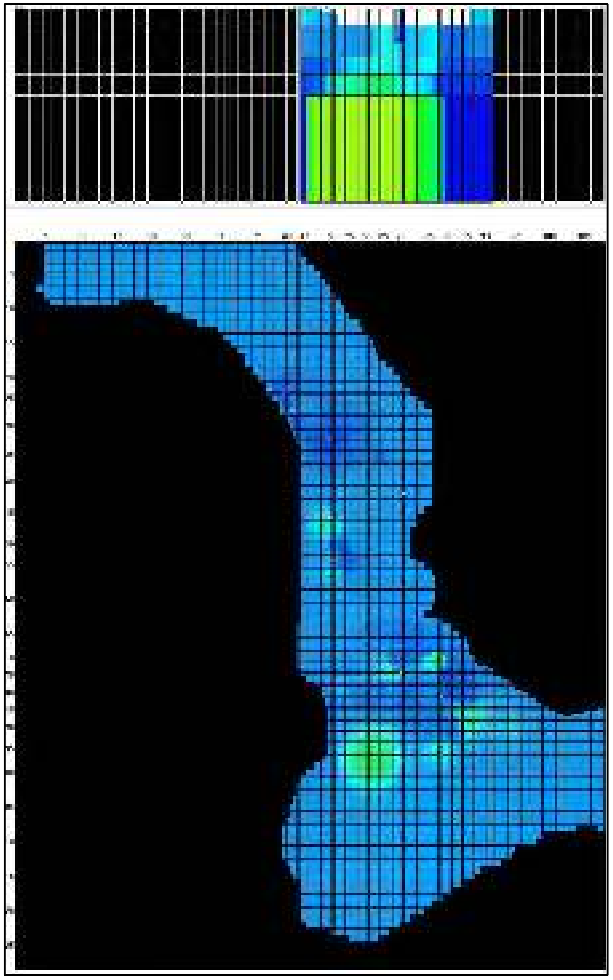
Hydrogeological Study
ISWMS - Regen - Geothermal System
Grand Cayman



1-YEAR SIMULATION



5-YEAR SIMULATION



10-YEAR SIMULATION

40°C

25°C

SIMULATED TEMPERATURE

0 3000 6000 Feet

SCALE

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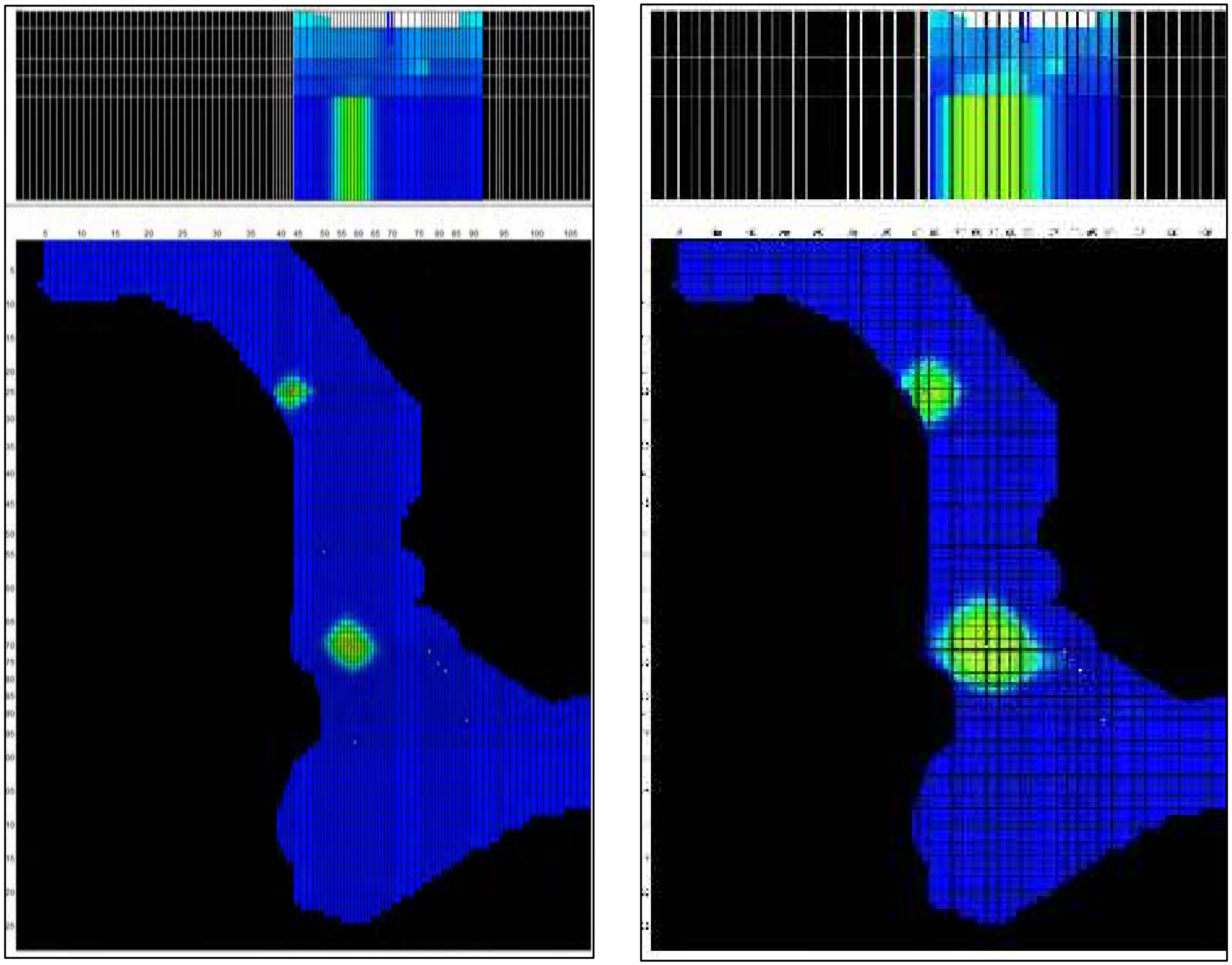
FIGURE 6A

MODEL OUTPUT - 1, 5, & 10-YEAR
TEMPERATURE ISOCONTOURS-LAYER 2
MIN Khor - MIN Kvert

Hydrogeological Study
ISWMS - Regen - Geothermal System
Grand Cayman

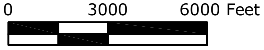


1-YEAR SIMULATION

5-YEAR SIMULATION

10-YEAR SIMULATION

SIMULATED TEMPERATURE



SCALE

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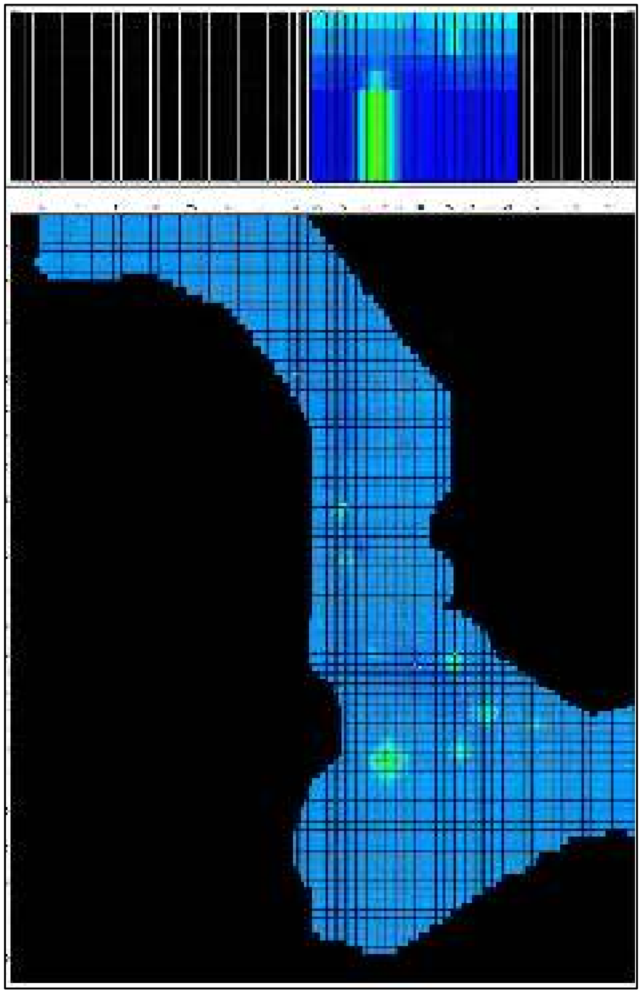
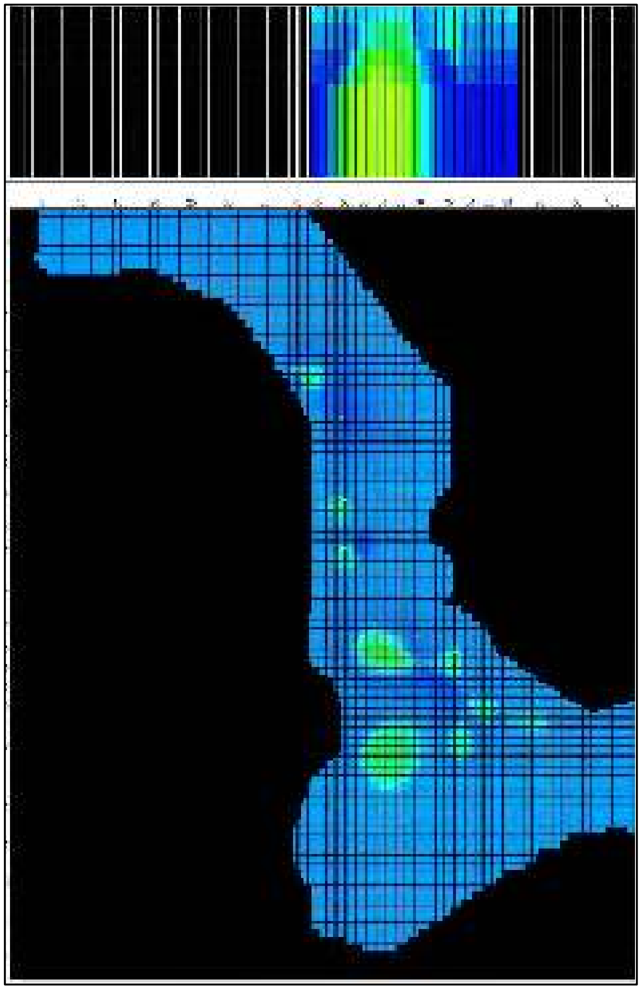
FIGURE 6B

MODEL OUTPUT - 1, 5, & 10-YEAR
TEMPERATURE ISOCONTOURS-LAYER 5
MIN Khor - MIN Kvert

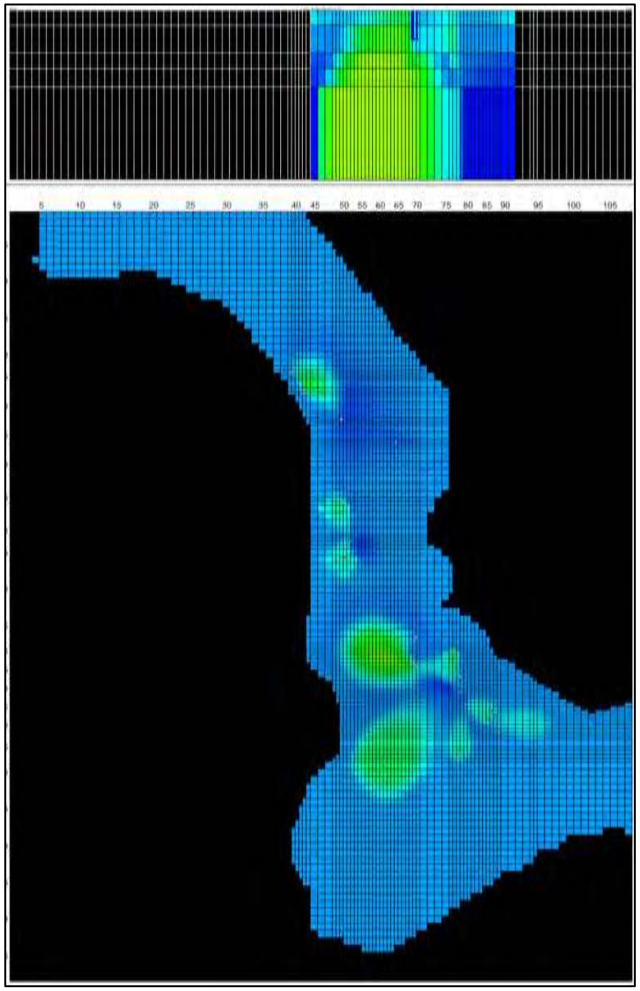
Hydrogeological Study
ISWMS - Regen - Geothermal System
Grand Cayman



1-YEAR SIMULATION



5-YEAR SIMULATION



10-YEAR SIMULATION

40°C

25°C

SIMULATED TEMPERATURE

0 3000 6000 Feet

SCALE

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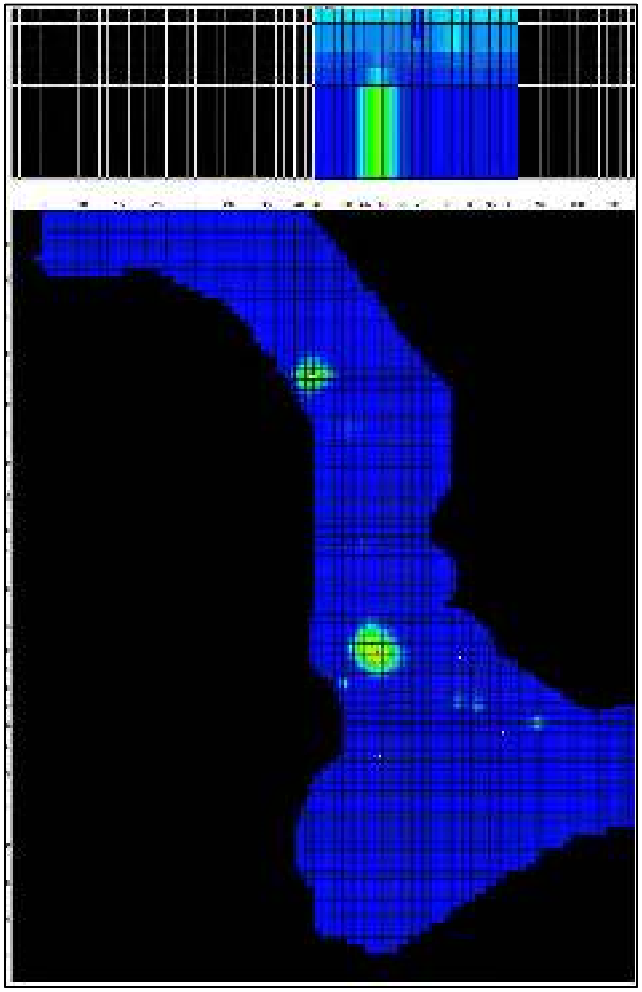
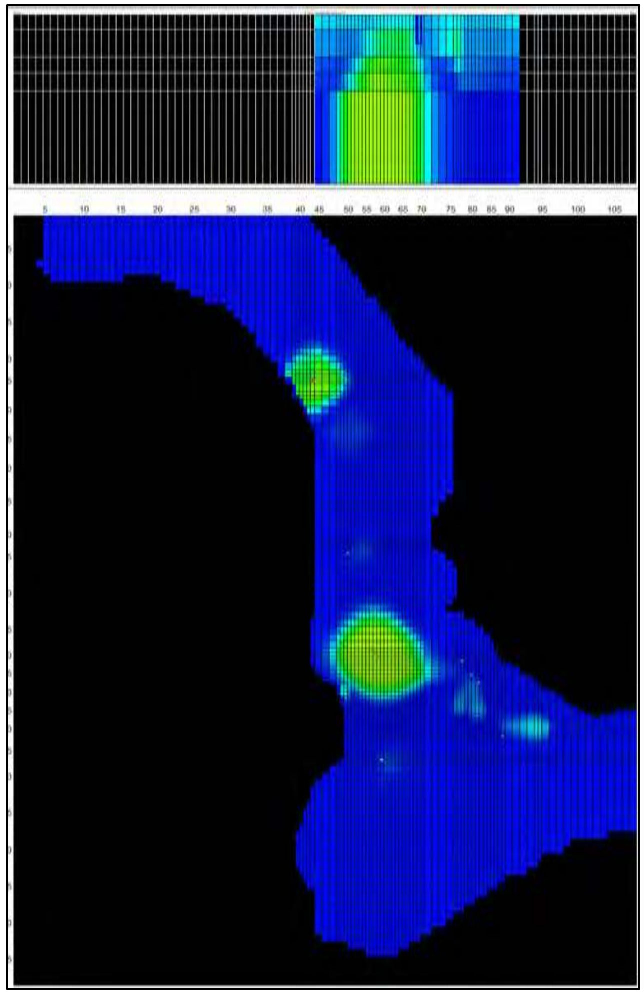
FIGURE 7A

MODEL OUTPUT - 1, 5, & 10-YEAR
TEMPERATURE ISOCONTOURS-LAYER 2
MAX Khor - MAX Kvert

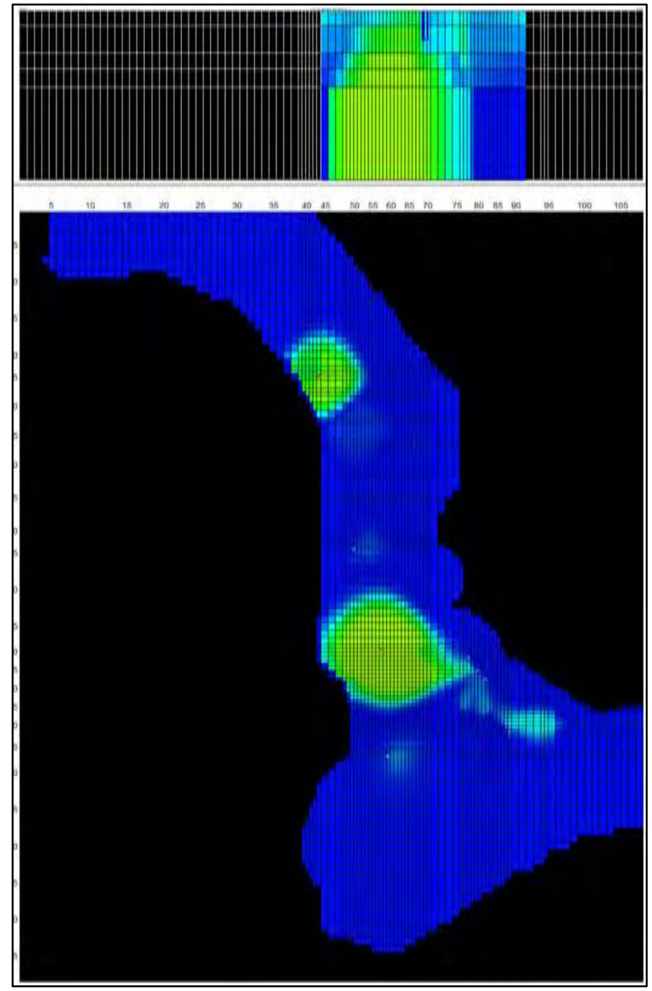
Hydrogeological Study
ISWMS - Regen - Geothermal System
Grand Cayman



1-YEAR SIMULATION



5-YEAR SIMULATION



10-YEAR SIMULATION

SIMULATED TEMPERATURE

0 3000 6000 Feet

SCALE

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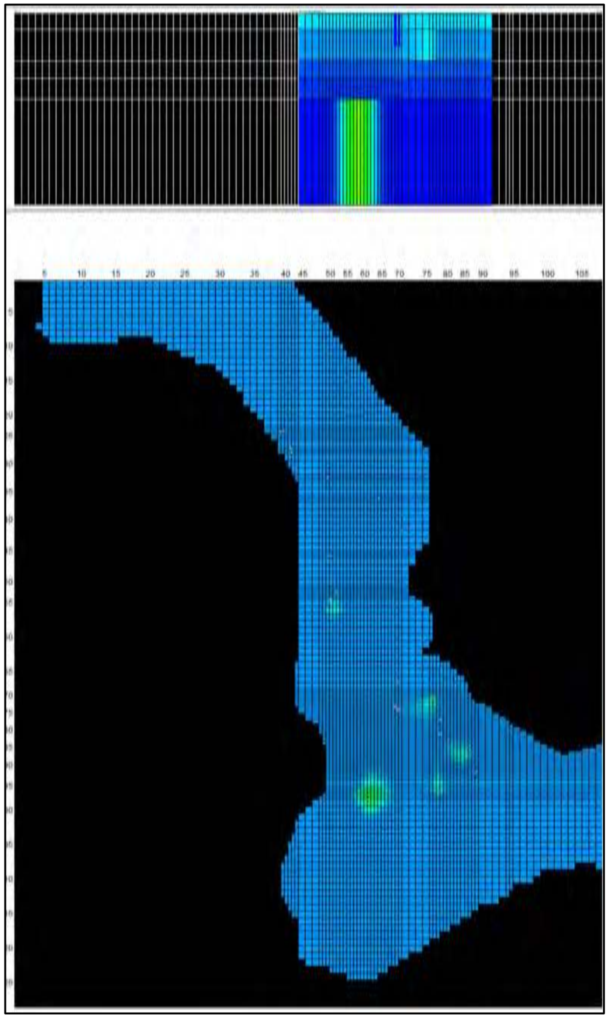
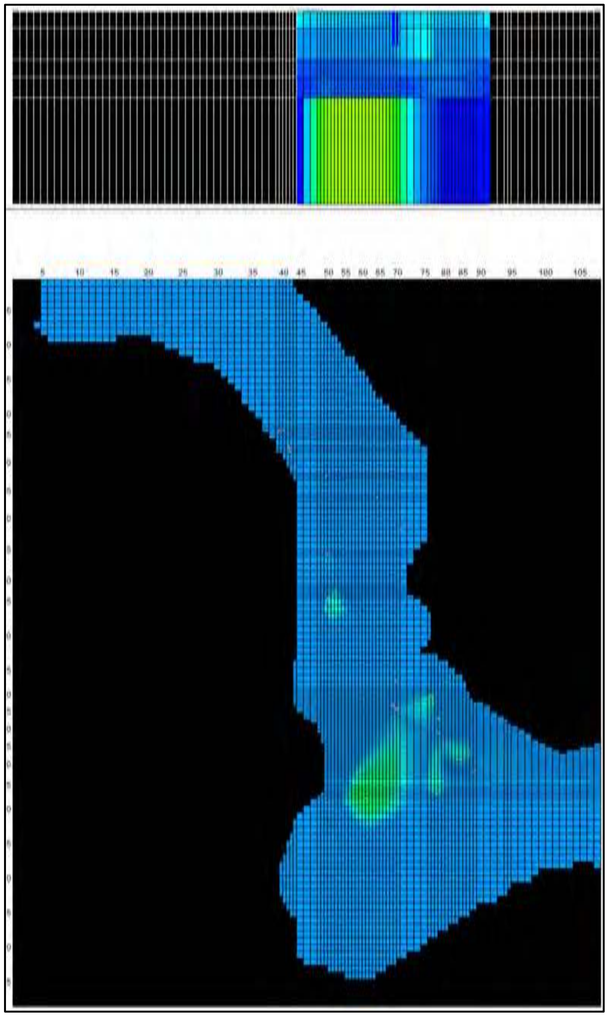
FIGURE 7B

MODEL OUTPUT - 1, 5, & 10-YEAR
TEMPERATURE ISOCONTOURS-LAYER 5
MAX Khor - MAX Kvert

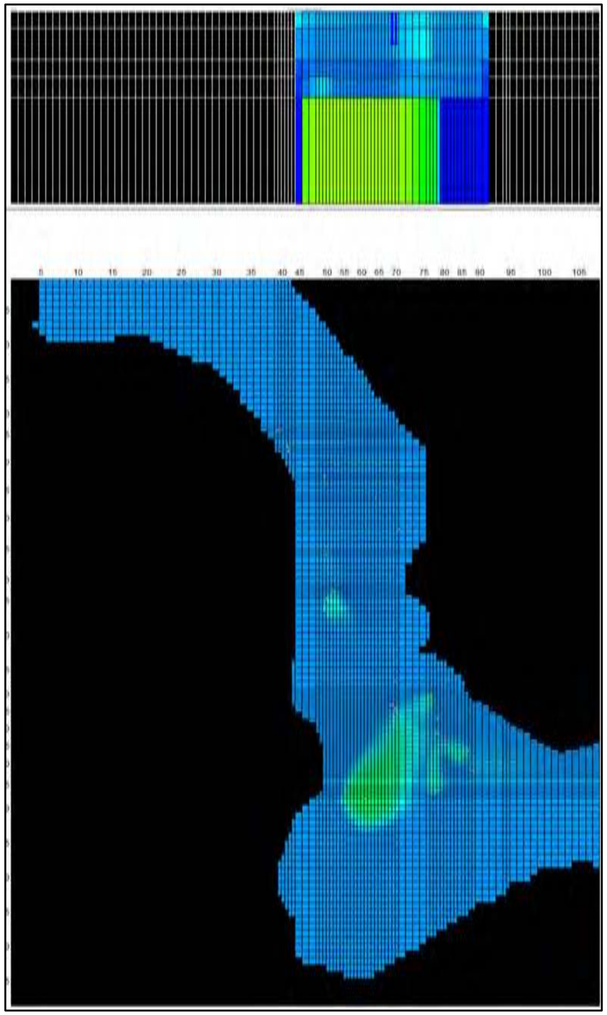
Hydrogeological Study
ISWMS - Regen - Geothermal System
Grand Cayman



1-YEAR SIMULATION



5-YEAR SIMULATION



10-YEAR SIMULATION

SIMULATED TEMPERATURE

0 3000 6000 Feet

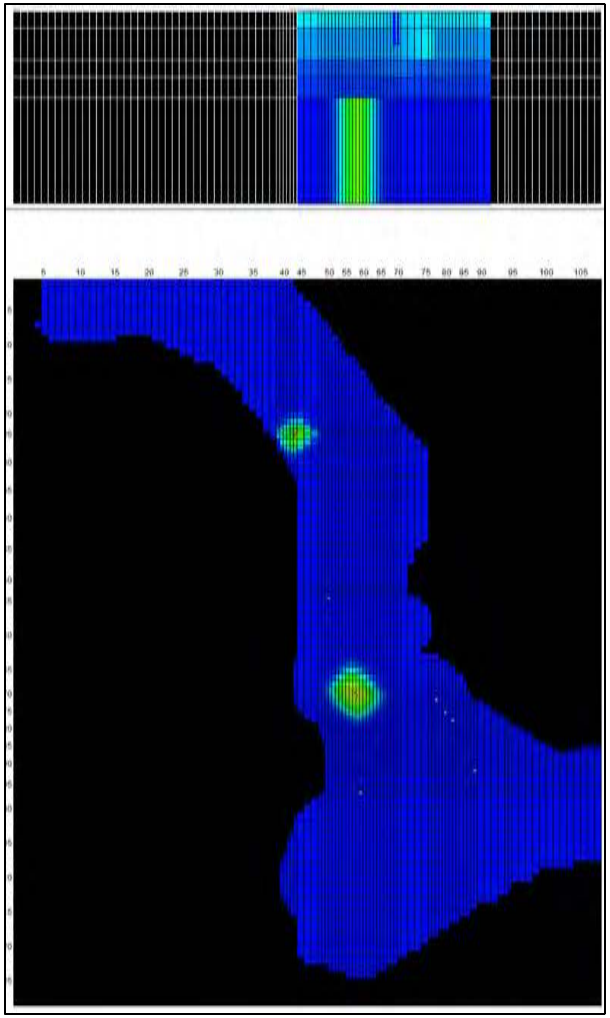
SCALE

RC MINNING & ASSOCIATES
10218 Tarpon Drive - Treasure Island, FL 33706

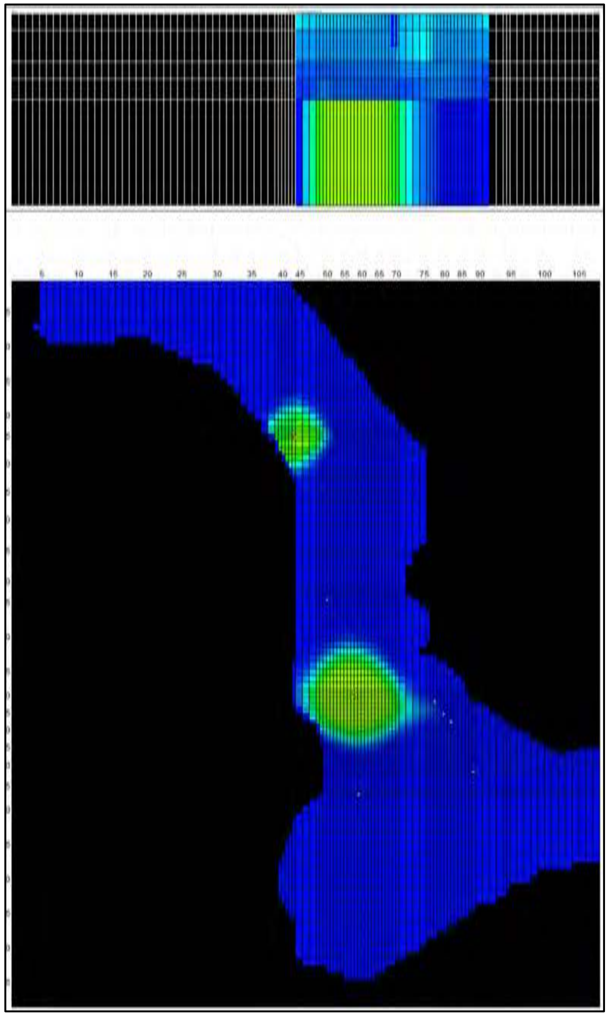
FIGURE 8A

MODEL OUTPUT - 1, 5, & 10-YEAR
TEMPERATURE ISOCONTOURS-LAYER 2
MAX Khor - MIN Kvert

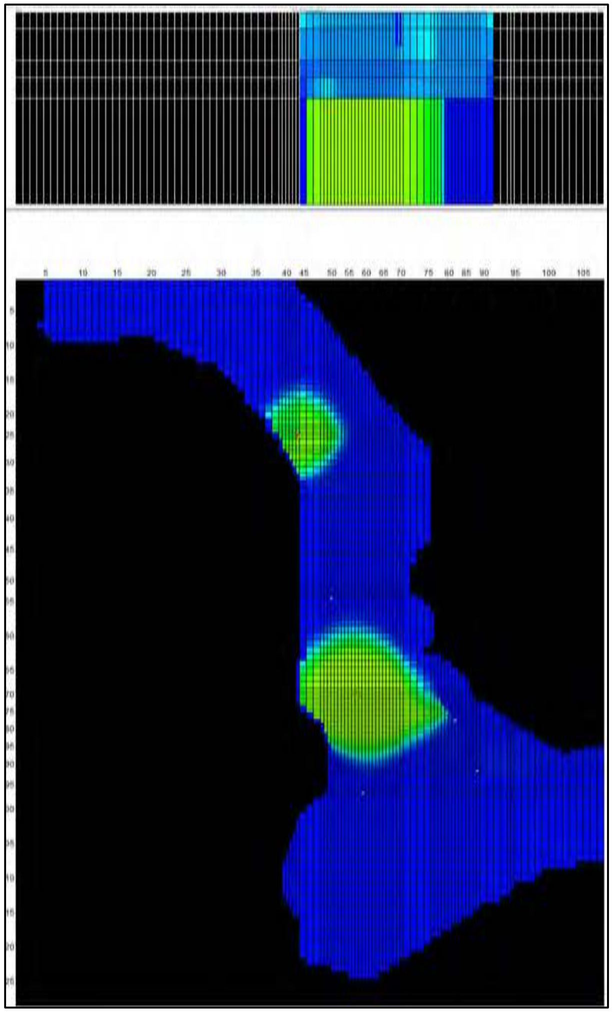
Hydrogeological Study
ISWMS - Regen - Geothermal System
Grand Cayman



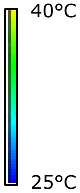
1-YEAR SIMULATION



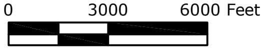
5-YEAR SIMULATION



10-YEAR SIMULATION



SIMULATED TEMPERATURE



SCALE

RC MINNING & ASSOCIATES
10218 Tarpon Drive - Treasure Island, FL 33706

FIGURE 8B

MODEL OUTPUT - 1, 5, & 10-YEAR
TEMPERATURE ISOCONTOURS-LAYER 5
MAX Khor - MIN Kvert

Hydrogeological Study
ISWMS - Regen - Geothermal System
Grand Cayman

APPENDIX A

ReGen Project, Grand Cayman - Geological and Hydrological Study and Investigation in Support of Proposed Geothermal Cooling System.
Method Statement – September 28, 2021

September 28, 2021

ReGen Project, GRAND CAYMAN
GEOLOGICAL AND HYDROLOGICAL STUDY & INVESTIGATION IN SUPPORT OF PROPOSED GEOTHERMAL COOLING SYSTEM

METHOD STATEMENT

1.0 BACKGROUND AND INTRODUCTION

ReGen is advancing the design of an energy recovery facility (ERF) at 11B91&94, George Town, Grand Cayman. A dedicated geothermal cooling system is proposed to service the new development. The average flow required for the cooling system is estimated to be 11,000 gallons per minute (gpm) with a temperature delta of 18 Fahrenheit. The values of the cooling water flow demand and temperature differential are the expected values for the lifetime of the project and are based on the ERF functioning at full thermal capacity.

The preliminary proposed locations of the ERF geothermal cooling wells will be developed using the following general criteria.

- Provide a minimum of four (4) abstraction wells and three (3) disposal wells.

- Minimum horizontal separation of 100ft between abstraction wells and 200ft between disposal wells. This is the proposed horizontal separation between the wells within the abstraction and disposal groups. In other words, the abstraction wells will be located at a minimum spacing of 100ft to next abstraction well.

- Minimum horizontal separation of 2,000ft between the nearest disposal and the nearest abstraction well.

Geothermal systems on Grand Cayman are typically based on the abstraction of cooler deeper groundwater and the disposal of the same but heated water at a shallower elevation (this model can be reversed so that the heated water is discharged at the deeper elevation). The actual depths of abstraction and disposal wells will be confirmed based on the hydrology study findings. The presence of an aquitard (*Cap Rock*) between the disposal point and the abstraction point greatly reduces the risk of a short circuit where the warmed water is taken back into the geothermal system.

The nearby North Sound and the presence of other ground water users in proximity to the proposed geothermal system needs to be considered. The disposal of the warmed ground water may impact the North Sound and the operations of neighbouring groundwater users. Hydraulic modeling and pilot wells are used to analyze and quantify the risk of impacts. The modeling can also be used to mitigate predicted impacts. The study and the hydrological model will also address potential impact on the North Sound and the Caribbean Sea.

The tasks to be undertaken are set out in the following table and narrative sections. They are intended to meet ReGen's brief and be responsive to the requirements for further hydrogeological studies articulated in the Terms of Reference of the Environmental Impact Assessment of the ReGen project. This study will be integrated in the EIA to apply for a groundwater abstraction license and discharge permit as required by the Water Authority Act.

Task #	Title	Task Description
1	**Initial desktop and modelling review prior to hydrogeological field investigation and detailed modeling for proposed geothermal installation for ReGen ERF Waste Heat Disposal**	This review will investigate the geothermal impacts of the proposed installation to service the proposed ERF. A hydrological model will be developed using information from our previous work and groundwater user information provided by the Water Authority (WAC). Predicted geological profiles based on a compilation of our historic investigations in this part of the George Town district will be modelled. The modeling will investigate the impacts of the new wells on each other and existing installations using the ground water aquifer. The well locations and design will be adjusted to mitigate their impacts and to optimize their performance for the proposed installation to service the ERF. This desktop study will be presented to ReGen and EAB/WAC for their review prior to commencement of the proposed pilot wells and detailed study report as set out in Task 2.
2	**Hydrogeological in field investigation, testing and modeling for the proposed geothermal installation for the ERF. Draft and final reports for client and environmental review board (EAB) review**	Study including placing pilot boreholes and field and laboratory testing followed by permitting support services as described in this method statement. The pilot bores can be converted to monitoring or production wells. The findings and conclusions of this investigation, testing and modeling study will take precedence over the predictions of Task 1. The draft and final reports will be presented to ReGen and EAB/WAC for their review and commentary.

1.1 TASK 1

Develop a hydrological model for the site to include neighbouring groundwater users. The model will be used to predict, subject to the future findings from geological borings and laboratory testing of rock cores, the outcome of the following scenarios.

1. Impacts on groundwater of operating the proposed 11,000 gpm / delta 18° Fahrenheit geothermal cooling system to service the proposed ERF at 11B91&94.

2. Proposed mitigation measures to help counter any predicted negative impacts from the proposed geothermal cooling system on existing neighbouring ground water user operations. Task 1 will provide an estimate of anticipated zone of temperature variance. This will provide a preliminary indication of the impact of discharged water on adjacent groundwater users.

The report on the Task 1 predictive study will be submitted to the Environmental Advisory Board (EAB) for review and commentary. It is understood that the WAC is a member of the EAB.

1.2 TASK 2

Task 2 covers the field investigation using pilot test boreholes to determine the rock profile with depth, its characteristics including porosity, water flow paths and potential volumes. Rock chippings and cores are taken for visual review and laboratory analysis to determine densities, porosities, fracture characteristics and thermal conductivity. Pumping tests are carried out. The field results are incorporated into the hydrological model to determine the optimum location and design of the wells and to mitigate their impacts on surrounding ground water users. Final reports on the hydrogeological study and recommendations for appropriate well placement and design are provided. Seeking direction and discussing the report with the authorities is included in Task 2 activities.

For the purposes of this proposal, it has been assumed that two boreholes to a depth of 400ft and 150ft below grade will be sufficiently deep to provide a profile of the rock formation including a clear definition of the location and thickness of the *Cap Rock*. If field investigations indicate otherwise, the location and depth of the boreholes may have to be altered.

2.0 DETAILED SCOPE OF TASKS

TASK 1

Review all available reports, documents, literature and data pertaining to geologic/hydrogeologic conditions in the area and existing reverse osmosis (RO) and geothermal cooling systems.

Meet with WAC personnel as well as others to discuss the proposed systems, determine regulatory requirements, and operational history of their existing facilities.

A hydrological model based on information from our previous work and groundwater user information provided by the Water Authority (WAC) will be further informed by predicted geological profiles based on a compilation of our historic investigations in this part of the George Town district.

The modeling will investigate the impacts of the new wells on each other and existing installations using the ground water aquifer. The proposed well locations and design will be adjusted to mitigate their impacts and to optimize their performance for the proposed installation.

This desktop study will be presented to ReGen and EAB/WAC for their initial review prior to advancing the final study reports on completion of Task 2.

TASK 2

The field geological investigation will identify the underlying rock formations and the physical characteristics and condition of these formations. A suite of laboratory tests will be conducted on rock cores to determine the porosity and vertical and horizontal permeabilities of the rock.

The investigation will include:

1. Drilling, coring and logging a six (6)-inch diameter borehole (BH#1) to 400 feet below ground level approximately. Borehole may be located so that it can be later reamed out to a larger diameter and used as a monitoring well for the proposed geothermal system. APEC will record the penetration rate and the pull-down pressure on the drill-bit every five feet and/or change in formation. Ten (10), ten foot long cores and drill cuttings will be obtained during the first 250 feet of drilling followed by taking drill cuttings every five-feet and/or change in formation for the remaining 150 feet of drilling. Some additional cores may be taken below the 250 feet mark. Fifteen samples from these cores will be selected and sent to our geologist for whole core porosity and permeability testing amongst others including thermal conductivity. A borehole video camera and temperature/conductivity probe will be run the entire length of the 6-inch diameter, 400ft deep pilot borehole. The data obtained will be used to correlate/confirm the lithology, apparent porosity and

permeability and to determine the ambient vertical groundwater temperature gradient.

Please note that it is very important to assess the presence/thickness/or absence of the *Cap Rock* or some other low permeability layer that can act as a hydraulic barrier (aquitard) between the abstraction and injection zones. The number and depth of core samples to be taken as well as the number of core samples to be tested are provided as an estimate based on similar previous work. The actual number of cores as well as the number of core samples to be tested will be adjusted depending on test well drilling information in real time.

2. Collect groundwater sample(s) and analyze for chemical composition as needed for the geothermal system. Contact equipment manufacturer/supplier for water quality specifications.

3. The elevation of the measuring point for the borehole will be surveyed and a pressure transducer installed and monitored to determine any tidal fluctuations.

4. Drilling a six (6)-inch diameter test well (BH #2) to the bottom of the *Cap Rock* at the location selected based on the preliminary hydrological model. Again, it is very important to verify the presence and thickness of the *Cap Rock*. Five (5) ten feet long cores and well cuttings will be obtained from this well. Five samples from these cores will be selected and sent to the geologist for whole core porosity and permeability testing amongst others including thermal conductivity at the selected location along the depth of the borehole to the bottom of cap rock. Drilling protocols, temperature logging and borehole video survey will be conducted in the same manner as for BH #1. The open borehole will be grouted back to the top of the *Cap Rock*, with surface casing installed as needed. The elevation of the measuring point will be surveyed and a pressure transducer installed. Monitoring of the pressure transducers in BH #1 and BH#2 will be carried out for a minimum of 48 hours to see if there are any head differentials between the shallow and deep wells to demonstrate hydraulic separation. Water level measurements will be made in both BH #1 and BH #2 at six hour intervals with an electric tape. Also use lag times to calculate aquifer transmissivities.

   The number and depth of core samples to be taken as well as the number of core samples to be tested are provided as an estimate based on similar previous work. The actual number of cores as well as the number of core samples to be tested will be adjusted depending on test well drilling information in real time.

5. A data logger will be installed at the North Sound. Tidal data from the data logger will assist in calibration of the hydrology models.

The hydrological modelling work will include:

- Constructing a model of the groundwater flow system using the latest version of MODFLOW and MT3D. The MODFLOW code simulates groundwater flow by solving the groundwater flow equation at each cell, assuming that flow is homogeneous and isotropic within that cell. In this way, it is possible to simulate groundwater flow in porous media. Although the aquifer materials are carbonates (usually associated with fracture flow) the materials are porous enough, fractured enough, and have a higher enough degree of secondary/dual porosity to behave like standard porous media. This makes the use of the MODFLOW code valid. Model code MT3D is used for the heat transport portion of the simulations. MT3D was developed to simulate contaminant movement in groundwater (solute transport), however, the heat transport and the solute transport equations are analogous. MT3D is routinely used for heat transport in groundwater systems by substituting thermal properties for the solute transport properties commonly input. In these simulations, temperature was input as “concentration” and thermal dispersivity for “hydraulic” dispersivity.

- This approach will be presented to the WAC at the preliminary meeting for consensus. Input parameters would be based on data from published documents/reports, the geological assessment of the subsurface lithology, thermal conductivity of the *Cap Rock*, porosity and permeability testing, the borehole video log, lag time calculations, head differential and others. The model will be calibrated to actual head conditions.

- Query model for:
    - Locations/spacing of four (4) 400ft deep abstraction wells each pumping at 2,750 gpm (+/) and three (3) 150ft shallow injection wells each injecting at 3,700 (+/-) gpm.
    - Incorporate the locations, depths and abstraction/injection rates for identified RO and geothermal systems in the area.
    - Determine the extent and magnitude of thermal impacts on the groundwater flow system, existing RO and geothermal systems, North Sound and other surface water bodies.

Finally, a draft and final report will be presented. These will capture the geological, borehole surveys/logs and hydrological investigation, hydraulic modeling results, presenting all data, calculations, model inputs/outputs, potential impacts and recommendations on the feasibility of the proposed geothermal system from a geological and hydro-geological perspective.

3.0 APEC'S TEAM

The APEC team comprises the following.

- **Dr Brian Jones, Geologist**
  Dr Jones is WAC's preferred geologist. He is the preeminent expert in the geology of the Cayman Islands. Brian was the geologist for the Kimpton Seafire geothermal system and many other projects in the Cayman Islands.

- **Mr Robert Minning, Hydrologist, R.C. Minning and Associates, Inc**
  Bob Minning is the hydrologist for the Kimpton Seafire geothermal system and Dragon Bay and Dart Central Laundry RO projects.

- **Mr Pearse Murphy, Mr Ali Sabti, Mr Denis Murphy, Mr Daniel McCarthy, Mr Adam Cullen, APEC Consulting Engineers Ltd**
  APEC carries out project lead and scoping tasks and is very familiar with Cayman's geotechnical and deep well construction practices. APEC provides project performance specifications for contractors, logistics, field samples and data collection, fieldwork supervision of the Kimpton Seafire, Central Laundry and other investigations, liaised with the authorities and carried out permitting tasks for the award of the requisite licenses.

APPENDIX B

Water Authority-Cayman July 14, 2020 Letter Re: Major Groundwater Projects for Dart. Letter to Dart and APEC teams

14th July 2020

Mr. Frank O'Leary, Senior Construction Engineer, Dart, Frank.OLeary@dart.ky
Mr. Bryan Fitzgerald, Dart, Bryan.Fitzgerald@dart.ky
Mr. Andrew Small, Senior Manager Project Management, Dart, Andrew.Small@dart.ky
Mr. Martin Edelenbos, Engineering Coordinator SWM, Dart, Martin.Edelenbos@dart.ky
Mr. Denis P. Murphy, Senior Engineer, APEC Consulting Engineers Ltd, Denis@apec.com.ky
Mr. Ali Sabti BSc(Eng), Senior Civil and Structural Engineer, APEC Consulting Engineers Ltd, Ali@apec.com.ky
Mr. Pearse Murphy, Principal, APEC Consulting Engineers Ltd, Pearse@apec.com.ky

Re: Major Groundwater Projects for Dart

Dear Dart and APEC teams,

The Water Authority has been approached by Dart and APEC about the Water Authority's requirements and background information for various major groundwater projects proposed by Dart:

1. **ISWMS**, the Energy Recovery Facility for the Integrated Solid Waste Management System. Geothermal cooling, project location to be confirmed, initial proposal on 19A 4REM6, but site may have been relocated.
   Project contacts: Andrew Small and Martin Edelenbos, Dart and various staff of APEC.
2. **Laundry Facility**, Feedwater abstraction and disposal of brine for Reverse Osmosis Plant for Laundry Facility on 19A 4REM6.
   Project contacts Denis Murphy and Ali Sabti, APEC.
3. **Camana Bay,** Geothermal cooling for Camana Bay on 12E 115, location to be confirmed.
   Project contact Frank O'Leary, Dart.
4. **Ritz Carlton**, Geothermal cooling for Ritz Carton hotel on 12C 393, location to be confirmed.
   Project contact Ali Sabti and Denis Murphy, APEC.
5. **Indigo Hotel**, Geothermal cooling for Indigo Hotel on 11B 94 & 91.
   Project contact Ali Sabti and Denis Murphy, APEC

Rather than giving an individual reply for each project and providing the requested information to each of the project contacts, it is better to reply to all concerned at this stage because of the commonalities of the projects and because the groundwater use for each of these projects may impact existing and proposed use of groundwater.

P.O. Box 1104, Grand Cayman, KY1-1102, CAYMAN ISLANDS
P.O. Box 240, Cayman Brac, KY2-2002, CAYMAN ISLANDS
Website: www.waterauthority.ky

Tel No: 345-949-2837 Fax No: 345-949-0094
Tel No: 345-948-1403 Fax No: 345-948-1404
E-mail: info@waterauthority.ky

Please note that the Water Authority has not received basic information on proposed volumes of abstraction and disposal and the anticipated temperature of the cooling water that will be discharged for the geothermal projects. Also, we have not received information on the proposed volume of abstraction and disposal for the RO plant for the Laundry Facility. In addition, we are not sure about the locations of some of these projects.

Abstraction Licence and Discharge Permit under the Water Authority Law

Each of these projects is required to apply for an abstraction licence for the abstraction of groundwater and a discharge permit for the disposal of effluent under the Water Authority Law (2018 Revision), sections 22 and 34 respectively. Once we get further with the technical aspects of these projects, we will advise regarding the administrative process for the applications, inclusive advertising. Please be advised that the application process requires public consultation, therefore any technical reports that are part of the application may need to be available for public review.

If a project involves significant groundwater abstraction and disposal and there is potential impact on the groundwater resource, the Water Authority may require a hydrogeological study as part of the application process. This has been done for the Kimpton Seafire geothermal project, CUC groundwater cooling, the Government Administration Building geothermal project and the Camana Bay geothermal project. The hydrogeological study for the Camana Bay project was conducted by APEC on behalf of Dart in 2005, but the project was not carried out at the time. The Water Authority received the report, but as the project was not pursued the report has not been formally reviewed or accepted for that matter.

Existing and Proposed major Groundwater Projects that may impact each other

The proposed projects are unique, distinctive in nature, take place at different locations and are managed by different persons, but they all rely on the same groundwater resource. Also, there are already a number of existing groundwater projects that may be impacted by the new projects. For that reason, the Water Authority provides the attached inventory of existing and proposed groundwater projects that may be impacted by what is proposed (refer to attached excel spreadsheet and maps). The information is based on what the Authority has on record. Please note that the Authority will contact several developers (Cayman Water Company, Margaritaville and the Marriott) for updates on their groundwater usage. We would be grateful if Dart could confirm the status of the Dragon Bay and Camana Bay RO plants.

For each of the projects proposed by Dart the spreadsheet identifies existing and proposed projects within a radius of 2 km for the geothermal projects and 1.5 km for the RO project. Whereas these distances are arbitrary, it shows that there is a potential for the proposed projects to influence existing projects and/or each other. Although different studies may be undertaken for each proposed project, it is important that an overall evaluation is done whether the existing and proposed projects impact each other. If determined that the projects do not impact each other, separate studies for each project may suffice.

Proposed Study

The overall objective is to conduct a hydrogeological study to determine the most suitable well configuration (i.e. well depths and locations) in consideration of limiting and mitigating any medium- and long-term effects of abstraction and disposal on other groundwater users and the environment. Of specific concern is the impact of the discharge of the warmer cooling water and its potential impacts on groundwater used for other geothermal cooling projects and Reverse Osmosis plants, as increased feedwater temperature impacts the performance of RO plants. Also, where a project is close to the landfill, which has no liner, the well design needs to take potential impacts of landfill leachate into account.

In previous projects undertaken by Dart, such as the proposed landfill project in Bodden Town and the Kimpton Seafire geothermal cooling it engaged the service of APEC, who have worked closely with Dr. Brian Jones, Professor of Geology at the University of Alberta and Robert Minning and John Bomba of R.C. Minning & Associates. Whereas the Water Authority can only stipulate that qualified consultants need to be engaged, based on the track record and our experience with these consultants, there is a merit to involve them in the relevant studies.

The studies for CUC, Government Administration Building, Kimpton Seafire and Camana Bay involved the installation of pilot wells to collect geological samples, determined site specific properties and addressed the general geology and the site-specific geology of the project area. These studies also included site specific groundwater modelling for the geothermal projects.

Based on the overall potential impacts of the proposed projects, there is a need to review the existing reports and to identify gaps as additional development has taken place and more geological information has become available since these studies and reports were generated. We suggest that Dr. Jones is approached to provide his professional opinion on the existing geological reports to identify any additional work that needs to be undertaken to provide relevant and additional geological information for these projects. In a similar way we suggest that Robert Minning and John Bomba are consulted to provide their professional opinion on the existing hydrogeological reports for the geothermal projects to identify any additional work that needs to be undertaken to update and improve the predictive groundwater models for the proposed projects.

We suggest that they specifically provide their professional opinion on:

1. Need for additional site-specific investigations, i.e. is it necessary to install additional pilot wells to fill in gaps in the geological information available or other additional field work that they deem appropriate;
2. Need for additional information to develop an up to date groundwater model to predict the intermediate and long-term effects (1, 5- and 10-year predictions) of the cooling water abstraction and disposal.
3. Can the proposed projects be reviewed on an individual basis or is there a need for an overall approach that considers the specifics of all projects?

Once we have received their feedback, we can then determine the scope and need for further studies.

Consultation under the National Conservation Law

Please be advised that the proposed projects are subject to review by the National Conservation Council under the National Conservation Law, 2013. For the geothermal project for the ISWMS this process has already been initiated by the Environmental Impact Assessment for the ISWMS. Once we have the basic information for each of the other proposed project, such as specific location, abstraction and discharge volumes and temperature of cooling water, the Water Authority will contact the Department of Environment about their specific requirements for the other projects.

I trust this addresses the Water Authority's overall review and application process for the various groundwater projects proposed by Dart.

Yours sincerely,

Hendrik van Genderen
Water Resources Engineer

Enclosed:

1. Spreadsheet: Well Information for Dart - various projects, July 2020
2. Well Location Map Overall for Dart projects, July 2020
3. Well Location Map 1 for Dart Projects, July 2020
4. Well Location Map 2 for Dart Projects, July 2020
5. Well Location Map 3 for Dart Projects, July 2020

Well Information for DART - Various Groundwater Projects

Development	Location on Map	Nature	Location Block and Parcel	Abstraction m^3/day	Abstraction well details	Disposal m^3/day	Disposal well details	Geothermal max temp (°C)	Remarks	Proximity to other developments				
										ISWMS <2KM	LAUNDRY <1.5 KM	CAMANA BAY <2 KM	RITZ CARLTON <2KM	INDIGO <2KM
Kimpton Seafire	1	Geothermal cooling	11B69, 82, 83	14,762	3 wells 12" casing to 55ft, td 150 ft	14,762	2 wells, 12" casing to 255ft, td 280ft	33.9	Kimpton Seafire, airconditioning and production of non potable water for irrigation				Ritz Carlton	Indigo
Cayman Water Company - Governor's Harbour	3	Feed water for RO plant and brine disposal	11D8	27,252	5 wells, 10" casing to 100ft, td 150ft 3 wells, 14" casing to 100ft, td 150ft	18,259	2 wells, 10" casing to 200ft, td 250ft 1 wells, 14" casing to 200ft, td 250ft	n.a.	WA to verify details with CWC Info is dated from Kimpton cooling water project				Ritz Carlton	Indigo
Dragon Bay	4	Feed water for RO plant and brine disposal	17A262	1,183	1 well, 8" casing to 25 ft, td 75 to 100ft	710	1 well, 8" casing to 110ft, td 200ft	n.a.	WA to verify whether plant and wells have been installed and are operational. Production of non-potable water for irigation			Camana Bay	Ritz Carlton	Indigo
Ritz Carlton	6	Feed water for RO plant and brine disposal	12C394	2,120	2 wells, 8" casing to 60ft, td 85 ft	1,136	1 well, 10" casing to 130ft, td 150ft	n.a.	Ritz Carlton. Production non-potable water for irrigation				Ritz Carlton	Indigo
Foster's Food Fair (Strand Store)	7	Geothermal cooling	12C 350	2,725	1 well, 8" casing to 130ft, td 150ft	2,725	1 well, 8" casing to 60ft, td 80ft	31.4	Airconditioning			Camana Bay	Ritz Carlton	Indigo
Fosters IGA, Camana Bay	8	Geothermal cooling	12D33	2,725	1 well, 14" casing to 95ft, td 275ft	2,725	1 well, 14" casing to 60ft, td 160ft	31.0	Airconditioning	ISWMS		Camana Bay	Ritz Carlton	
Cayman Water Company - Britannia Plant	9	Feed water for RO plant and brine disposal	12D79REM1	8,176	3 wells 8" casing to 50ft, td 70ft 1 well 12" casing to 100ft, td 140ft	4,905	1 well 8" casing to 150ft, td 180ft	n.a.	WA to verify details with CWC Info is dated from Kimpton cooling water project	ISWMS		Camana Bay	Ritz Carlton	
RO plant for Camana Bay AC make-up water	10	Feed water for RO plant and brine disposal	12E115	473	no details	284	no details	n.a.	WA to verify. Info from site visit in Feb 2014. Staff confirmed 50,000 gpd production capacity	ISWMS		Camana Bay	Ritz Carlton	
Marriott Resort	11	Feed water for RO plant and brine disposal	13B2	473	no details	284	no details	n.a.	WA to verify. Water production for the resort. Records incomplete. In May 2015 new owner confirmed 72,000 gpd production capacity. Not sure whether RO plant is operational	ISWMS	Laundry	Camana Bay		
Margaritaville	13	Feed water for RO plant and brine disposal	13B124REM1	681	no details	409	no details	n.a.	WA to verify.Water production for the resort. Records incomplete. In May 2015 new owner confirmed 72,000 gpd production capacity. Not sure whether RO plant is operational	ISWMS	Laundry	Camana Bay		
NCB Hotel	14	Geothermal cooling	13E14	2,943	6 wells, 8" casing to 150ft, td 200ft	2,943	6 wells, 8" casing to 150ft, td 250ft	31.7	Airconditioning	ISWMS	Laundry	Camana Bay		
Government Administration Building	15	Geothermal cooling	14CJ 175	11,446	2 wells, 16" casing to 280ft, td 361ft	11,446	2 wells, 12" casing to 40ft, td 80ft	33.0	Airconditioning	ISWMS				
Water Authority Wastewater Treatment Works - current	16	Effluent disposal	13C2REM1	n.a	n.a.	9,463	3 wells, 12" casing to 150ft, td 225ft 1 well, 12" casing to 150ft, td 225ft	n.a.	3 wells (SHT 6, 7, 8) for effluent from SBR 1 well (SHT 9) for emergency overflow from pond 1.1	ISWMS	Laundry	Camana Bay		
Water Authority Wastewater Treatment Works - additional	16	Effluent disposal	13C2REM1	n.a	n.a.	9,463	tbd	n.a.	Planned additional treatment capacity, will be installed by 2025-2030	ISWMS	Laundry	Camana Bay		
Water Authority Wastewater Treatment Works - additional at full build out	16	Effluent disposal	13C2REM1	n.a	n.a.	18,925	tbd	n.a.	Additional treatment capacity at full build out of WWTW (i.e. total of the facility will be 37,852 m3/day)	ISWMS	Laundry	Camana Bay		
Progressive Distributors	18	Geothermal cooling	19A 27	2,725	1 well, 8" casing to 200ft, td 250ft	2,725	1 well, 8" casing to 80ft, td 130ft	33.0	Airconditioning	ISWMS	Laundry			
Caribbean Utilities Company	19	Feed water and cooling water for distiller and disposal	19E 178	5,178	2 wells, 12" asing to 80ft cased, td 100ft	5,178	1 well, 12" to 150ft, td 200ft	n.a.	Water production for turbines - see separate tab "CUC Cooling Water" for details	ISWMS	Laundry			

Well Information for DART - Various Groundwater Projects

										Proximity to other developments				
Development	**Location on Map**	**Nature**	**Location Block and Parcel**	**Abstraction m^3/day**	**Abstraction well details**	**Disposal m^3/day**	**Disposal well details**	**Geothermal max temp (°C)**	**Remarks**	**ISWMS <2KM**	**LAUNDRY <1.5 KM**	**CAMANA BAY <2 KM**	**RITZ CARLTON <2KM**	**INDIGO <2KM**
Caribbean Utilities Company	19	Geothermal cooling	19E32REM2, 34, 86, 114, 178	102,451	11 wells, details in separate tab "CUC Cooling Water"	102,451	2 marine outfalls, 4 disposal wells - details in separate tab "CUC Cooling Water"	42.0 (marine outfall)	Cooling water for electricity production	ISWMS	Laundry			
Water Authority Red Gate Water Works - Red Gate RO Plant	20	Feed water for RO plant and brine disposal	20B410	12,500	5 wells, 10" casing to 100ft, td 150ft	7,500	1 well, 12" casing to 200ft, td 250ft	n.a.	Current Operation	ISWMS	Laundry			
Water Authority Red Gate Water Works - North Sound RO Plant	20	Feed water for RO plant and brine disposal	20B410	15,000	2 wells, 14" casing to 100ft, td 160ft and 1 well, 16" casing to 96ft, td 154ft	9,000	1 well, 14" casing to 211ft, td 300ft	n.a.	Current Operation	ISWMS	Laundry			
Water Authority Red Gate Water Works - Future RO Plant	20	Feed water for RO plant and brine disposal	20B410	12,500	tbd	7,500	tbd	n.a.	Additional capacity, planned for June 2022	ISWMS	Laundry			
Mikes Ice & Refrigeration	21	Geothermal cooling	20B381H4	1,635	1 well, 12" casing to 160ft, td 210ft	1,635	1 well, 12" casing to 60ft, td 80ft	32.2	Ice production	ISWMS				
Foster's Food Fair (Distribution Centre)	22	Geothermal cooling	20C10 and 81	2,725	1 well, 8" casing to 160ft, td 210ft, or as required by site conditions	2,725	1 well, 8" casing to 60ft, td 80 ft, or as required by site conditions	31.0	Airconditioning	ISWMS				
Foster's Food Fair (Airport Store)	23	Geothermal cooling	20B 355	2,725	1 well, 14" casing to 150ft, td 275ft	2,725	1 well, 14" casing to 60ft, td 125ft	31.0	Airconditioning	ISWMS				
Cayman Islands Airport Authority	24	Geothermal cooling	20C78	9,811	2 wells, 12" casing to 120ft, td 300ft	9,811	2 wells, 12" casing to 150ft, td 250ft	30.0	Airconditioning	ISWMS				
PROPOSED FACILITIES (NOT WATER AUTHORITY)														
Indigo - Dart new hotel next to Kimpton	2	Geothermal cooling	11B94, 91	tbd	tbd	tbd	tbd	tbd	New hotel close to Kimpton, no groundwater use details available yet. Proposed through APEC				Ritz Carlton	Indigo
Ritz Carlton	5	Geothermal cooling	12C 393	tbd	tbd	tbd	tbd	tbd	Proposed through APEC			Camana Bay	Ritz Carlton	Indigo
Camana Bay	10	Geothermal cooling	12E115	29,432 average 52,324 peak	tbd	29,432 average 52,324 peak	tbd	tbd	Geothermal project for Camana Bay - Study done in 2005, Dart is currently revisiting this project	ISWMS	Laundry	Camana Bay	Ritz Carlton	
Cayman Water Company - new plant	12	Feed water for RO plant and brine disposal	13B230	tbd	tbd	tbd	tbd	n.a.	WA to verify. Proposed CWC Site next to Hospice Care - details on wells and production not available yet.	ISWMS	Laundry	Camana Bay		
Dart Laundry facility next to WA WWTW	17	Feed water for RO plant and brine disposal	19A4REM6	tbd	tbd	tbd	tbd	n.a.	Production non-potable water for laundry facility, proposed through APEC	ISWMS	Laundry	Camana Bay		
ISWMS - cooling water for ERF	17	Geothermal cooling	19A4REM6 - may have moved	tbd	tbd	tbd	tbd	tbd	Geothermal project ISWMS - no details available yet, Dart contact Andrew Small	ISWMS	Laundry	Camana Bay		

NOTES

ISWMS - Integrated Solid Waste Management System - Energy Recovery Facility - geothermal cooling, project location to be confirmed, possiby moved from 19A4REM6

Laundry Facility - feedwater abstraction and disposal of brine for Reverse Osmosis plant, location 19A4REM6

Camana Bay - geothermal cooling 12E115 - location to be confirmed

Ritz Carlton - geothermal cooling, location 12C 393 to be confirmed

Indigo Hotel - geothermal cooling, location 11B94, 91

CUC Inventory of Wells Used for Geothermal Cooling

Abstraction Wells

Well ID	Date Installed	Service Location	Block and Parcel	Casing Depth (ft)	Total Depth (ft)	Casing Diameter (in)	Maximum Abstraction Rate (USGPM)	Maximum Abstraction Rate (USGPD)
A3	Jun-98	U-3	19E 178	70	90	6	620	892,800
A4	Jun-98	U-4	19E 178	90	110	6	620	892,800
A32	9-Jul	U-32	19E 86	330	400	16	2,135	3,074,400
A33	7-Jun	U-33	19E 32	330	400	10	2,135	3,074,400
A34	9-Jul	U-34	19E 32	330	400	12	1,629	2,345,760
A35	Apr-00	U-35	19E 32	330	400	12	1,629	2,345,760
A36	Mar-00	U-36	19E 32	330	400	12	1,629	2,345,760
A28.1	16-Jun	A28.1	19E 34	330	500	12	2,100	3,024,000
A28.2	16-Jun	A28.2	19E 34	330	500	12	2,100	3,024,000
A30	16-Jun	A35	19E 86	330	500	12	2,100	3,024,000
A31	16-May	A36	19E 86	330	500	12	2,100	3,024,000
Maximum total cooling water abstraction rate							**18,797**	**27,067,680**

North Sound 24" and 36” marine discharge pipelines

Discharge location of 24” pipeline in the North Sound is east of George Town Barcadere east of Block 19E, Parcel 105 and Block 20C, Parcel 59.
Discharge location of 36” pipeline in the North Sound is north west of George Town Barcadere and east of Block 19A, Parcel 4REM5.
Maximum discharge rate of the pipelines is 27,067,680 US gallon per day, max Temperature: 42 ℃

Disposal wells - *Note that these wells are for back-up of North Sound discharge and normally they are not operational*

Well ID	Date Installed	Service Location	Block and Parcel	Casing Depth (ft)	Total Depth (ft)	Casing Diameter (in)	Maximum Disposal Rate (USGPM)	Maximum Disposal Rate (USGPD)
D32	Jul-09	U-32	19E 34	80	130	16	2135	3,074,400
D33	Jul-09	U-33	19E 34	80	130	16	2135	3,074,400
D34/35	Mar-00	U-34 and U35	19E 114	80	130	12	3258	4,691,520
D36	Apr-00	U-36	19E 114	80	130	12	1629	2,345,760
Maximum total cooling water disposal rate in disposal wells							**9,157**	**13,186,080**

Well Location Map Overall - Dart Projects July 2020

Well Location Map 1 - Dart Projects July 2020

Well Location Map 2 - Dart Projects July 2020

Well Location Map 3 – Dart Projects, July 2020

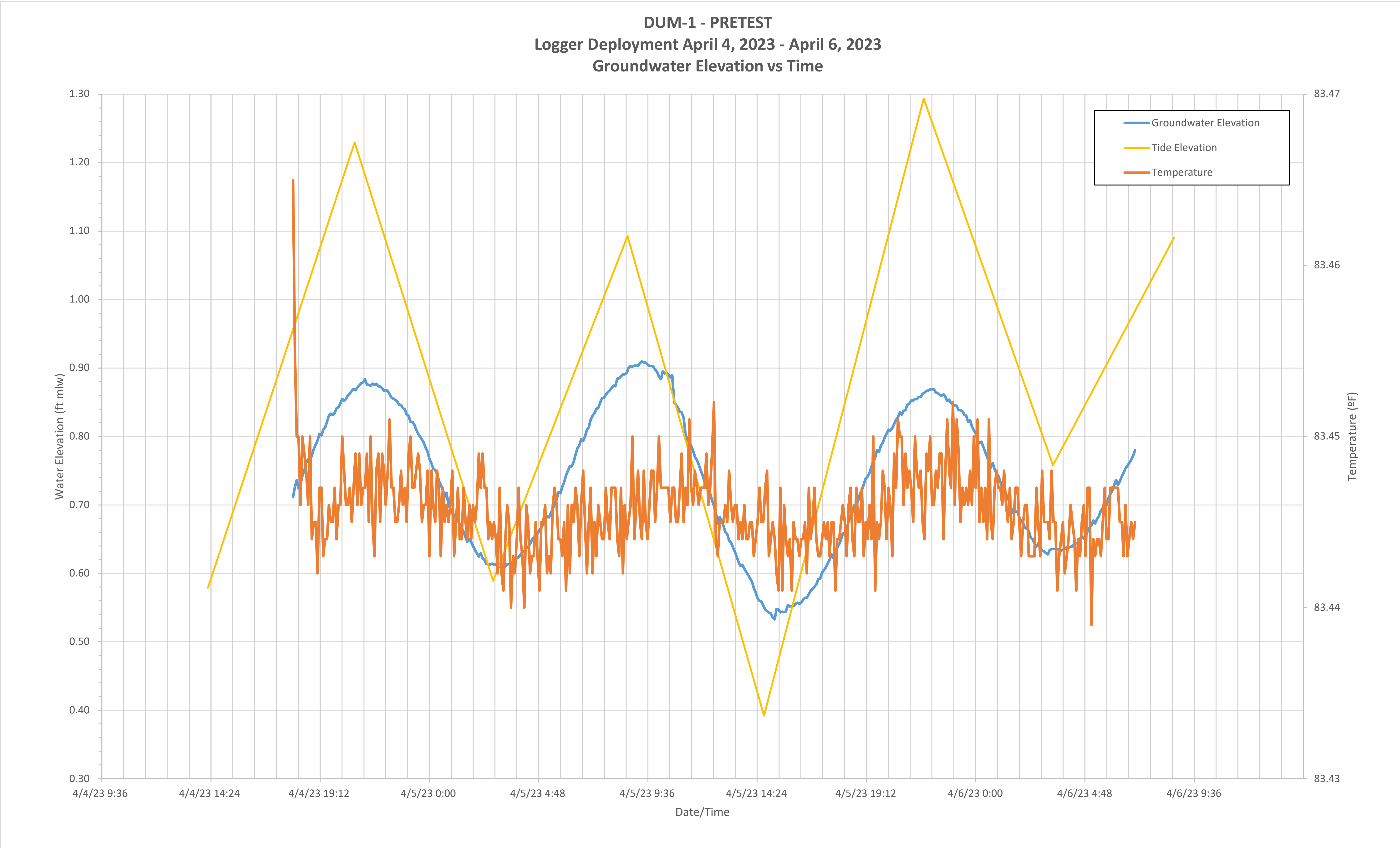
APPENDIX C

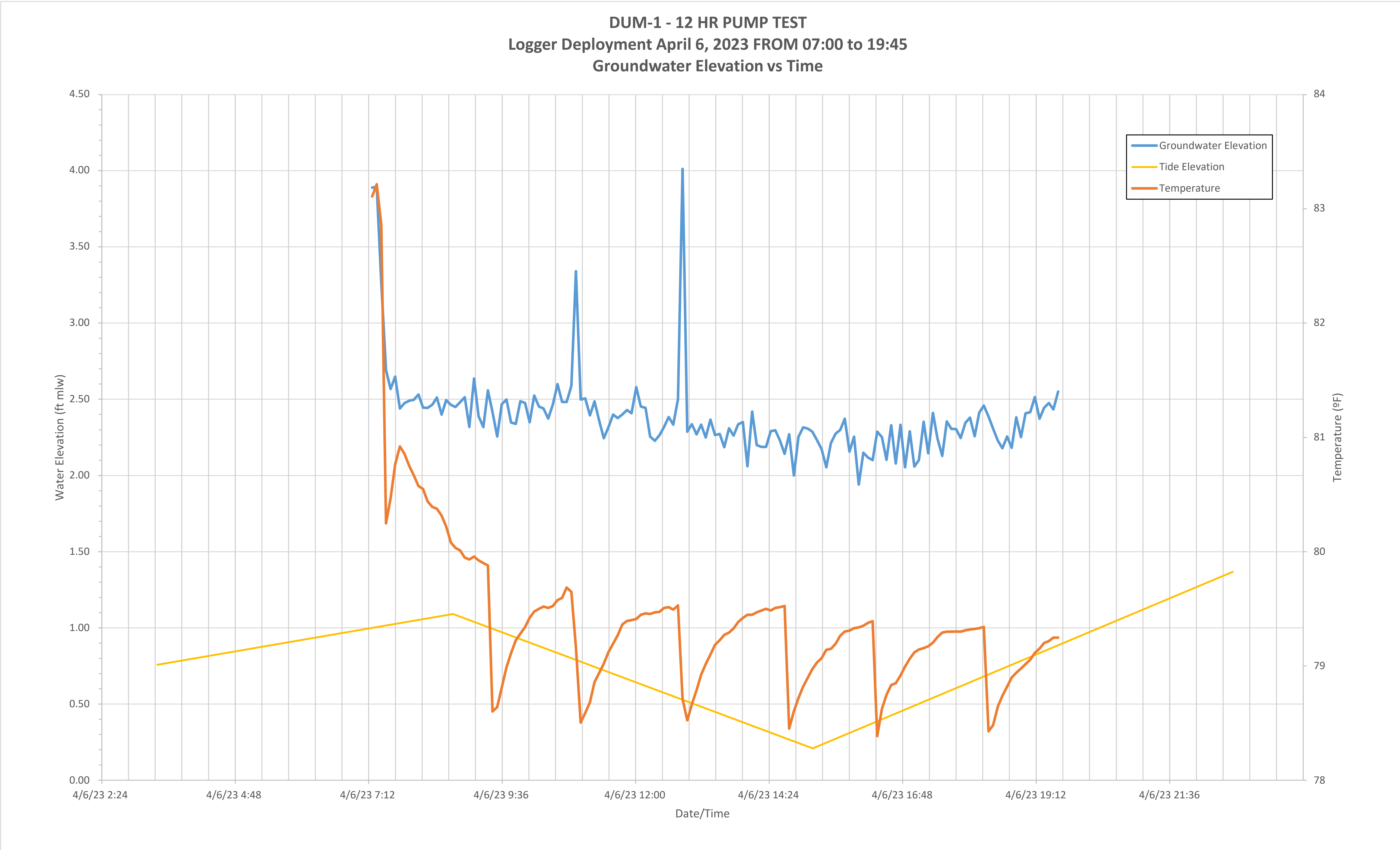
Analyses of Pumping Test Data

DUM-1 and DUM-3 PUMPING TEST ANALYSES

1. DUM-1 has a Total Depth of 407 ft with 250 ft of casing leaving 157 ft of open borehole. A sixty (60) hour pumping test was conducted on April 5 and 6, 2023 which consisted of a 24 hour rest-period (no pumping), a 12 hour pumping period followed by a 24 hour recovery period. Water level fluctuations during the entire test were recorded via a pressure transducer supplemented with periodic electric tape measurements to an established bench mark on the casing top. The pumping portion of the test was at a rate of 356 gallons per minute (gpm). The pre-test, pumping test and post (recovery)test water levels were plotted along with the corresponding tidal stage and groundwater temperature. These plots are presented on the attached graphs. The static water level just prior to the start of the test was ~ -3.9 ft below the top of casing (TOC) and “stabilized” at ~ -2.4 ft below the TOC. However, a review of the tide chart for the test period showed a number of full tidal periods occurred during the test period. The corresponding specific capacity (SC) is equal to the pumping rate “Q” in GPM divided by the measured drawdown “s” which in this case is 356 GPM/1.5 ft = 237 GPM / foot of drawdown. The theoretical drawdown at Q = 1,000 GPM would be 1,000/237 = 4.2 ft and at 2,000 GPM it would be twice that or 8.4 ft. Note that the well was only pumped at 356 GPM so in reality we do not know what the response would be to the higher pumping rates. Since the -250 ft to -407 ft interval will be the injection zone, i.e., receiving water, the projected drawdown becomes the head needed for the particular injection rate.

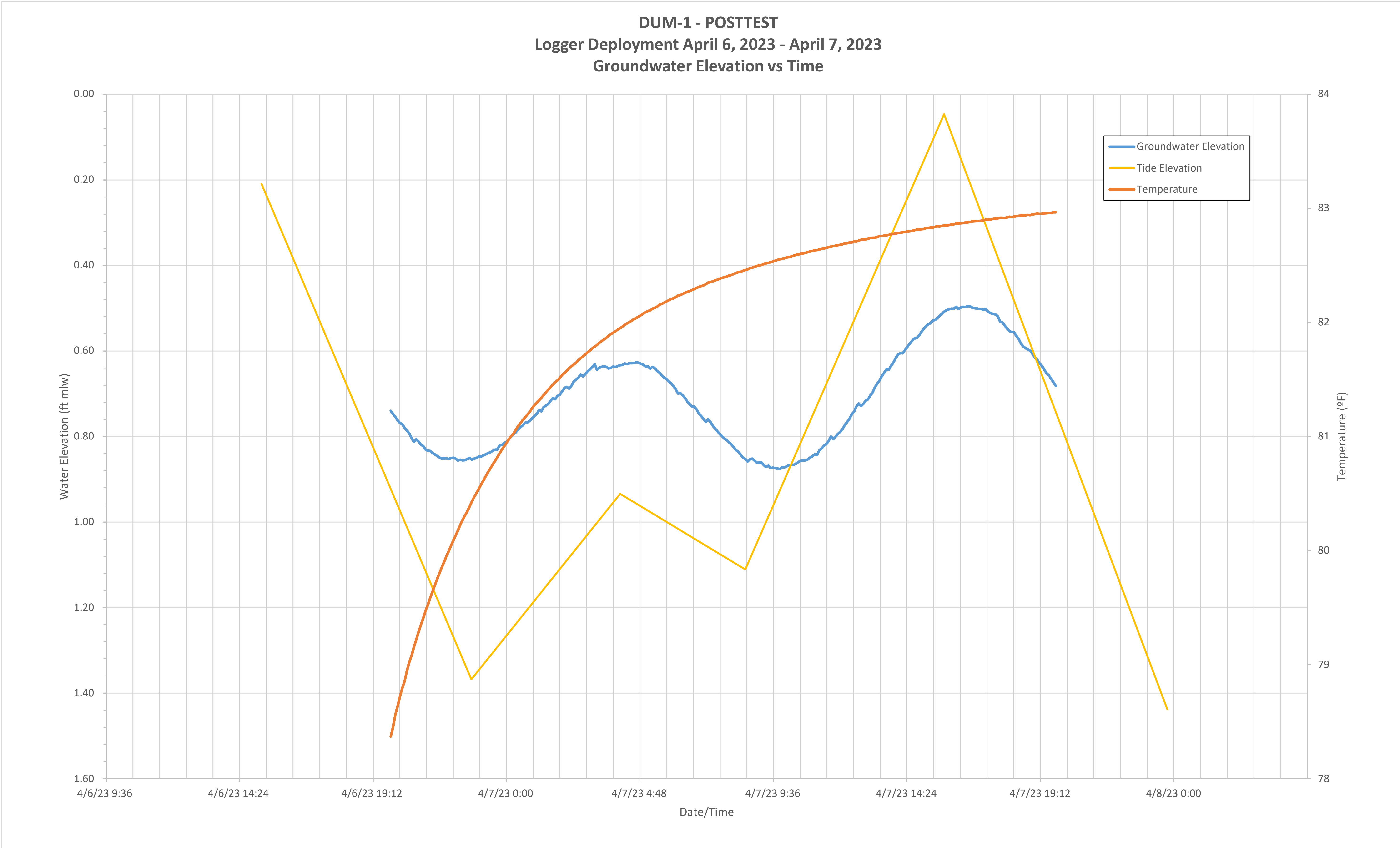
2. DUM-3 has a Total Depth of 147 ft with 50 ft of casing leaving 97 ft of open borehole. A five (5) hour pumping test was conducted on March 16, 2023, at an extraction rate of 356 gallons per minute (GPM). The static water level at 1:10pm, just prior to the start of the test was -99 inches below the top of casing (TOC). Pumping began at 1:15pm and continued for five (5) minutes at which time the pumping level is reported to have stabilized at 119 inches below the TOC. The pumping level at the end of the test was -114 inches below TOC for an apparent drawdown of 15 inches (114 inches – 99 inches). A review of the tide chart for the test day showed that the tide was falling during the test period. The apparent rise in the pumping level during the test could be due to the lag time between tidal levels in the ocean or North Sound and the water level response in DUM-3. Therefore, a conservative approach was used which attributes the maximum measured drawdown of 1.67 ft (119 inches – 99 inches/12) to the pumping of the well. The corresponding specific capacity (SC) is equal to the pumping rate “Q” in GPM divided by the measured drawdown “s” which in this case is 356 GPM/1.67 ft = 212.6 GPM / foot of drawdown. The theoretical drawdown at Q = 1,000 GPM would be 1,000/212.6 = 4.7 ft and at 2,000 GPM it would be twice that or 9.4 ft. Note that the well was only pumped at 356 GPM so in reality we do not know what the response would be to the higher pumping rates.


DUM-1 - PRETEST
Logger Deployment April 4, 2023 - April 6, 2023
Groundwater Elevation vs Time
Water Elevation (ft mlw)
1.30
1.20
1.10
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
Temperature (ºF)
83.47
83.46
83.45
83.44
83.43
4/4/23 9:36
4/4/23 14:24
4/4/23 19:12
4/5/23 0:00
4/5/23 4:48
4/5/23 9:36
4/5/23 14:24
4/5/23 19:12
4/6/23 0:00
4/6/23 4:48
4/6/23 9:36
Date/Time
Groundwater Elevation
Tide Elevation
Temperature



DUM-1 - 12 HR PUMP TEST
Logger Deployment April 6, 2023 FROM 07:00 to 19:45
Groundwater Elevation vs Time
Water Elevation (ft mlw)
Temperature (ºF)
Date/Time
Groundwater Elevation
Tide Elevation
Temperature
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
84
83
82
81
80
79
78
4/6/23 2:24
4/6/23 4:48
4/6/23 7:12
4/6/23 9:36
4/6/23 12:00
4/6/23 14:24
4/6/23 16:48
4/6/23 19:12
4/6/23 21:36

KECK


DUM-1 - POSTTEST
Logger Deployment April 6, 2023 - April 7, 2023
Groundwater Elevation vs Time
Water Elevation (ft mlw)
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
1.60
Temperature (ºF)
84
83
82
81
80
79
78
Date/Time
4/6/23 9:36
4/6/23 14:24
4/6/23 19:12
4/7/23 0:00
4/7/23 4:48
4/7/23 9:36
4/7/23 14:24
4/7/23 19:12
4/8/23 0:00
Groundwater Elevation
Tide Elevation
Temperature

Appendix C

Flood Risk Assessment

Flood Risk Assessment: Storm Surge

Grand Cayman Island

August 4, 2023

The Power of Commitment

Contents

Table index

Figure index

1. Introduction

1.1 Purpose

The purpose of this study is to estimate the flood elevations due to hurricane-induced storm surge for a proposed Integrated Solid Waste Management System (ISWMS) development in the Cayman Islands. This report summarizes the development and calibration of a coastal model that simulates storm surge elevations resulting from hurricane events that are based on three exposure categories outlined in the Terms of Reference (Wood, 2021).

1.2 Project Location

The ISWMS comprises approximately 30 acres and is located on the western coast of Grand Cayman highlighted by the orange boundary, north of George Town (Figure 1).

Figure 1 Project Vicinity Map

2. Model Setup

2.1 Introduction

The DHI MIKE software package was utilized to simulate the storm surge elevations, specifically an integrated hydrodynamic and wave model. The process involved the setup and calibration of the model using publicly available, high water mark elevations generated by Hurricane Ivan (FEMA, 2005). The model inputs, modelling tools, and model outputs are described in the flow chart provided in Figure 2.

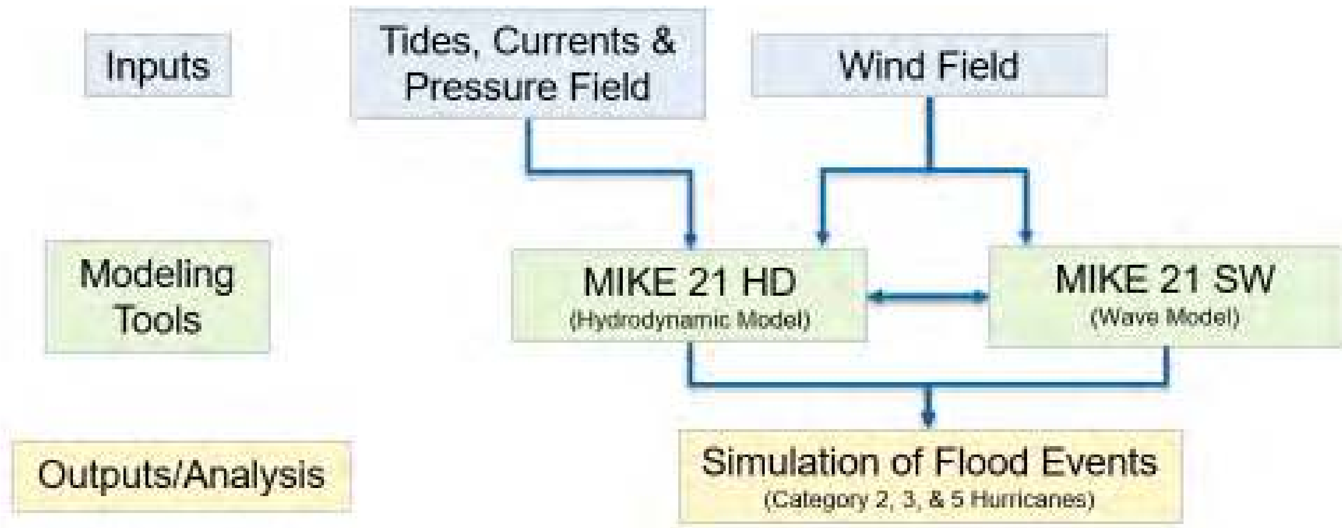


Figure 2 Modelling Flow Chart

2.2 Modelling Framework

The first step in the model setup was to develop a framework that ensures consistency throughout the project's lifetime. The modelling framework considers parameters such as the extent of the project area, type of software used, knowledge of local bathymetry, topography, hydrodynamic and wave climates, and availability of measured data sets required to both drive the model and validate its results. Table 1 provides a summary of the overall modelling framework used for the hydrodynamic and wave model calibration.

Table 1 Modelling Framework

Item	Detail
Model Datums	Horizontal Datum: Lat/Long, WGS84 Vertical Datum: MSL
Model	MIKE 21 HD, MIKE 21 SW, MIKE 21 Cyclone Wind Generator
Calibration Data	Hurricane Ivan High Water Mark Elevations (FEMA, 2005) Hurricane Ivan Best Track Data (NOAA, 2021)
Model Domain	Base Mesh: North Carolina v6c ADCIRC (ADCIRC, 2021) Offshore Boundary: 60° W Longitude Land Boundary: North & South America
Model Geometry	The mesh resolution is finest along the shoreline of interest (Grand Cayman). In general, the mesh resolution is as follows: – Grand Cayman Shoreline: 1 km

Item	Detail
	– Gulf of Mexico & Caribbean Sea: 30 – 35 km – Atlantic Ocean: 80 km
Hurricane Data	The model simulates three synthetic hurricane events based on the exposure categories outlined in the ToR (Wood, 2021) using the following parameters. – Best Track Data – Hurricane Ivan (NOAA, 2021) – Radius to Maximum Winds – Hurricane Ivan (NOAA, 2021) – Maximum Wind Speed – Saffir Simpson Scale • Category 2 (110 mph) • Category 3 (129 mph) • Category 5 (157 mph) – Central Pressure – Saffir Simpson Scale • Category 2 (965 millibars) • Category 3 (945 millibars) • Category 5 (919 millibars)
Elevation Data	Offshore: Bathymetry from ADCIRC mesh Grand Cayman: MERIT DEM (Yamazaki et al, 2018)

2.3 Model Input Parameters

2.3.1 Model Domain

GHD's model domain and mesh was developed using a previously validated ADCIRC model mesh (ADCIRC, 2021). The mesh extends over the North Atlantic from the coast of North and South America up to the 60° W parallel and comprises 58,369 elements and 31,435 nodes and is used by the United States (US) Department of Homeland Security to forecast storm surge ahead of hurricane events and by the US Federal Emergency Management Agency (FEMA) to update the National Flood Insurance Program coastal inundation maps. This mesh was further refined in the area of interest surrounding Grand Cayman Island and the ISWMS project site. The final mesh comprises 60,087 elements and 32,351 nodes with mesh resolutions as fine as 1 km along the Grand Cayman shoreline (Figure 3).

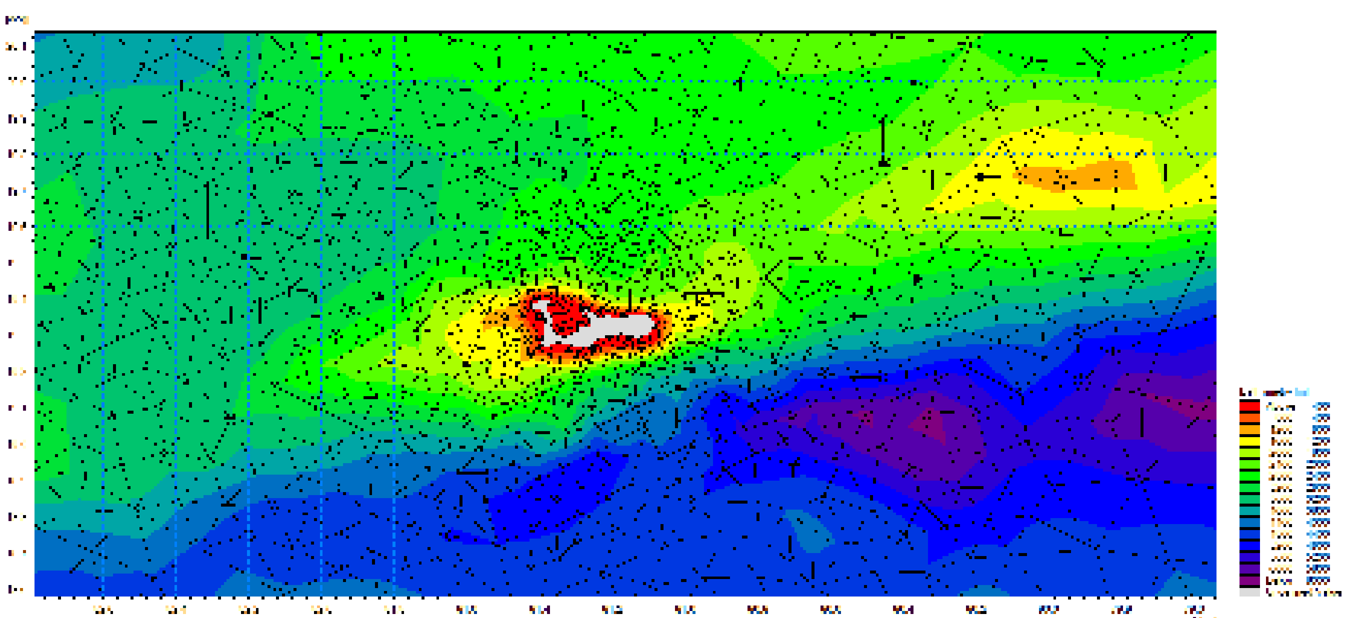


Figure 3 Mesh Refinement and Incorporation of Grand Cayman

2.3.2 Boundary Conditions

The coupled MIKE 21 HD and SW model was forced at a single offshore boundary using a 0.125° x 0.125° resolution global tide model with 8 tidal constituents. Space and time-varying hurricane wind and pressure fields obtained from the MIKE 21 Cyclone Toolbox were used as forcing across the domain. These two model boundaries are listed in the bullets below and depicted spatially in Figure 4.

1. Water surface elevations are used to drive the model's offshore, eastern boundary. The tidal information is based on DHI's global tide model which is available at a resolution of 0.125° (~8.6 miles). The tidal conditions include contributions from 4 semidiurnal constituents (M2,S2,K2,N2) and 4 diurnal constituents (K1, O1, P1, Q1).

- Wind and pressure fields generated from the MIKE 21 Cyclone Toolbox for the scenarios depicted in Table 2.

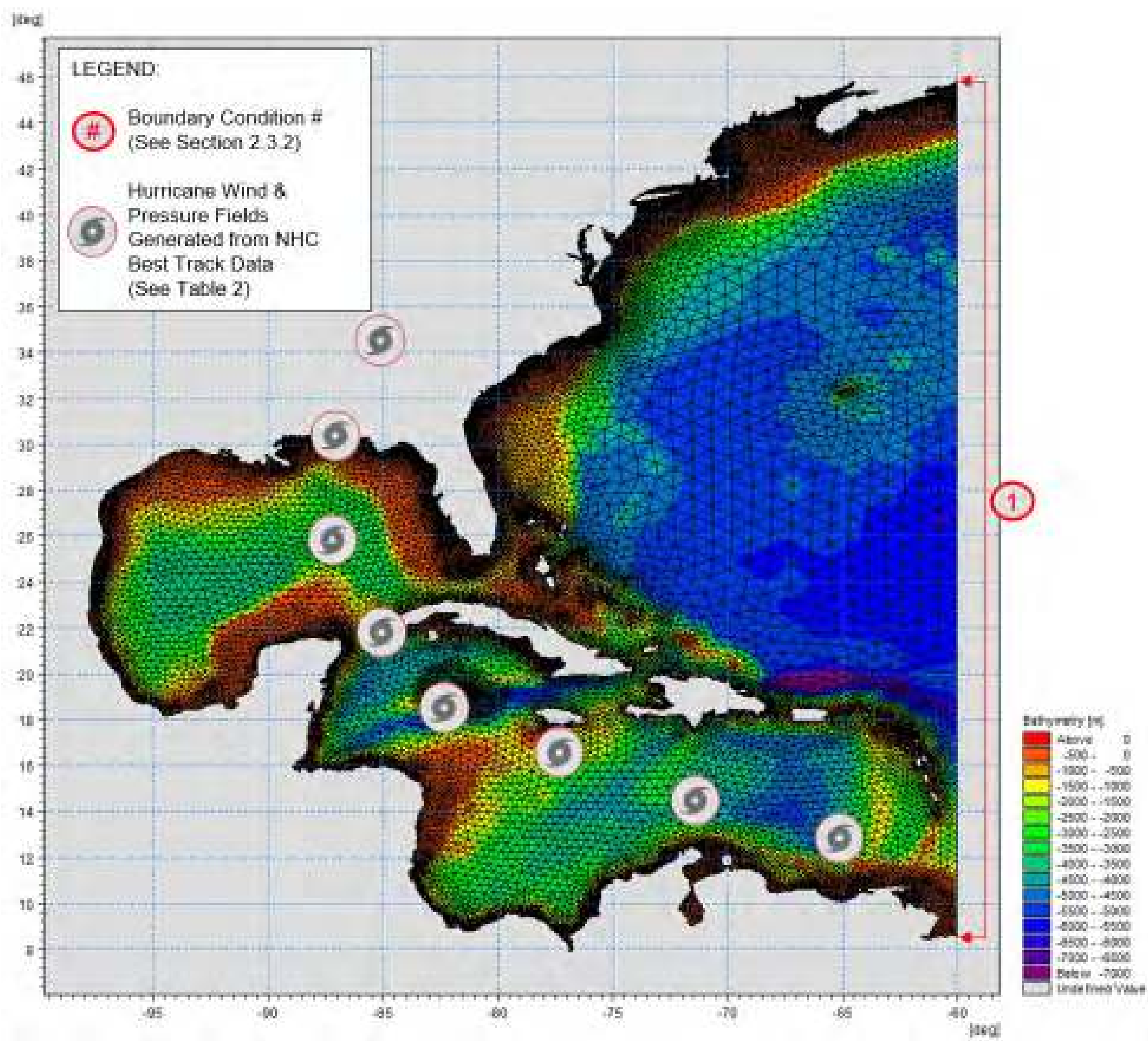


Figure 4 ***Model Domain & Boundary Condition Schematic***

2.3.3 Forcing Conditions

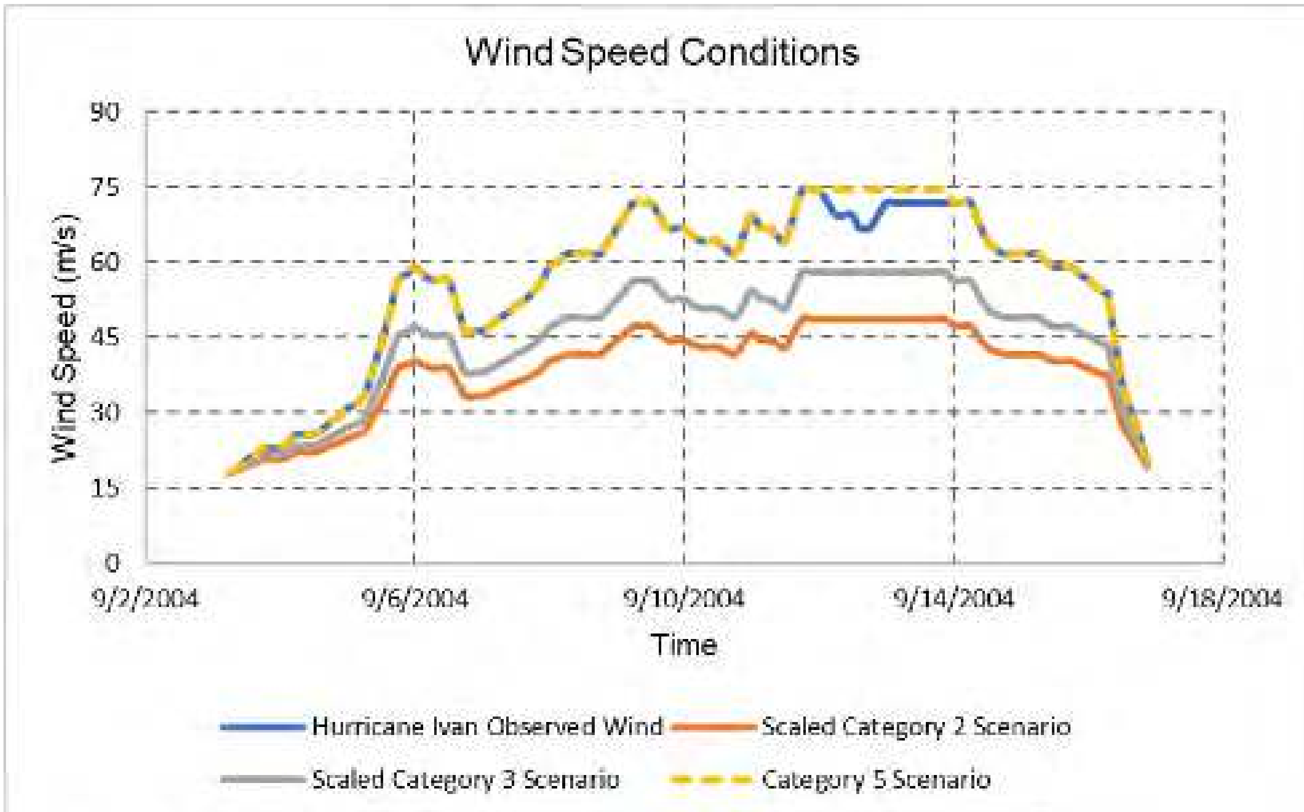
For the purposes of model calibration and the evaluation of shifting the track of Ivan to the north of Grand Cayman (runs 1 and 2 respectively), the native wind and pressure conditions of Hurricane Ivan obtained from observational data were used as input to the parametric cyclone model. In the cases of the Category 2 and 3 scenarios (runs 3 and 4 respectively), scaling of the wind and pressure timeseries is necessary. In these instances, the maximum wind speed and minimum central pressure based on the Saffir-Simpson scale (Table 3) was used as the storm passed Grand Cayman to provide the most conservative conditions for a storm of that Category. For the Category 5 scenario, the maximum observed wind speed and minimum observed central pressure was specified as a constant value while the storm is passing the island of Grand Cayman. A timeseries of wind speed and central pressure for all scenarios is displayed in Figure 5.

Table 2 Hurricane Model Parameters by Scenario

Run #	Description	Parametric Model	Best Track & Ground Speed	Wind Speed (mph)	Central Pressure (millibars)	Wind Friction
1	Calibration	Holland, Single Vortex	Hurricane Ivan (NOAA, 2021)	Varies, up to 167 mph	Varies, down to 910 mb	Linear Variation from 0.00125 – 0.0025
2	Track shifted north of Grand Cayman	Holland, Single Vortex	Hurricane Ivan (NOAA, 2021). Track shifted 1° to the north	Varies, up to 167 mph	Varies, down to 910 mb	Linear Variation from 0.00125 – 0.0025
3	Category 2 Hurricane	Holland, Single Vortex	Hurricane Ivan (NOAA, 2021)	Scaled to a maximum 110 mph	Scaled to a minimum 965 mb	Linear Variation from 0.00125 – 0.0025
4	Category 3 Hurricane	Holland, Single Vortex	Hurricane Ivan (NOAA, 2021)	Scaled to a maximum 129 mph	Scaled to a minimum 945 mb	Linear Variation from 0.00125 – 0.0025
5	Category 5 Hurricane	Holland, Single Vortex	Hurricane Ivan (NOAA, 2021)	Varies, up to 167 mph	Varies, down to 910 mb	Linear Variation from 0.00125 – 0.0025

Table 3 Saffir-Simpson Hurricane Scale

Saffir-Simpson Category	Maximum Sustained Wind Speed			Minimum Central Pressure (mb)
	(mph)	(m/s)	(kt)	
1	74-95	33-42	64-82	> 980
2	96-110	43-49	83-95	979-965
3	111-130	50-58	96-113	964-945
4	131-155	59-69	114-135	944-920
5	156+	70+	136+	< 920



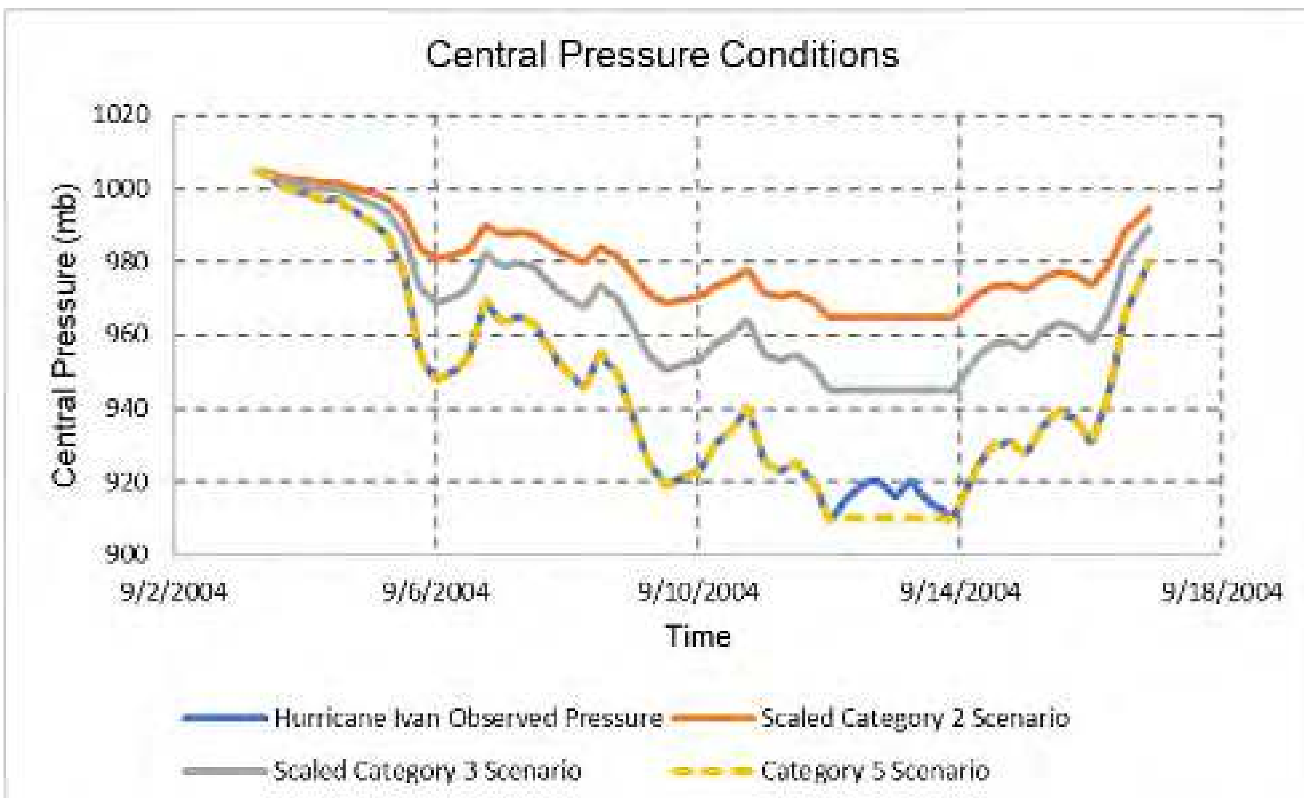


Figure 5 Wind Speed and Central Pressure Conditions

3. Model Calibration

Verification of a model is a multi-step process of model adjustments, or calibrations, and comparison of modelled parameters versus measurements or previously validated model results. For this model, storm surge calibration and validation were evaluated through visual comparison of the model outputs to the measured and predicted data along with quantitative comparisons. This was performed using:

- Plan view maps comparing the modelled storm tide to a visual output from a NOAA SLOSH model (Figure 7).
- Plan view maps comparing the modelled storm tide to a previously validated ADCIRC model (Figure 8).
- Comparison of modelled storm tide to measured high water marks (HWM) surveyed by FEMA.
- Comparison of modelled storm tide to a BSRC storm surge model for Hurricane Ivan performed by the Florida Department of Environmental Protection (FDEP).

3.1 Calibration Data and Parameters

The model calibration was performed by simulating the storm surge generated by Hurricane Ivan, which formed on September 4, 2004, reached Grand Cayman as a Category 4 hurricane on September 12, 2004 and made landfall in the United States near Mobile, Alabama as a Category 3 hurricane on September 16, 2004.

The radius to maximum winds (RMW) is a parameter required by the parametric model to generate a realistic hurricane structure that captures the wind field extent and distribution of the simulated storm. Generally accepted estimates for the RMW are based on distance to the 50-kt wind speed contour. The published range for the RMW varies from $0.15R_{50}$ to $0.35R_{50}$ (Takagi and Wu, 2016). The calibrated value utilized in the current modelling is the median value of $0.23R_{50}$ which corresponds to a radius of approximately 29 miles at time of landfall near Mobile, AL. This corresponds well with a RMW of 28 miles reported by (Stewart, 2005) which is used as the basis of a storm tide model of Hurricane Ivan presented in (FDEP, 2005).

A calibration of wind friction was necessary to capture the wind induced setup along the coastal areas where landfall occurred. A linear variation of wind friction based on the wind speed was found to be the most appropriate. Values ranged from 0.00125 for wind speeds of 7 m/s and below to a maximum value of 0.0025 in areas where the wind speeds exceeded 25 m/s. These values agree well with the results of field and laboratory tests presented in Figure 6 (Curcuc and Haus, 2020). Finally, local refinement of the shoreline bathymetry based on NOAA navigational charts near the landfall area were implemented to capture the peak surges observed along the seaside shoreline (NOAA, 2021a).

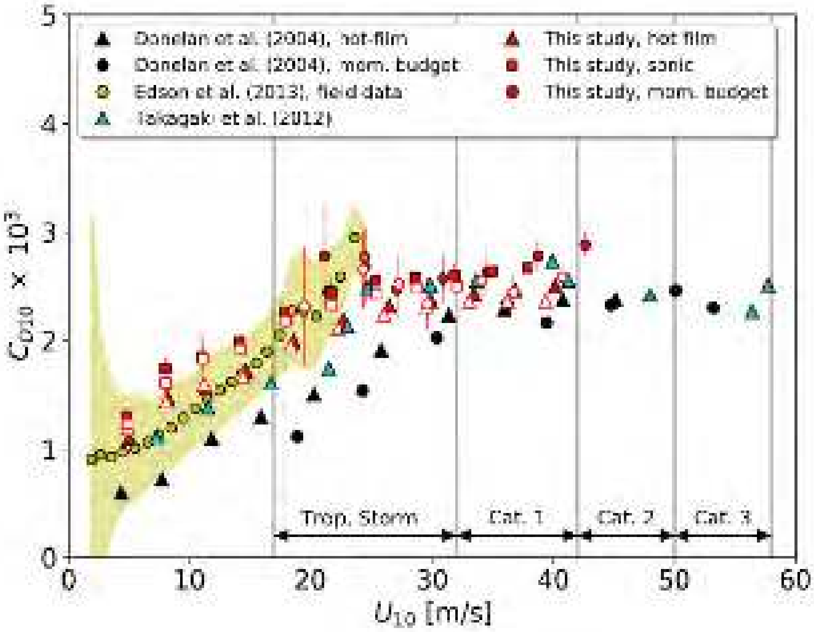


Figure 6 *Field and Laboratory Reported Wind Drag Coefficient Values*

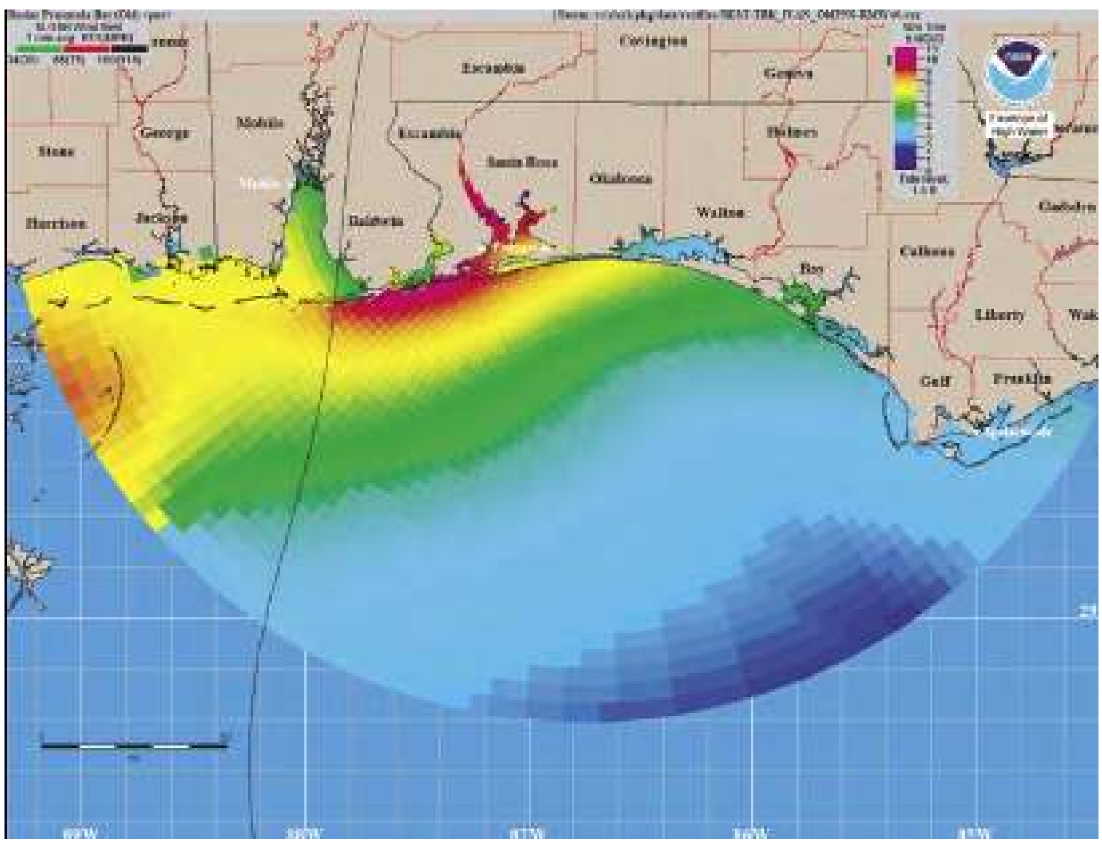


Figure 7 *Hurricane Ivan Envelope of High Water Calculated by NOAA SLOSH Model (ft, NGVD) (FEMA, 2005)*

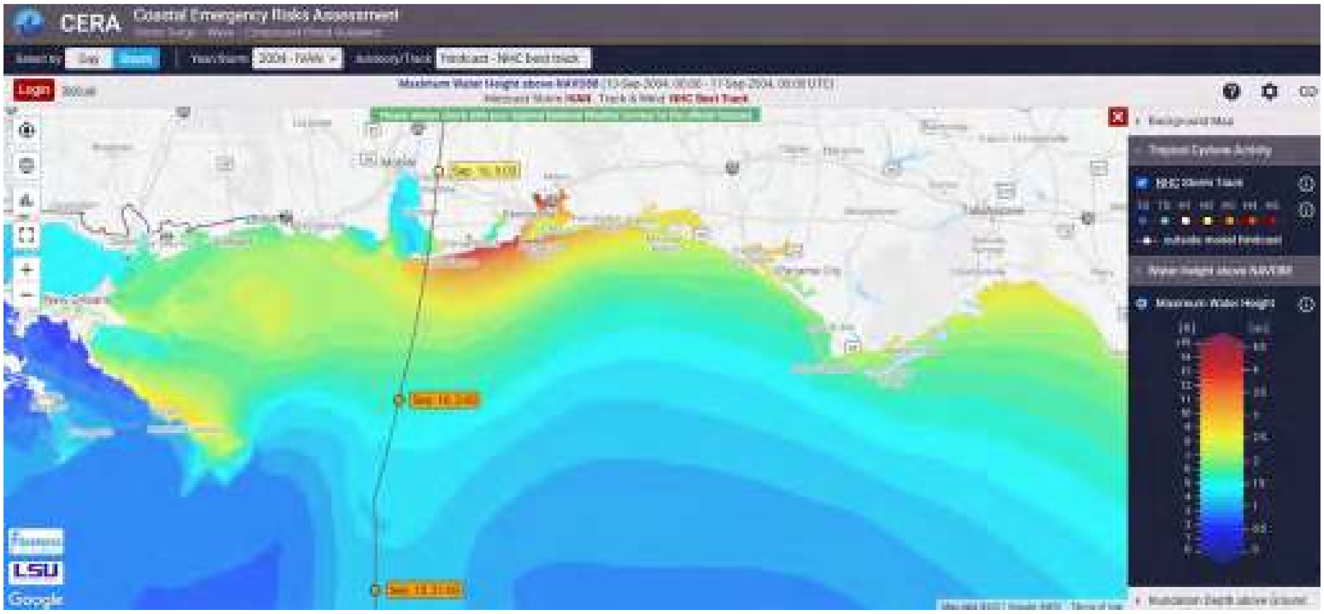


Figure 8 *Hurricane Ivan Maximum Water Elevations (ft, NAVD-88) from ADCIRC Model (CERA, 2021)*

3.2 Surge Elevations

The maximum simulated storm surge occurs just east of Hurricane Ivan's track local to the Gulf Shores area. Figure 8 displays the maximum modelled water surface elevations from Harrison County in Mississippi to the eastern border of Jefferson county in the Florida panhandle for purposes of comparison to the NOAA SLOSH and ADCIRC models on Figure 7 and Figure 8, respectively. The model accurately reproduces the effect of the pressure setup along the storm's path and the subsequent structure of the surge along the coastline with some of the highest surge values occurring in the Gulf Shores area and along Pensacola beach. The Pensacola and Perdido back bay area's exhibit similar tendencies to both the SLOSH and ADCIRC models with the highest water surface elevations occurring at the limits of the bay areas. The maximum simulated surge values agree well with the results from the ADCIRC model on the order of ~13-15 ft over the National Geodetic Vertical Datum of 1929 (NGVD). The maximum reported water surface elevation from the NOAA SLOSH model is lower at ~11 ft, NGVD. The SLOSH model takes into account the effect of atmospheric pressure, size, track, and speed of the storm system but does not explicitly resolve or account for wave induced setup (NOAA. 2021c). This can contribute to the lower surge elevations displayed on Figure 7. The modelled storm surge is reported in feet over NGVD for the purpose of comparison to Figure 7 and survey data presented in Table 4. The difference between NGVD and MSL within the area shown on Figure 9 is ~0.5ft on average (NOAA, 2021d).

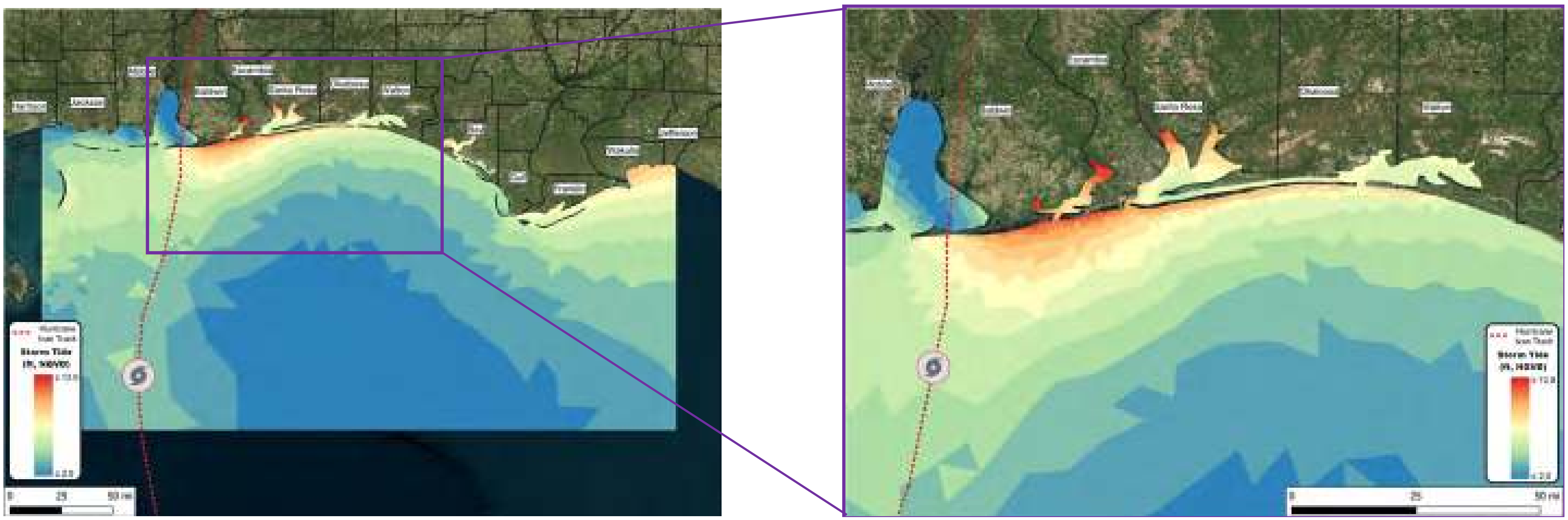


Figure 9 Maximum Simulated Storm Surge Along the Alabama-Florida Coastline (ft, NGVD)

Figure 10 FEMA Surveyed HWM locations

Table 4 Comparison of surveyed HWM locations throughout coastal Alabama and Florida

Location	Latitude	Longitude	Surveyed HWM (ft, NGVD)	BSRC Storm Tide (ft, NGVD)	Modelled Storm Tide (ft, NGVD)
Gulf Beach-1	30.29473	-87.45055	11.4	14.1	12.3
Gulf Beach-2	30.30118	-87.42695	12.5	-	12.2
Ft. McRee-1	30.345	-87.28972	9.7	11.8	9.4
Ft. McRee-2	30.34542	-87.26775	13.6	-	8.3
Pensacola Bay-1	30.39822	-87.24213	11.8	10.6	8.1
Pensacola Bay-2	30.40513	-87.21600	10.8	-	7.5
Pensacola Beach-1	30.3267	-87.17358	12.2	11.8	10.6
Pensacola Beach-2	30.33003	-87.15951	9.5	-	10.2
Pensacola Beach-3	30.33601	-87.11674	12.1	-	10.7
Pensacola Beach-4	30.3398	-87.09635	12.4	-	10.4
Pensacola Beach-5	30.34508	-87.07961	10.1	-	10.3
Gulf Breeze	30.35222	-87.15639	10.3	9.5	5.8
Navarre Beach-1	30.37305	-86.91335	10.4	10.0	9.6
Navarre Beach-2	30.38216	-86.87036	9.6	-	6.6
Navarre Beach-3	30.37946	-86.86830	11.6	-	9.6
Ft. Walton Beach-1**	30.39736	-86.63113	13.8	8.8	9.0
Ft. Walton Beach-2	30.39825	-86.62328	8.5	-	9.1
Destin-1	30.38291	-86.50265	10.7	8.1	8.1

Location	Latitude	Longitude	Surveyed HWM (ft, NGVD)	BSRC Storm Tide (ft, NGVD)	Modelled Storm Tide (ft, NGVD)
Destin-2	30.38427	-86.49094	9.1	-	8.3
Destin-3**	30.38423	-86.47846	13.4	-	8.5
Destin-4	30.37097	-86.33866	10.2	-	8.3

*hyphen denotes no value calculated by the BSRC model given at this location

**Surveyed HWM displays survey error (FDEP, 2005)

The modelled storm surge elevations agree well with both the observed HWM and BSRC modelled storm tide elevations along the US coastline impacted by the landfall of Hurricane Ivan. Modelled storm tide elevations from both the current modelling and BSRC reported values were generally less than the HWM survey data. This is prominent at locations Ft. Walton Beach-1 and Destin-3 where the survey data displays error (FDEP, 2005). The model underestimates the maximum surges in the back bay and lagoon side of Pensacola which can largely be attributed to the coarse bathymetric resolution of the mesh in those areas. Due to the location of the project area being situated on Grand Cayman, which is a highly exposed Caribbean Island, surges will not have to be resolved through complex coastal inlets and extensive back bay areas. For these reasons the model's performance is acceptable.

4. Results

The coastal flood elevations (storm surge + wave setup) are presented in the following section. Each scenario is generated based on the parameters and descriptions presented in Table 2. The results are presented by figures of the spatial distribution of the maximum water surface elevations experienced under the conditions of each scenario. The elevations are referenced to meters above local mean sea level (LMSL).

4.1 Track Comparison

Prior to the execution of the Category 2, 3, and 5 scenarios, a comparison of surges resulting from storm path variability was conducted. In the case of Run 2 (Table 2), the best track data of hurricane Ivan was shifted north by 1° of latitude along its entire extent to compare the surges produced by the actual trajectory of Hurricane Ivan which passed to the south of Grand Cayman versus the same storm passing to the north. Figure 11 displays the storm's best track path (red) and the offset track (pink) with Grand Cayman Island positioned in the middle.

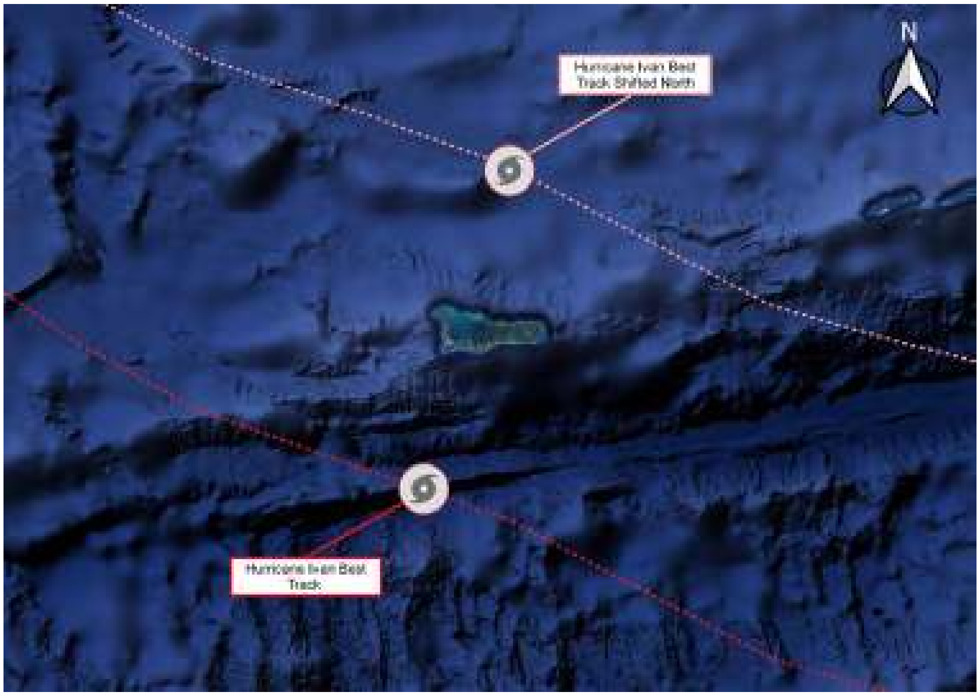


Figure 11 ***Best Track Comparison***

The computed surges resulting from the two paths were compared to determine which case is more severe along the Grand Cayman shoreline adjacent to the ISWMS Development Site. It was found that the actual best track results in higher storm surge elevations at the site. The counter clockwise (CCW) rotation of the storm coupled with Grand Cayman being positioned in the right-hand sector of the storm exposes the island to higher wind velocities attributed to the southeast-northwest movement of the storm. The actual best track was used in the scenarios described in the following sections.

4.2 Category 2 Scenario

Maximum water surface elevations resulting from category 2 conditions generally range from 0.2 to 0.4m (1.3 - 2 ft) around the northern and western portions of Grand Cayman with slightly larger surges experienced around the south-eastern portion of the island. The most severe surge occurs in the north bay area with elevations peaking at 1.8m (5.9 ft) (Figure 12).

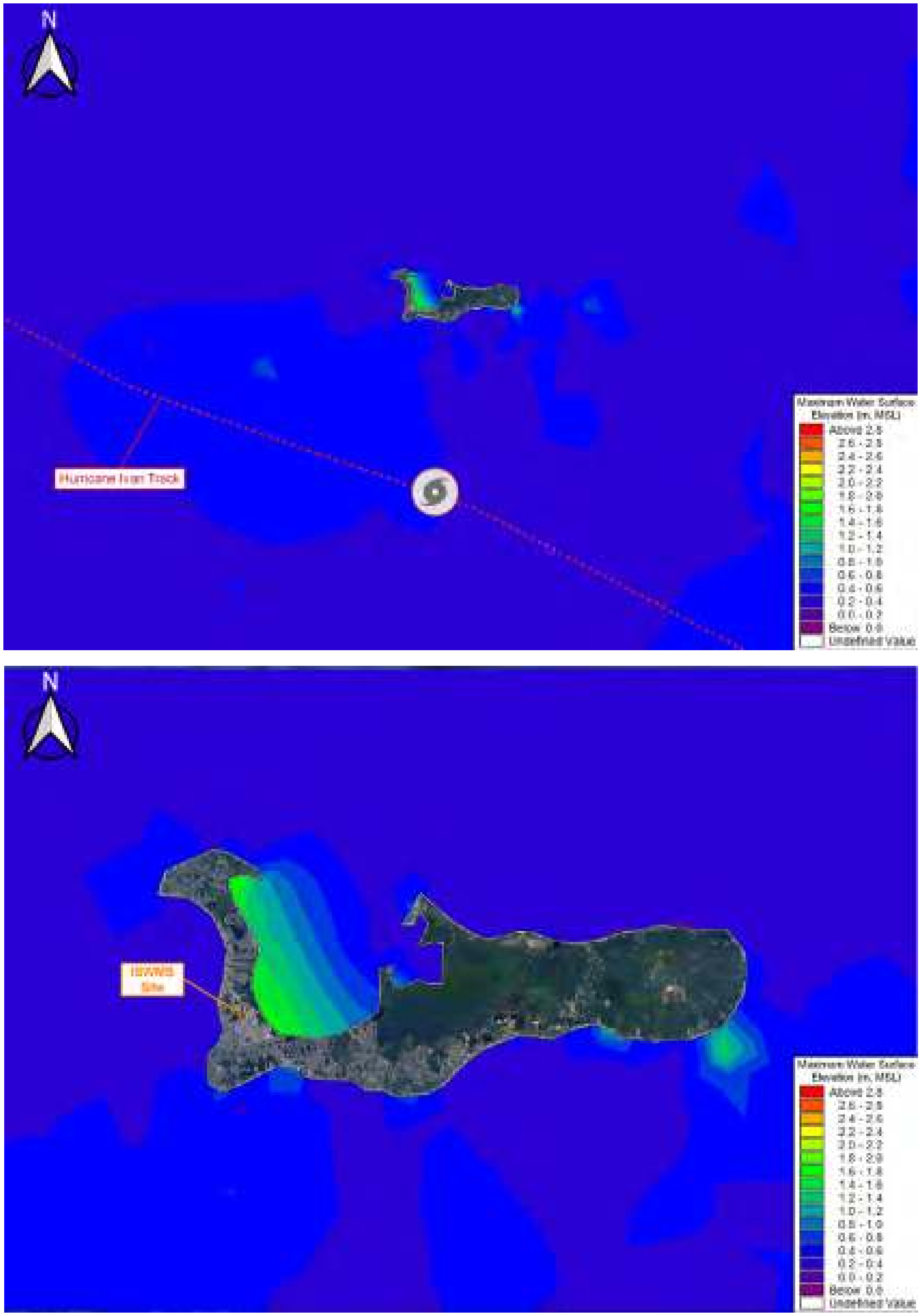


Figure 12 ***Far field (top) and near field (bottom) maximum water surface elevations under Category 2 conditions***

4.3 Category 3 Scenario

Similar water level tendencies are observed under category 3 conditions with the western and northern portions of Grand Cayman experiencing the least intense storm surges generally varying between 0.2 – 0.4m (1.3 - 2 ft). The northern bay is subject to similar maximum water levels that peak around 1.8m (5.9 ft) across the majority of the western interior bay shoreline (Figure 13).

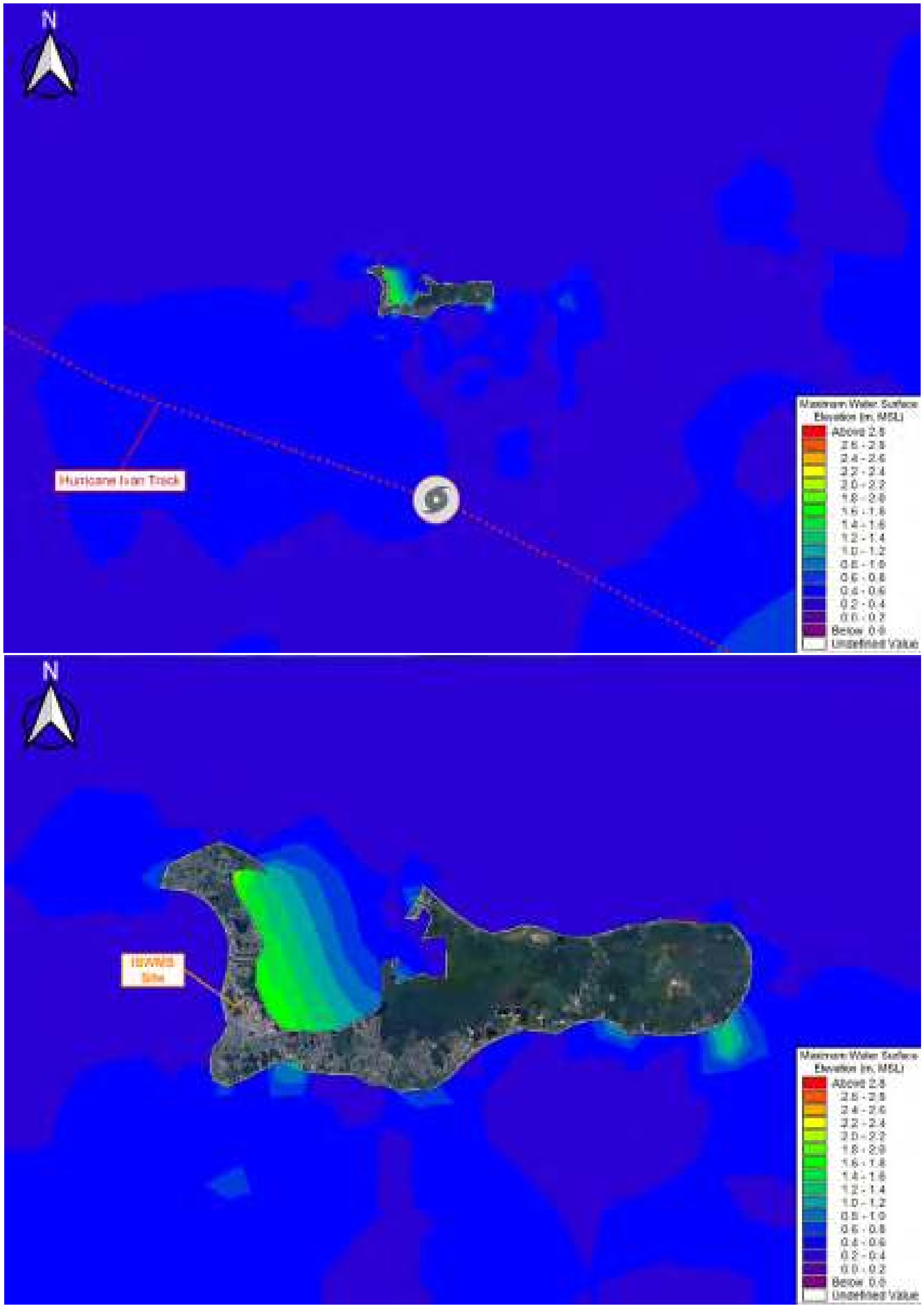


Figure 13 ***Far field (top) and near field (bottom) maximum water surface elevations under Category 3 conditions***

4.4 Category 5 Scenario

The effects of pressure induced setup are highly distinguishable under category 5 forcing conditions (Figure 14). Wind and breaking wave setup increase the surge to between 0.4 -0.6m (1.3 - 2 ft) along much of Grand Cayman's western, southern, and eastern shorelines. The storm surge experienced in the north bay reaches a maximum of approximately 2.8m (9.2 ft) which agrees well with reported surges between 8-10ft in this area (ECLAC, 2004)

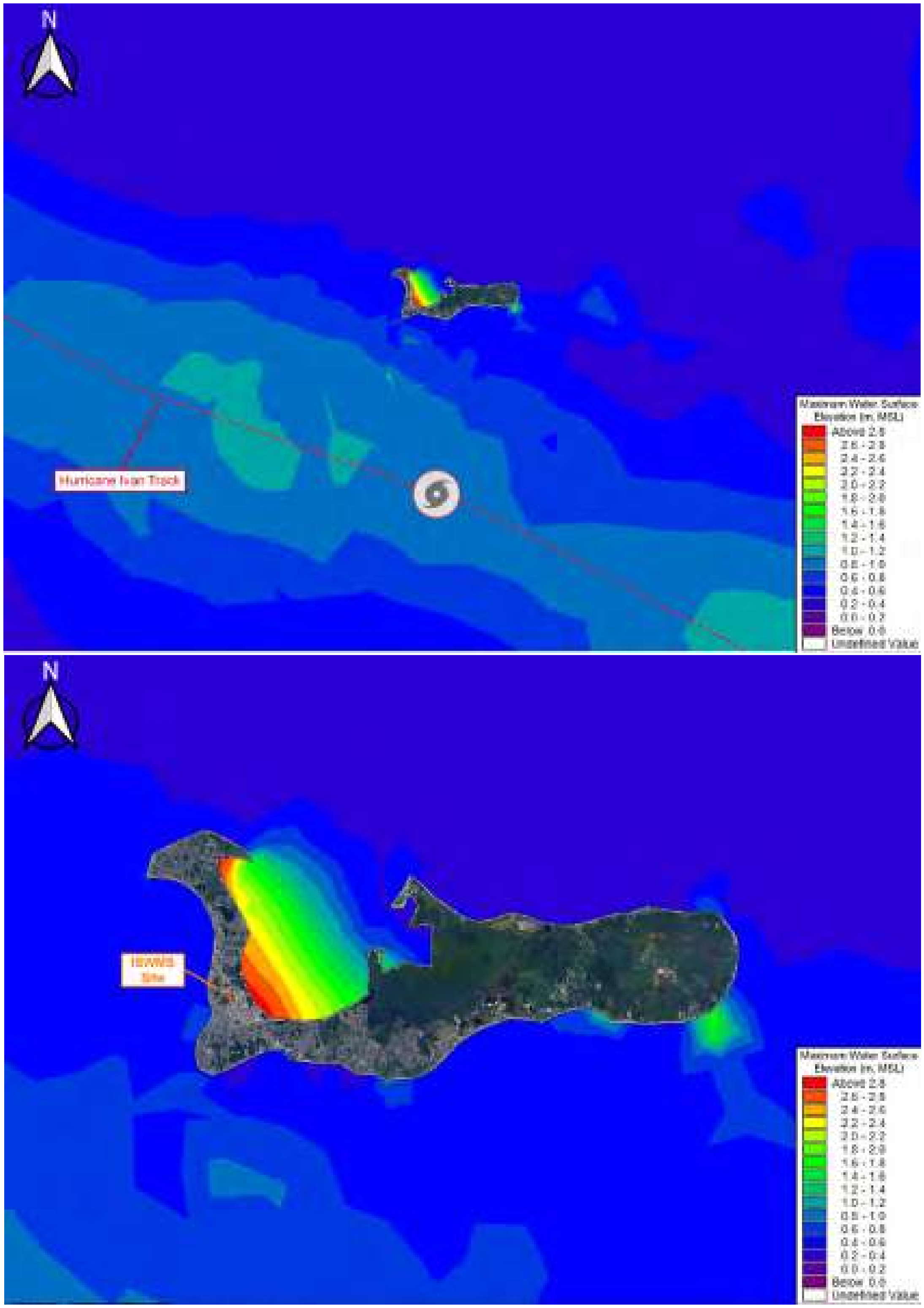


Figure 14 *Far field (top) and near field (bottom) maximum water surface elevations under Category 5 conditions*

5. Conclusions

Hurricane Ivan was selected for use in the current modelling due to its proximity to Grand Cayman, the island on which the proposed ISWMS site is located, and it is categorized as one of the most powerful storms to impact the Caribbean, and Grand Cayman in particular, in recent years (ECLAC, 2004). A summary of maximum coastal storm surge per scenario is listed in Table 5 below:

Table 5 Maximum Storm Surge Adjacent to ISWMS

Scenario	Maximum Surge Adjacent to ISWMS site (m, MSL)	General Location of Occurrence
Category 2	1.7 (5.6 ft)	Western side of North Bay
Category 3	1.8 (5.9 ft)	Western side of North Bay
Category 5	2.9 (9.5 ft)	Western side of North Bay

The results of this study indicate the following:

– The most severe storm surge conditions due to wind, pressure, and wave setup occur in the interior of the north bay. This corresponds with previous coastal storm modelling efforts that attribute much of the coastal flooding in the north bay area to the wave setup and CCW wind structure of the passing storm (Baird, 2015).
– Water surface elevations under category 2 and 3 conditions are similar in distribution and peak values (~1.7-1.8 m)
– Category 5 conditions produce the largest surges around the island peaking at 2.9 m within the North Bay.
– The generally steep bathymetric geometry surrounding much of Grand Cayman contributes to lessening the severity of the surges experienced on the shoreline
– Maximum water levels varied from approximately 0.2 to 0.8 m in the worst case along the open shorelines of the island
– The North Bay area of Grand Cayman is suspectable to significant surge effects due to its shallow bathymetry and semi-enclosed geometry
– It is worth noting that compound flood effects such as coastal storm surge combined with extreme rainfall can exacerbate flooding. This is relevant in the case of Hurricane Ivan where records indicate that Ivan dumped between 15-18 inches of rainfall over the course of hours as the storm passed (GeoSY Ltd, 2004)
– It may be desirable in future work(s) to consider the effect of extreme rainfall associated with storm events in a coupled coastal hydrodynamic-precipitation model to obtain a comprehensive view of compound flooding on Grand Cayman
– The location of the ISWMS site exposes it to coastal flood inundation coming from the north bay to the east if a storm similar to Ivan were to occur. Generally, a storm surge event that tends to produce higher water surface elevations on the eastern side of the bay may be more threatening to the ISWMS.

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The Power of Commitment

Appendix D

Geological Report – Carbex Geological Services (2023)

GEOLOGICAL ATTRIBUTES OF THE REGEN SITE, GRAND CAYMAN

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March 29, 2023

SUMMARY

This report details the subsurface geology of the ReGen site that is located on the western part of Grand Cayman close to the George Town Landfill that is situated near George Town. The geology of this area is assessed baed on three wells (DUM-1, DUM-2, DUM-3) that were drilled to various depths and comparison with available information from other wells in the surrounding area. The following points encapsulate the main aspects of this area.

- Wells DUM-1, DUM-2, and DUM-3, were drilled to depths of 407.25 ft, 207,5 ft, and 146,5 ft, respectively.
- 10 ft long cores were obtained for virtually the entire sequences in DUM-1 (15 cores) and DUM-3 (14 cores), and the deeper part of well DUM-1 (5 cores). Chip samples, collected over 5 ft intervals, were obtained from the strata between the cored intervals.
- Downhole video provided continuous images of the walls of each well and highlighted the presence of fractures and cavities. It should be noted, however, that cloudy water conditions in some parts of the wells obscured some of the finer details.
- Porosity and permeability values were obtained for twenty-five samples from various parts of the succession in each well.
- Wells DUM-1, DUM-2, and DUM-3 penetrated, from youngest to oldest, the Ironshore Formation, Pedro Castle Formation, Cayman Formation, and Brac Formation. No samples were collected from the Ironshore Formation because the constituent rocks are extremely friable and disintegrated during drilled.
- The Pedro Castle Formation is formed of dolostone and some limestone, the Cayman Formation is formed entirely of dolostone, whereas the Brac Formation is formed of limestone and dolostone. Fossils (mainly, corals and bivalves) are common throughout the succession. Those organisms that originally had aragonitic skeletons are now represented by fossil-moldic porosity.
- The successions in wells DUM-1, DUM-2, and DUM-3 are similar to the successions found in the surrounding area, including those around the nearby sewerage works, and wells to the south and north of the ReGen site.
- A cave was encountered in well DUM-1 at a depth of 108 to 114 ft.
- Porosity in the limestones and dolostones of the Pedro Castle Formation, Cayman Formation, and Brac Formation includes intercrystalline pores, fossil-moldic porosity, fractures, and caves/cavities of various sizes. Tested porosity values for 25 samples from all formations ranges from 10.1 to 39.7%. The range of porosity values is similar for all three formations.
- Vertical fractures are common in some parts of the succession (e.g., between 350 an 404 ft in DUM-1).
- Permeability in the limestones and dolostones of the succession in wells DUM-1, DUM-2, and DUM-3 are highly variable. Although the Kmax values are generally low, some samples are characterized by high Kmax values.

- Based on the data from the 25 tested samples from DUM-1, DIM-2, and DUM-3, there is no correlation between the porosity and permeability (Kmax), irrespective of the formation or position of the samples in each formation.
- The porosity and permeability patterns DUM-1, DUM-2, and DUM-3 are similar to those found in other wells from the surrounding area, including those around the nearby sewerage works, and wells to the south and north of the ReGen site. Such comparisons also show the geographic and stratigraphic variability in porosity and permeability patterns, at all scales, in this area.

INTRODUCTION

This report focuses on the geological succession found in subsurface of the ReGen site, which is located near the George Town Landfill (GTLF) situated just north of George Town (Fig. 1). Three wells were drilled to assess the subsurface geology of the area relative to the well-established stratigraphic succession of the Cayman Islands (Fig. 2).

Figure 1. Southwest corner of Grand Cayman showing location of drilling site (DUM), area to north and east (white box) where numerous wells have been drilled, and wells GTH-1 and GET-1.

STRATIGRAPHY

The stratigraphic succession in the upper 500 ft of strata on the Cayman Islands is divided, from oldest to youngest, into the Brac Formation, Cayman Formation, Pedro Castle Formation, and Ironshore Formation (Figs. 2, 3). Full descriptions of each formation can be found in Jones (2022). The main characteristics of each formation are as follows.

Brac Formation: This formation is poorly known on Grand Cayman because it is not exposed at the surface and has only been found in some of the deeper wells (e.g., LV#2, SHT#4). On Cayman Brac, it is exposed in the cliff faces on the east end of the island where it includes various types of limestones and dolostones. Available information indicates that it is probably Upper Oligocene in age.

Cayman Formation: This formation, widely exposed on Cayman Brac and Grand Cayman, is formed mostly of dolostones that contain a rich, diverse biota that includes corals, bivalves, and gastropods. In the central eastern part of Grand Cayman, the formation includes limestones, but these have only been found in some of the deeper wells.

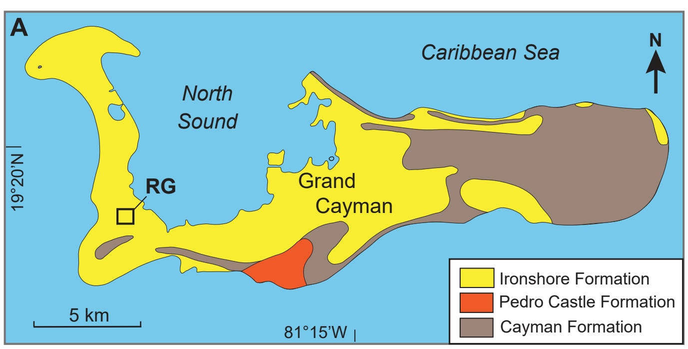


Figure 2. Map showing surface distribution of the Cayman Formation, Pedro Castle Formation, and Ironshore Formation on Gr and Cayman (modified from Jones, 1994, his Fig. 2.3A). RG indicates location of the ReGen site.

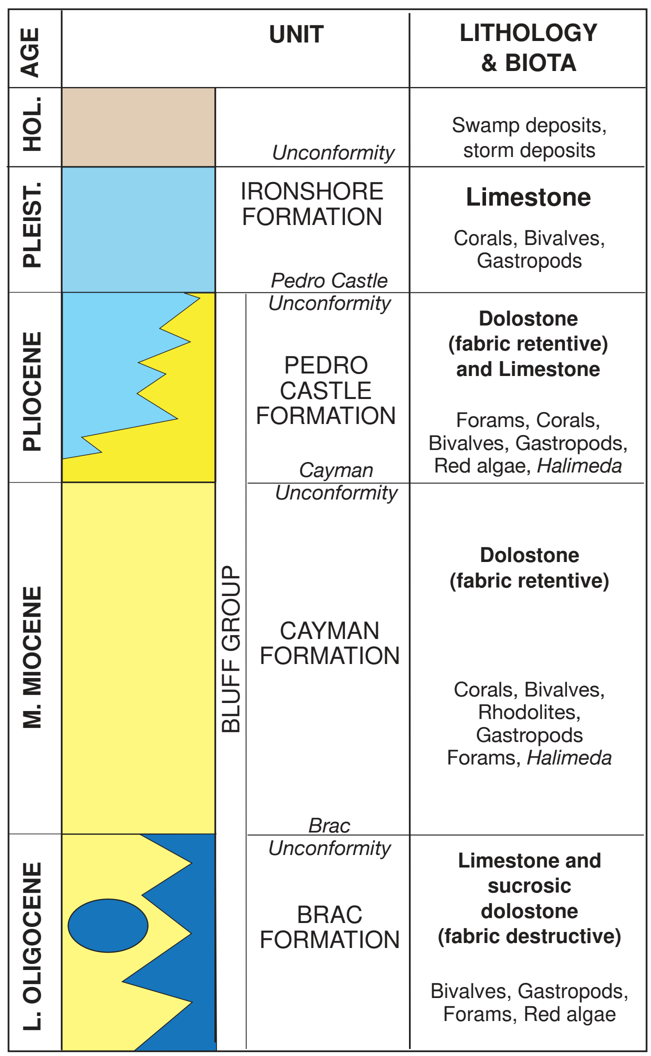


Figure 3. Stratigraphy of the Cayman Islands (modified from Jones, 1994, his Fig. 2.4).

Pedro Castle Formation: This formation, exposed on the east end of Cayman Brac, the area around Pedro Castle on Grand Cayman, and possibly some in some scattered outcrops on Little Cayman, is formed of variable amounts of limestone and dolostone that commonly contain diverse faunas of corals, bivalves, and gastropods.

Ironshore Formation: This formation, widely exposed on each of the Cayman Islands, is formed of friable limestones that typically contain numerous, well-preserved corals, bivalves, and gastropods. It is generally impossible to obtain cores from this formation.

Recognition of Critical Stratigraphic Boundaries

The four formation in the upper 500 feet of strata on the western part of Grand Cayman (Fig. 3) are separated from each other by unconformities that are characterized by high relief topographies that developed when the island was exposed to weathering during periods of sea-level lowstands. For convenience, these unconformities are referred to as the Brac Unconformity, Cayman Unconformity, and Pedro Castle Unconformity (Fig. 3). The upper boundary of the Ironshore Formation is either buried beneath modern peat deposits or exposed at the surface. Some of these unconformities are well known because they are exposed at the surface (e.g., Cayman Unconformity – exposed in Pedro Castle quarry) and/or have been documented from many wells. In contrast the Brac Unconformity on Grand Cayman is poorly understood because it has only been found in a few of the deeper wells.

The summary information in Figure 4 shows the topographies of the unconformities on an island-wide scale. It is important to note, however, that local variations in the elevations on the these unconformities are also common, but impossible to depict at the scale used in Figure 4.

Pedro Castle Unconformity

This unconformity, which separates the Pedro Castle Formation from the underlying Cayman Formation is easy to identify during drilling by the significant change in drilling rate from the poorly lithified limestones of the Ironshore Formation to the harder, better lithified limestones of the Pedro Castle Formation. On the western part of Grand Cayman it is generally impossible to obtain cores from the Ironshore Formation, whereas cores can be produced from the Pedro Castle Formation.

Cayman Unconformity

This unconformity, well-exposed in the south wall of Pedro Castle quarry, is characterized by a rugged topography with at least 100 feet of relief on it across Grand Cayman. On the western part of the island, the transition from the Pedro Castle Formation to the underlying Cayman Formation is typically marked by (1) a reduction in the drilling rate, and (2) an increase in the core recovery percentage. Cores from the Pedro Castle Formation are commonly characterized by broken core pieces and low core recovery rates, whereas the uppermost part of the Cayman Formation is generally characterized by high core recovery rates and longer core segments. In some areas, the lower part of the Pedro Castle

Formation is formed of limestones whereas the underlying Cayman Formation is formed of dolostone. Some care must be taken with this issue because the Pedro Castle Formation is, in some areas, formed of intercalated limestone and dolostone.

Brac Unconformity

Although well exposed in the cliff faces on the east end of Cayman Brac, the Brac Unconformity is difficult to characterize on Grand Cayman because (1) it is not evident in any surface exposures, and (2) it has only been identified in a few of the deeper wells drilled in the central and western part of the island. Given the paucity of good cores from the deeper wells on Grand Cayman, recognition of the Brac Unconformity has been based largely on the $^{87}Sr/^{86}Sr$ ratios of the rocks given that this ratio is known to have systematically changed during the Oligocene, Miocene, and Pliocene (Wang et al., 2019). McCormick and Jones (2021) followed a similar approach by suggesting that the sudden change in the

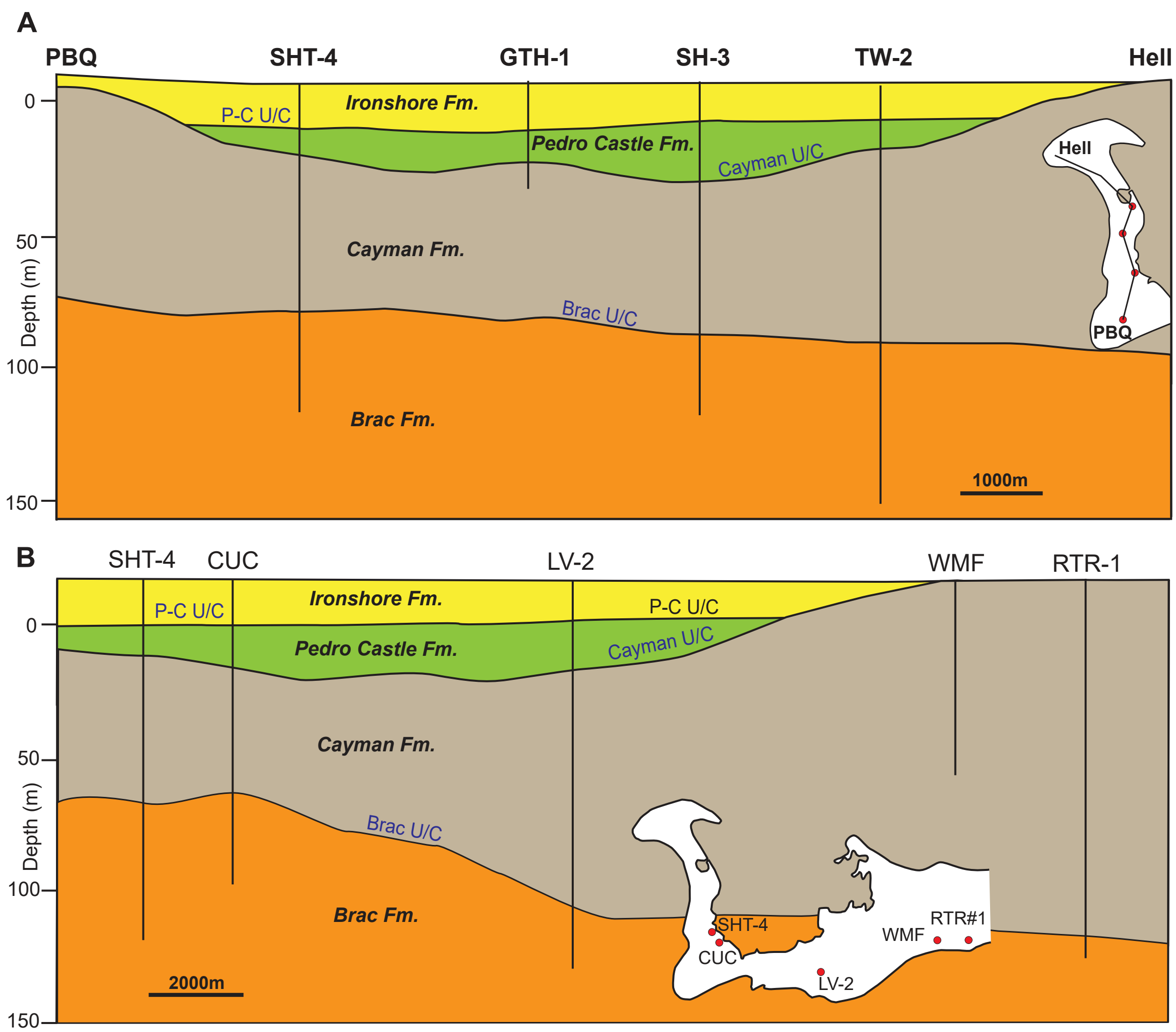


Figure 4. Stratigraphic cross-sections from (A) PBQ to Hell, and (B) SHT#4 to RTR#1 showing variations in thicknesses of the Brac Formation, Cayman Formation, Pedro Castle Formation, and Ironshore Formation and the Brac Unconformity (Brac U/C), Cayman Unconformity (Cayman U/C), and Pedro Castle Unconformity (P-C U/C) that form the boundaries between the formations. Modified from McCormick and Jones (2021, their Fig. 11).

$^{87}Sr/^{86}Sr$ ratios in these successions is an indicator of the Brac Unconformity. In well SHT#4, located ~200 m NNE of DUM-1 (Fig. 3), they placed the Brac Unconformity at a depth of 75.7 to 80.6 m (248.3 to 264.4 ft) based on (1) a sudden change in the $^{7}Sr/^{86}Sr$ ratios, and (2) the presence of a 1 cm thick layer of terra rossa in the core from that interval. They also used the "break" in the $^{7}Sr/^{86}Sr$ ratios to map the position of the Brac Unconformity on the western peninsula of Grand Cayman (Fig. 4A) and in a west-east direction along the southern part of Grand Cayman. In contrast to the relatively minor relief on the Brac Unconformity on the western peninsula, McCormick and Jones, 2021) showed that there is significant relief on the unconformity along the south coast (Fig. 4B). In well LV#2, for example, the unconformity is at a depth of 123 m (403.4 ft), whereas in well RTR#1 it is at 129 m (423 ft). Although it is evident that the Brac Unconformity is characterized by significant relief, it must be stressed that it is impossible to produce a detailed, island-wide map of the relief because this unconformity has only been found in the deeper wells.

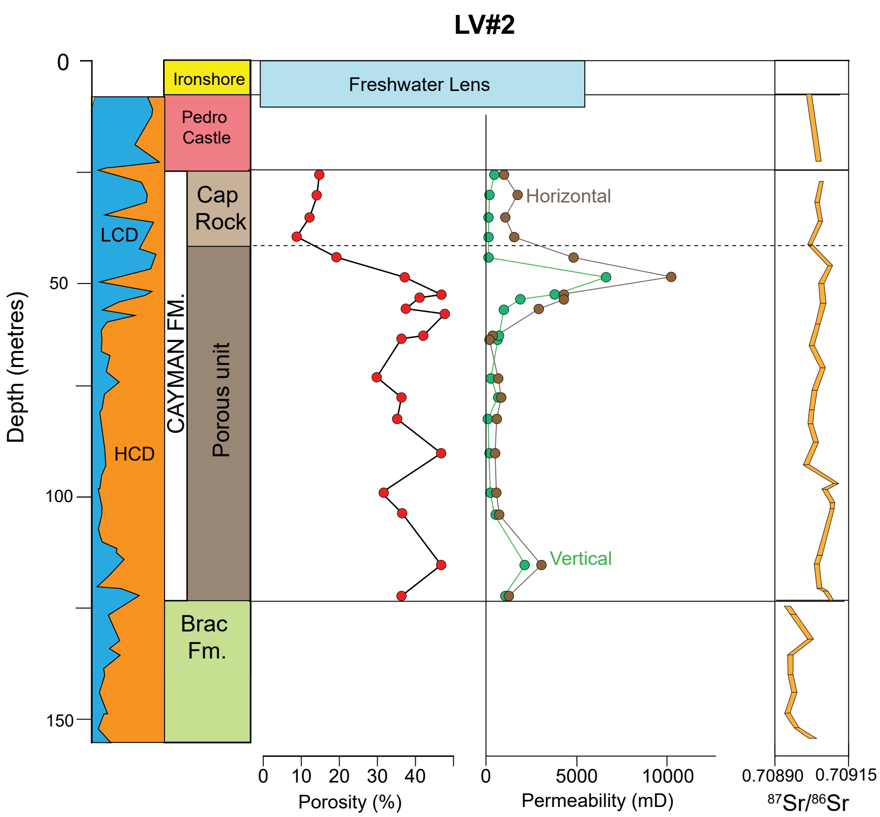


Figure 5. Succession in well LV-2 (Lower Valley) showing stratigraphic succession, porosity, permeability, and $^{87}Sr/^{86}Sr$ ratios. Note position of freshwater lens, "cap rock" at top of the Cayman Formation, and distinct break in the $^{87}Sr/^{86}Sr$ profile at the boundary between the Brac Formation and Cayman Formation. Modified from Jones (2022, Fig. 4.15).

Reference section

Well LV#2, drilled on the Water Authority site in Lower Valley in 1993, is used as a reference section because (1) it is one of the rare wells on Grand Cayman that includes the complete succession from the Brac Formation to the Ironshore Formation, and (2) it has been well documented in terms of its lithology, porosity, permeability, and $^{87}Sr/^{86}Sr$ ratios (Fig. 5) and many other geochemical attributes. Critical aspects of the succession in this well include (1) delineation of the "cap rock" at the top of the Cayman Formation,

Figure 6
West wall in Pedro Castle Quarry showing Cayman Unconformity that separates the Pedro Castle Formation (PCF) from the Cayman Formation (CF). Quarry wall is ~ 20 ft high with unconformity ~ 15 ft above sea level. The position of the unconformity is highlighted by the contrast in weathering colours.

and (2) the break in the $^{87}Sr/^{86}Sr$ ratios at the boundary between the Brac Formation and Cayman Formation. The lack of core from Brac Formation, prior to this study, meant that no porosity or permeability values are known for that part of the succession.

The "cap rock" at the top of the Cayman Formation is an informally designated dolostone unit at the top of the Cayman Formation that is characterized by low porosity and low permeability values that contrast with the high porosity and permeability values that characterize the underlying "porous unit" (Fig. 5). Parts of the "porous unit" are also characterized by high permeabilities (Fig. 5). The drilling rates through the cap rock were slower than those through the underlying "porous unit". It is important to note, however, that the cap rock is not recognizable in every well that has been drilled through the Cayman Formation. On the eastern part of the island, for example, it is rarely apparent. Similarly, it is not always evident in wells drilled on the western part of the island. Where present, it is commonly of different thickness to that in well LV#2. This variance in the development of the "cap rock" reflects the fact that its presence reflects diagenetic processes that (1) transformed the original limestones to dolostone, and (2) controlled the development of porosity and permeability in these rocks. Despite an extensive database, it has been impossible to identifiable pattern to the presence/absence of the cap rock and the degree to which it developed across the island. It is critical to recognize that this hard, low-porosity and low permeability unit is not present at all locations.

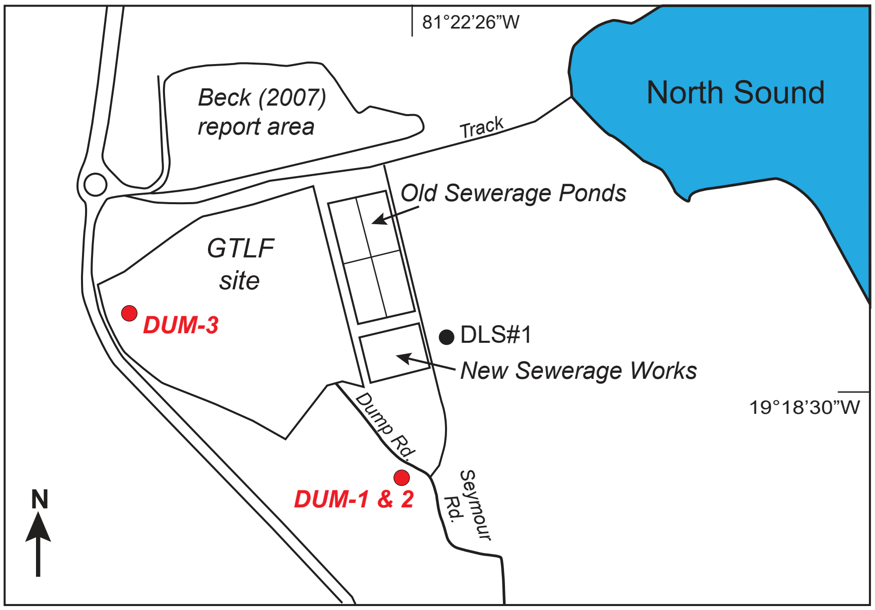


Figure 7
Map showing location of wells DUM-1, DUM-2, and DUM-3 relative to the area mapped by Beck (2007), the Old Sewerage Works, the New Sewerage Works, and well DLS#1.

METHODS

Three wells (DUM-1, DUM-2, DUM-3) were drilled on the Regen site by Brewster Well Drilling, during early December 2022 (Fig. 4). Each core, 4 inches (~10 cm) in diameter, was cut using a 10 foot (~3 m) core barrel.

(1) Well DUM-1 was drilled to a depth of 407.25 ft with (1) no samples from the upper 30 ft that penetrated the poorly lithified Ironshore Formation, (2) five 10 ft cores from 250-260 ft, 310-320 ft, 338.5-346 ft, 372.5-382 ft, and 397.5-407 ft and (3) cutting samples were collected from the upper part of the well and between the cores (Fig. 9). Each sample of cuttings were collected from 5 feet thick intervals (Fig. 9).

(2) Well DUM-2, located ~ 6 m from DUM-1 and drilled to a depth of 207.5 ft. Coring started at 31 ft, with essentially continuous coring to a depth of 170 ft (14 ten-foot cores), (2) chip samples were collected between 170 to 200 ft, and (3) one core from 200 to 210 ft (Fig. 9). Each sample of cuttings were collected from 5 feet thick intervals (Fig. 5). This well was drilled because a large cavity at 108-113 ft in well DUM-1 caused problems with drilling and water circulation.

(3) Well DUM-3, located ~650 m to northwest of DUM-1 and DUM-2, on the outer edge of the GTLF site, was drilled to a depth of 146.5 ft. No cores were obtained from the upper 28 ft of the well that penetrated through the Ironshore Formation. Fourteen cores (up to 10 ft long) were obtained between 28 ft and the base of the well at 146.5 ft (Fig. 9).

While in the field, each segment of core was sequentially numbered from the top down (e.g., C1-1, meaning core #1, segment #1, top), labelled with an arrow that indicate the "way-up" of the core, and carefully packed in a core box. Well cuttings were placed in plastic sample bags that were carefully labelled with their depth intervals. While in the field, after labelling, photographs were taken of all core. Photographs of all the core from the wells DUM-1, DUM-2, and DUM-3, are provided in Appendices 1, 2, and 3, respectively. Photographs of the chip samples from DUM-1, below a depth of 250 ft were also taken. The chip samples were tested with 10% HCl in order to determine if they are formed of calcite or dolomite.

Rock Competence

Rock competence is used to describe the overall "strength and resistance" of a rock. Although impossible to measure precisely, the hardness of the rock are herein assessed, on a relative basis, from the drilling rates, Core Recovery (CR) percentage, and the Rock Quality Designation (RQD). These data must be interpreted with caution because other factors related to the drilling process may influence these parameters. It is important to note that the values determined for the cores from wells DUM-1, DUM-2, and DUM-3 should not be compared directly with those values determined from other wells that were drilled and cored using different drilling systems.

Drilling Rates: This is based on the premise that the rate of drilling will primarily be a function of the "hardness" or "competency" of the rock. Although simple in principle, this parameter is also controlled by other factors, including the type of drill bit used, the age and degree of wear of the drill bit, drilling speed, and/or the downhole weight on the drill bit. Core drilling is typically slower than the drilling rates associated with the collection of well cuttings. Despite these issues, the rates of drilling can provide valuable insights regarding the hardness of the rock.

Core Recovery: This parameter provides a measure of the length of hard, competent rock relative to the amount of cavity space for a specified core run length. In theory, the length of retrieved core plus the cumulative lengths of bit drops should equal the total core run length. When drilling through poorly lithified rock, however, disintegration of the bedrock may occur and no core will be obtained. This is the reason, for example, why no core was obtained from the Ironshore Formation.

Rock Quality Designation: This term, introduced by Deere (1967), is based on the total length of core pieces that are each longer than 4 inches (10 cm) relative to the length of the core run. It can be used as a measure of the "good" rock in a borehole (Deere and Deere, 1988). This index is, however, sensitive to the length of the core run. Thus, comparisons of the RQD should be based on core run lengths that are, or close to being, the same.

Downhole video

Following drilling of wells DUM-1 and DUM-2, a GeoVISION Dual Scan Micro Camera system was lowered down each well in order to obtain a continuous visual video record of the walls of each well. These videos provides coverage of those parts of the well that were not cored or intervals for which core recovery was poor.

As the video camera was lowered down the hole, it was stopped at various depths so that it could obtain a 360° panoramic view of the borehole. These video images are particularly useful because they show the (1) general nature of the intervals for which core were not obtained, and (2) the presence of fractures that may not be evident from the core - this is especially true for the larger fractures. It is, however, impossible to determine if the rock is limestone or dolostone from the video images.

Problems were encountered with the acquisition of the downhole videos because of the substantial amounts of very-fine grained sediment that was present in parts of the wells. In many areas, this sediment lined the smaller pores and lay on the floor of the larger cavities. Disturbance of this sediment during drilling meant that the water in the wells commonly remained turbid for long periods of time after the drilling was completed.

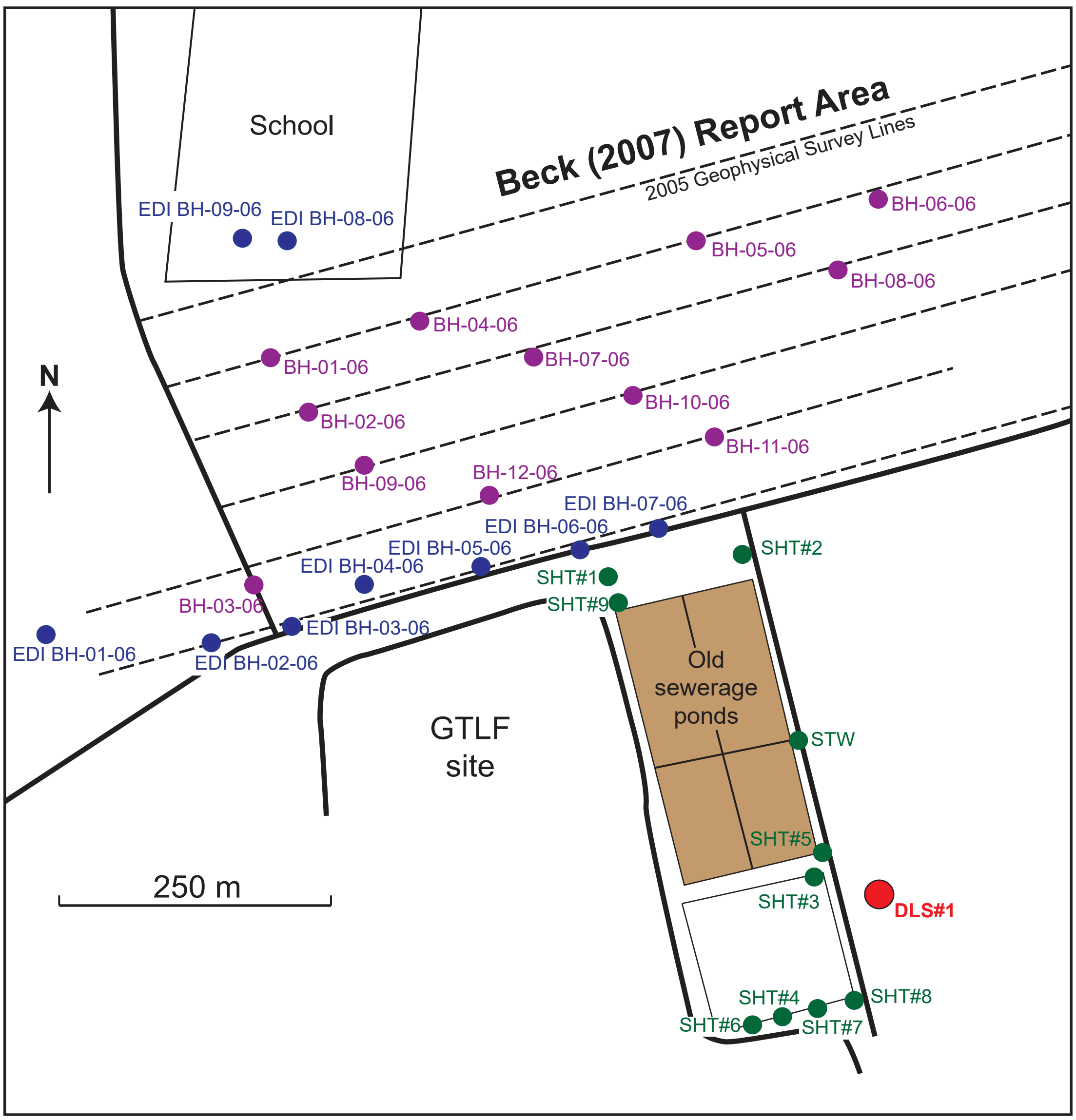


Figure 8: Location of wells that have been drilled in areas around the GTLF site. See text for listing of the origin of these wells.

Given that DUM-1 and DUM-2 were drilled very close to each other (~20 ft apart). Continuous coring to a depth of 170 ft in DUM-1 provides a continuous record of the rock succession. Accordingly, the downhole video for this succession focuses on the succession in DUM-1 between 170 and 407.25 ft.

WELLS DRILLED AROUND DUM WELLS

Data obtained from wells DUM-1, DUM-2, and DUM-3 are assessed relative to numerous wells that have been drilled to the east and north of the GTLF site (Figs. 6, 7) that includes the following:

1. **North of GTLF site**: Beck (2007) provided a detailed report that covered 12 wells that were drilled and cored to a maximum depth of about 130 ft using a wire-line drilling system. These wells penetrated the Ironshore Formation, Pedro Castle Formation, and the upper part of the Cayman Formation. His report provided images of all of the cores that are now held in storage by Dart.

2. **North of GTLF site and school site:** Environmental Diagnostics Inc (EDI) drilled two wells on the site where the school is now built and 7 wells on the north side of the east-west track at the north end of the area that encompasses the GTLF site and the old sewerage work site (Fig. 4). These wells, drilled to a maximum depth of about 130 ft, penetrated the Ironshore Formation, Pedro Castle Formation, and the upper part of the Cayman Formation. The report on these wells included photographs of all of the core. The location of these core today is unknown.

3. **Old Sewerage Works:** A research group, led by Dr. Brian Jones (University of Alberta) drilled and cored 6 wells (SHT#1 to 5 and 9) around the north and east margins of the old sewerage ponds (Fig. 4). Core from these wells, that were drilled to a maximum depth of 130 feet, penetrated the Ironshore Formation, Pedro Castle Formation, and the Cayman Formation. Information from these cores has been included in various theses and papers. The core from these wells is stored at the University of Alberta.

4. **New Sewerage Works:** The Water Authority drilled four wells along the southern boundary of the Water Authority site (to south of new processing plant). These wells (SHT#4, SHT#6, SHT#7, and SHT#8) included SHT#4 that reached a depth of 480 feet. The well cuttings and core obtained from SHT#4 well are stored at the University of Alberta. No core or cutting samples were collected from the other wells. These wells penetrated the Ironshore Formation, Pedro Castle Formation, and Cayman Formation. The lower part of well SHT#4 penetrated the Brac Formation.

5. **Laundry well:** This well (DLS#1-Fig. 8), drilled in 2020 by Industrial Services and Equipment Ltd., reached a depth of 200 ft. Cores and well cuttings were obtained from this well. The report on this well (Jones, 2020) included photographs of the core.

Integration of information from the wells in these five areas, which has involved analyses of the core, well cuttings, and tested porosity and permeability values means that there is a good understanding of the subsurface geology of the area. This information is also assessed relative to information derived from well GTH-1 drilled to the north, GET#1 (Fig. 1) that was drilled to the south, and LV#2 drilled to the east of the DUM site, four wells drilled at the Cayman Utilities site, and 4 wells drilled at the Red Gate site (Water Authority) to the east has been well established and provides a model for assessing the subsurface geology

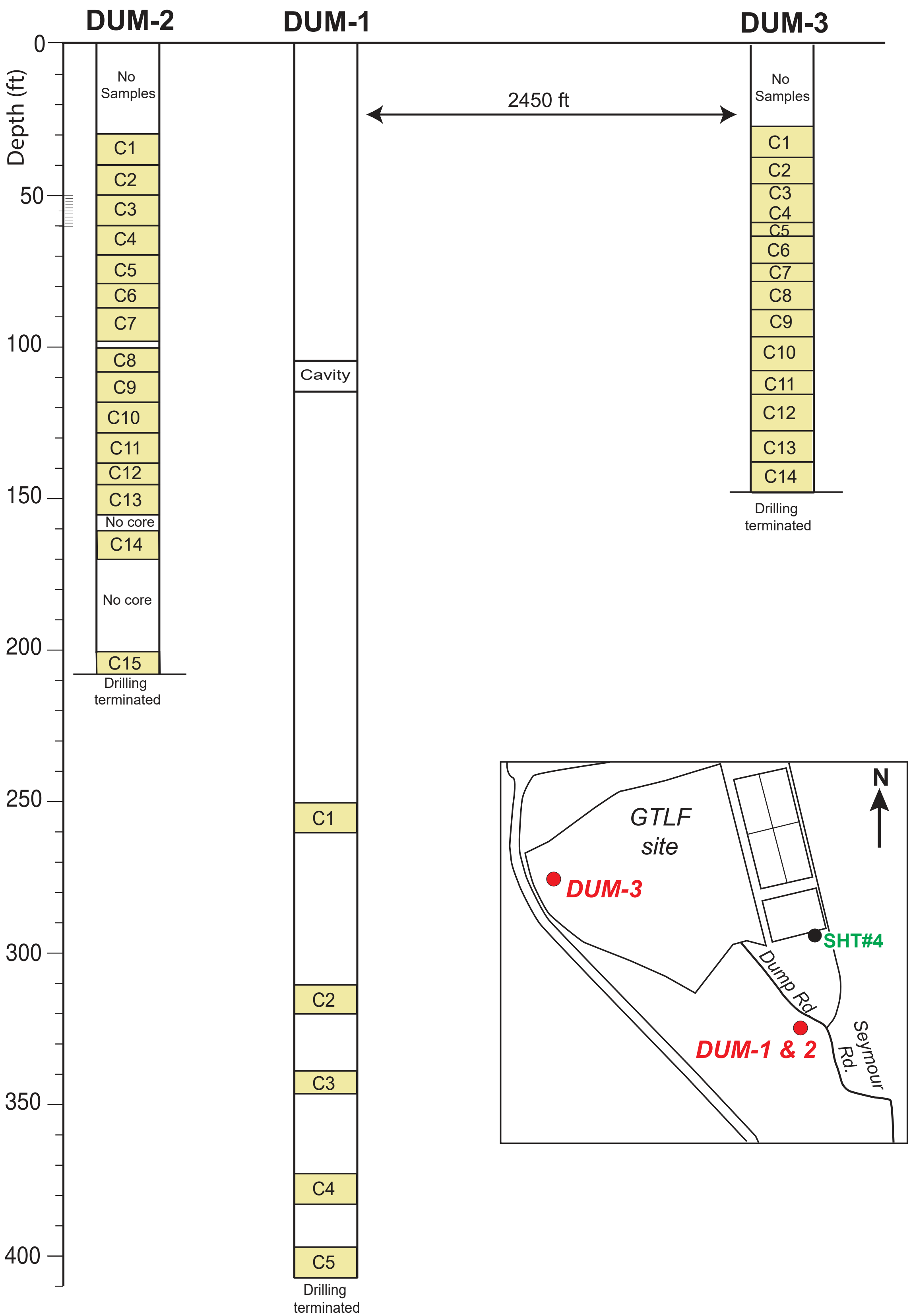


Figure 9: Location of cores cut in wells DUM-1, DUM-2, and DUM-3. Cuttings collected over 5 ft intervals between cores. DUM-1 and DUM-2 are adjacent to each other (< 20 ft apart).

penetrated by wells DUM-1, DUM-2 and DUM-3. It is important to note, however, that most of the wells in these areas are less than 200 feet deep with only SHT#4 (480 ft) being deeper. As a result, the upper 200 feet of strata are well documented from many perspectives, whereas information for those strata below 200 ft is available only from well SHT#4.

WELLS DUM-1, DUM-2 AND DUM-3

The area that encompasses wells DUM-1, DUM-2, and DUM-3 is located north of Georgetown on the southwest corner of Grand Cayman (Fig. 1). Wells DUM-1 and DUM-2 were only ~ 20 ft apart. The sequences evident in these wells must be considered relative to the succession in well LV-2 that is located on the Water Authority site, Lower Valley (Fig. 2) and various wells in the area around the GTLF site (Fig. 3). Well SHT#4 is particularly important in this respect because it includes a complete succession like that in well LV#2.

Rock Competence

The drilling rates for all three wells were rapid with little downhole variance (Figs. 9, 10). Significant variance in these rates was only encountered when different drill bits were used. There are no obvious reasons for the rare slower rates of drilling core in some parts of the successions (Figs. 9, 10).

Core recovery was excellent in all three wells with core recovery commonly in the 80 to 100% range (Figs. 10, 11). The reason for the variable core recovery percentage from the Cayman Formation in DUM-2 is not readily apparent (Fig. 9). This variability, however, was not evident in the DUM-3 well (Fig. 10). The RQD was high throughout all of the drilling with very few core pieces being < 4 in (10 cm) long (Figs. 10, 11). In wells DUM-2 and DUM-3 some intervals of rubble formed through the breakdown of the core are present (see Appendices 2 and 3).

No core was recovered from the Ironshore Formation because the limestones in that formation are extremely friable and disintegrate during drilling.

Formation Boundaries in DUM-1, DUM-2, and DUM-3

The boundaries between the formations are marked by the Pedro Castle Unconformity, the Cayman Unconformity, and the Brac Unconformity (Figs. 3, 4), with each being characterized by significant topographic variability (Fig. 4). In wells DUM-1 and DUM-2 and DUM-3, these unconformities are located at variable depths (Figs. 10, 11).

Pedro Castle Unconformity

The top of the Pedro Castle Formation is placed at the depth where resistance to drilling was first encountered and coring of the bedrock became possible. In DUM-1and DUM-2 this was at a depth of 30 ft, whereas in DUM-3 it was at a depth of 28.5 ft. This variation in the depth to the top of the Pedro Castle Formation is similar to that found throughout the surrounding area.

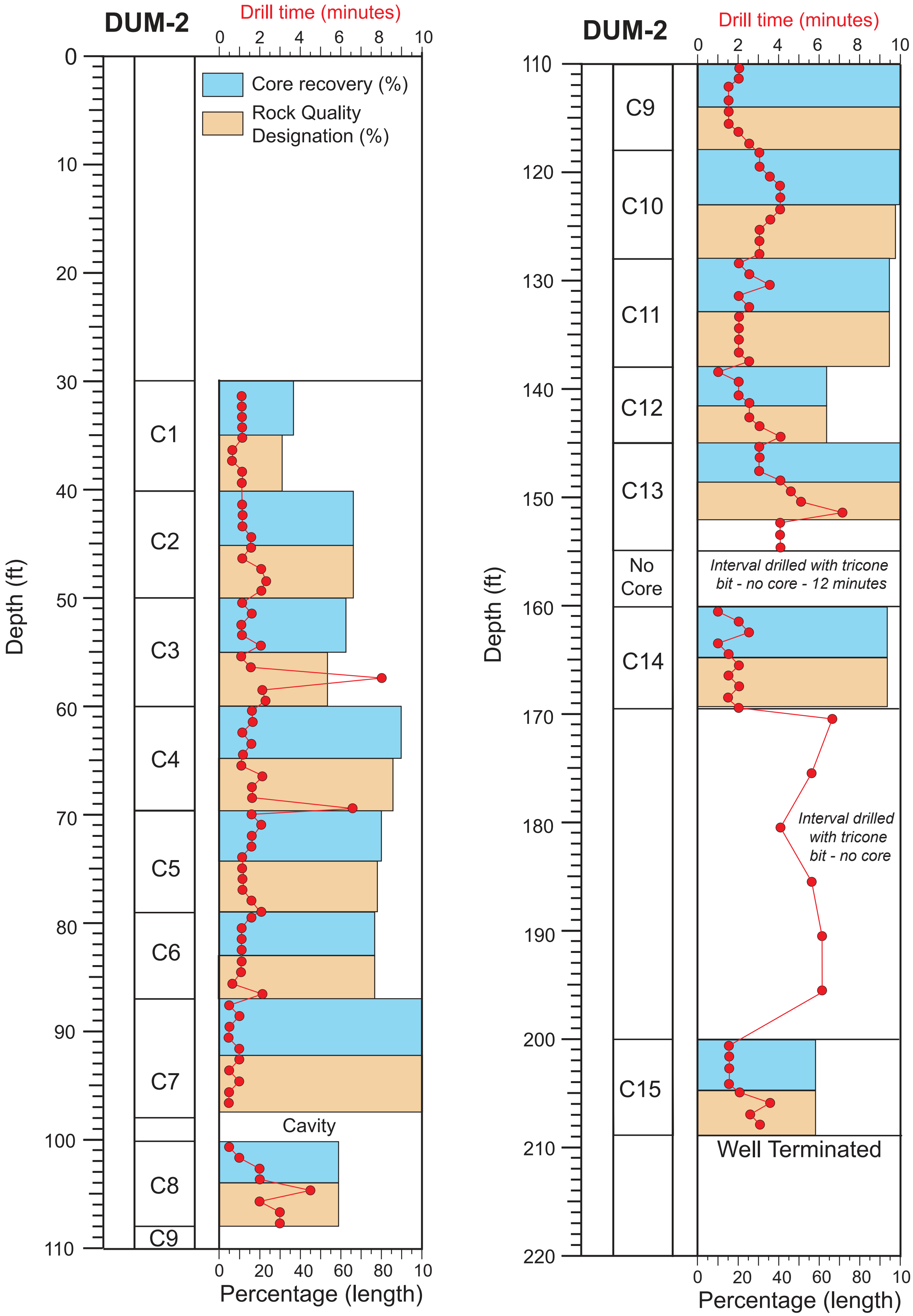
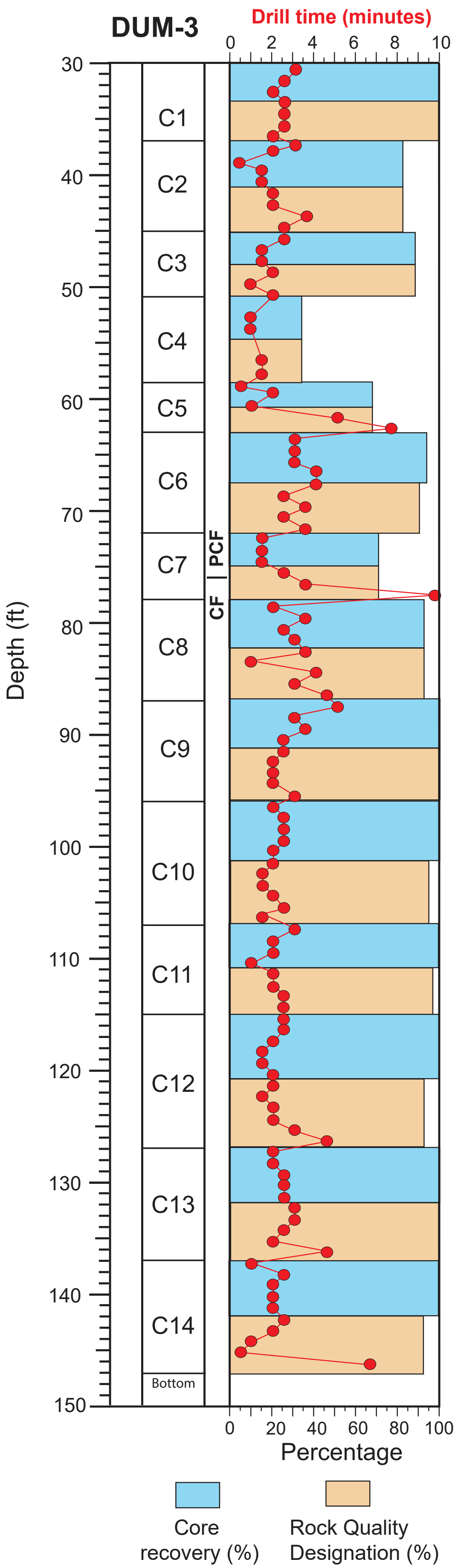


Figure 10: Well DUM-2 – location of cores C1 to C15, drill times, and percent core recovery, and rock quality designation (RQD).



Cayman Unconformity

The Cayman Unconformity is generally easy to recognize and locate in surface outcrops because of the difference in the weathered colours of the Cayman Formation and Pedro Castle Formation (Fig. 6). In the subsurface, however, it is commonly difficult to accurately place this boundary because weathered colours are not evident. Accordingly, it has commonly been placed where there there are changes in lithology, various geochemical parameters, the rate of drilling, and/or the core recovery percentage and RQD. Such parameters are commonly difficult to apply because the uppermost part of the Cayman Formation and lowermost part of the Pedro Castle Formation can both be formed of dolostone, the necessary geochemical parameters are lacking, and the rate of drilling and length of core pieces is largely a function of the drilling rig that was used.

In the following discussion it is important to note that there is a 3 ft difference between the depths determined during drilling (measured from drill table that is 3 ft above ground level) as opposed to that associated with the downhole video (measured from ground level.

In DUM-2, the boundary is probably located at a depth of about 76 ft. Between 30 and 76 ft, the core is generally broken into small lengths and characterized by numerous small cavities (Appendix 1). Careful inspection of the downhole video shows that the wall of the well between 30 to 76 ft is dark grey in colour and highly irregular with numerous small cavities (Fig. 12A, B). In contrast, the wall of the well below 76 ft is smooth and light grey to beige in colour (Fig. 12C, D).

For DUM-3, there are similar contrasts in the nature of

Figure 11

Well DUM-3 – location of cores C1 to C14, drill times, and percent core recovery, and rock quality designation (RQD). The boundary between the Pedro Castle Formation (PCF) and Cayman Formation (CF) is derived from the downhole video and core.

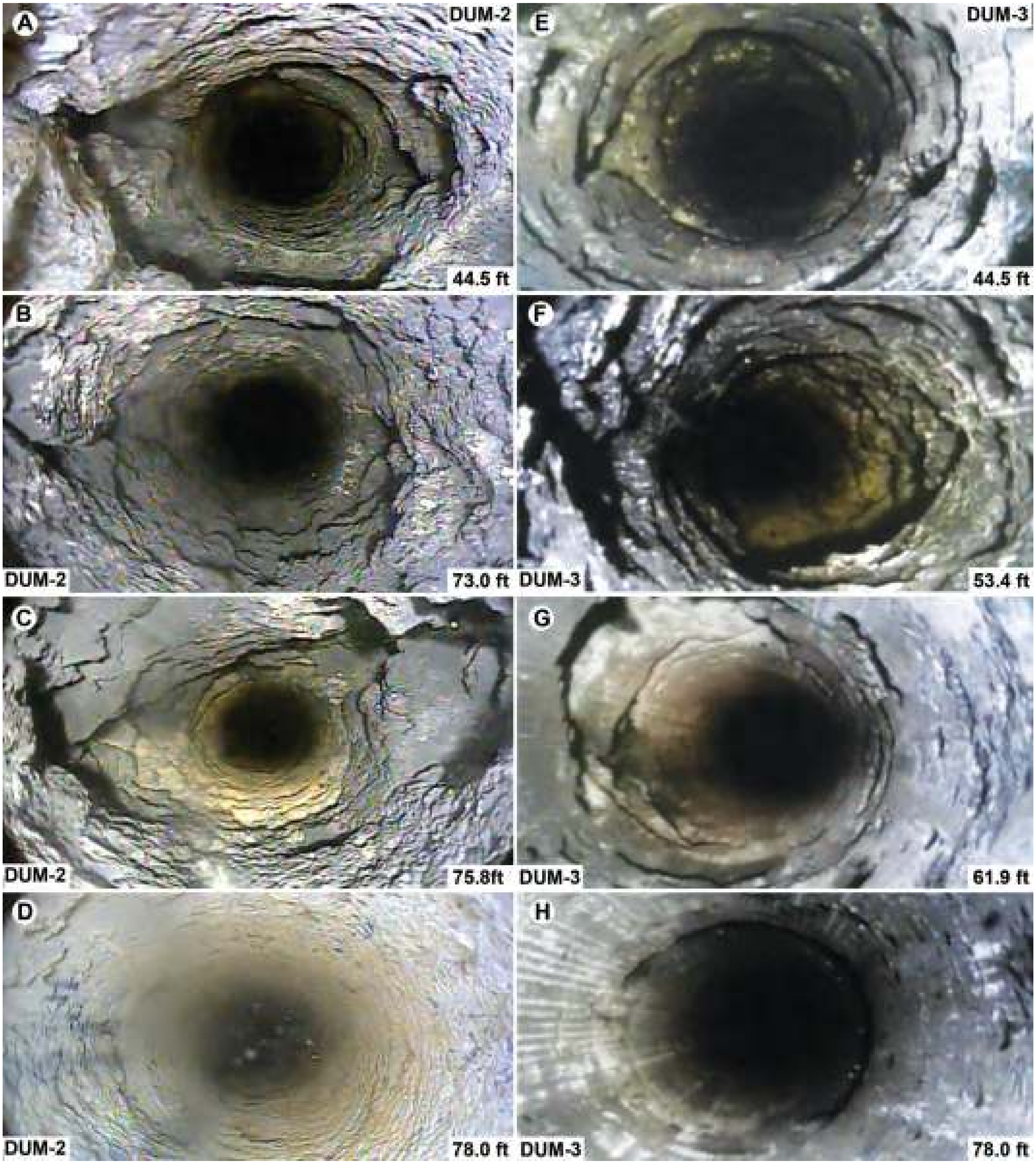


Figure 12

Location of Cayman Unconformity in DUM-2 (A-D) and DUM-3 (E-H) as identified from downhole video.

DUM-2: (A, B) Upper part of borehole characterized by uneven walls and dark-coloured rock. **(C)** Transition from Pedro Castle Formation to Cayman Formation highlighted by change in colour. **(D)** Cayman Formation, characterized by smooth walls and light coloured rock.

DUM-3: (E, F) Pedro Castle Formation with uneven walls. **(G)** Possible transition from Pedro Castle Formation to Cayman Formation. **(H)** Smooth walls of Cayman Formation.

Figure 13: Comparison of cores from the Pedro Castle Formation C1 and C2) and cores from the Cayman Formation (C5-7) from DUM-2. Note higher porosity and shorter core pieces from the Pedro Castle Formation relative to the Cayman Formation. Core diameter is 4 in (10 cm).

the core and well wall above and below ~73 ft (Fig. 12 E-H; Appendix) that probably denotes the position of the boundary between the Pedro Castle Formation and Cayman Formation.

It should be noted that there are no significant changes in the drilling rates, core recovery percentages, or RQD associated with the positions of the Cayman Unconformity in DUM-2 or DUM-3 (Figs. 10, 11).

Brac Unconformity

Recognition of the Brac Unconformity on Grand Cayman is difficult because it occurs at depths from which little core has ever been attained. Similarly, the position of the Brac Unconformity around the GTLF site is largely unknown because of the paucity of deep wells in the area. In well SHT#4, located ~200 m northeast of DUM-1, McCormick and Jones (2021) placed the Brac Unconformity at a depth of ~ 260 ft based on detailed analyses of the well cuttings, the presence of a thin layer of terra rossa, and a significant change in the $^{87}Sr/^{86}Sr$ ratios (Fig. 4A).

The position of the Brac Unconformity in DUM-1 is impossible to place accurately because of the wide spacing of the cores from that part of the succession. Core 1 (250.5-260.5 ft) is formed of finely crystalline, largely featureless dolostones (no reaction with 10% HCl acid) that probably belong to the Cayman Formation. In contrast, cores 2 (310-320 ft), 3 (338.5-346.5 ft), 4 (372.5-382.5 ft), and 5 (397.5-407.5 ft) are formed of darker coloured limestones/dolostones that are characterized by high porosity (core 2 - Fig. 12), fossil-mouldic prosity, and corals (core 3 - Fig. 12) probably belong to the Brac Formation. It is difficult, however, to pinpoint the exact location of the boundary between the Brac Formation and Cayman Formation between cores 1 and 2 (depth between 260.5 and 310 ft) in this well. Careful inspection of the downhole video from this part of the part of the well (Fig. 15) failed to identify any distinct change in the nature of the bedrock that could be attributed to the Brac Unconformity. It should be noted, however, that this unconformity can also be difficult to pinpoint in the cliffs at the east end of Cayman Brac where it was originally recognized and documented.

Between 210 ft and 406 ft in well DUM-1, there are some contrasts in the well cuttings in terms of their colour, general appearance, and reaction with 10% HCl (Fig. 16). There are, however, no systematic variations in these attributes that could be directly linked to the change from the basal part of the Cayman Formation to the upper part of the Brac Formation.

The Brac Unconformity in well DUM-1 is probably located at a similar depth to that in well SHT#4 , which is located ~ 200 m from DUM-1. Nevertheless, it must be remembered that the relief on this unconformity can be significant in some areas on Grand Cayman and on the east end of Cayman Brac (Fig. 4).

POROSITY AND PERMEABILITY

In general, the limestones and dolostones in the Pedro Castle Formation, Cayman Formation, and Brac Formation of the Cayman Islands are characterized by heterogeneous porosity and permeability patterns that are difficult to predict in any precise manner. This situation arises because the many different types of porosity and permeability developed through many different processes during their long diagenetic history.

Analysis of the Pedro Castle Formation, Cayman Formation, and Brac Formation in wells DUM-1,

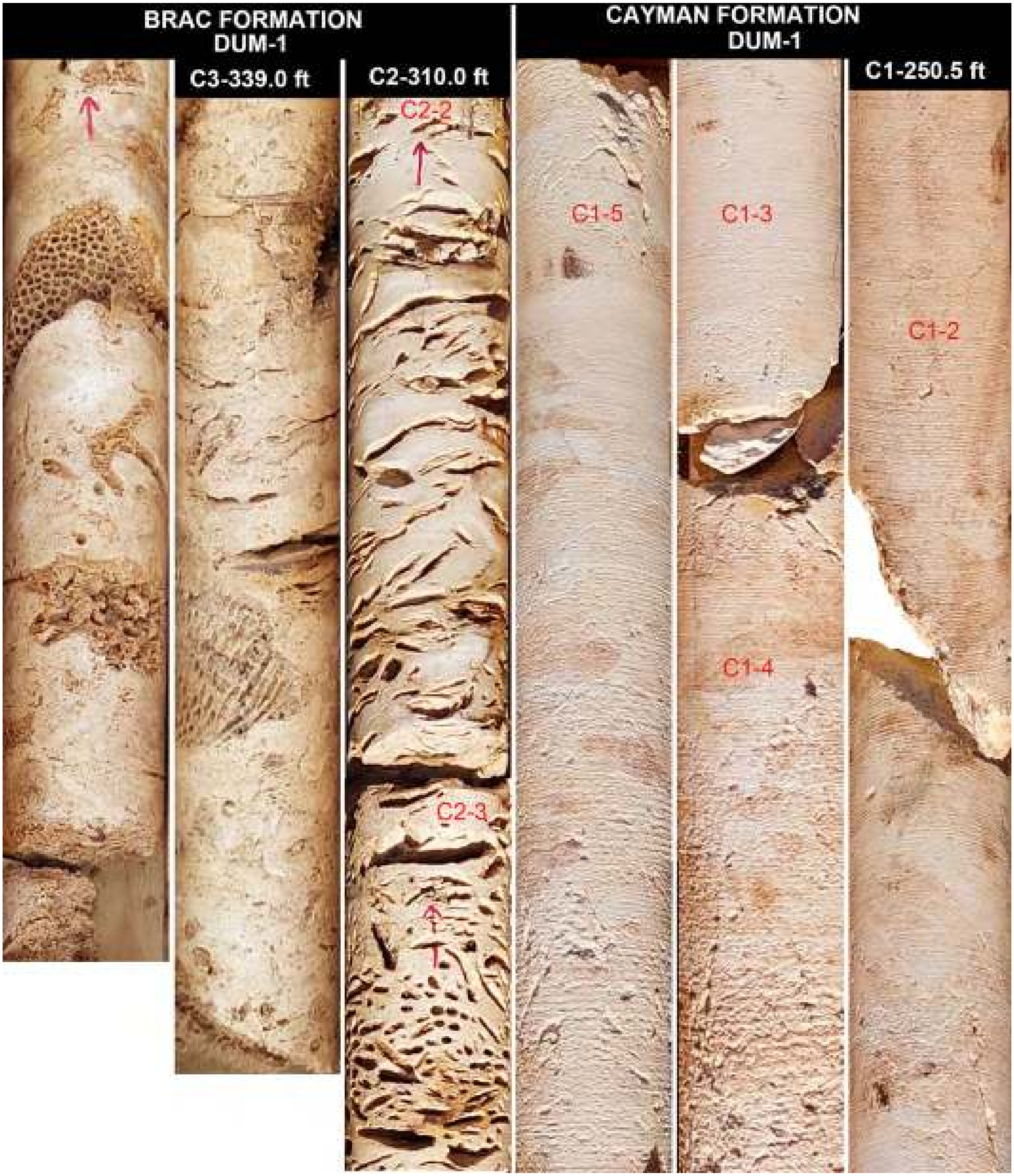


Figure 14: Comparison of cores from the Cayman Formation (dolostone) and the Brac Formation (C2-310 ft and core C3-339.0 ft). Note presence of fossils (corals) in the cores from the Brac Formation. All core from well DUM-1. Core diameter is 4 in (10 cm).

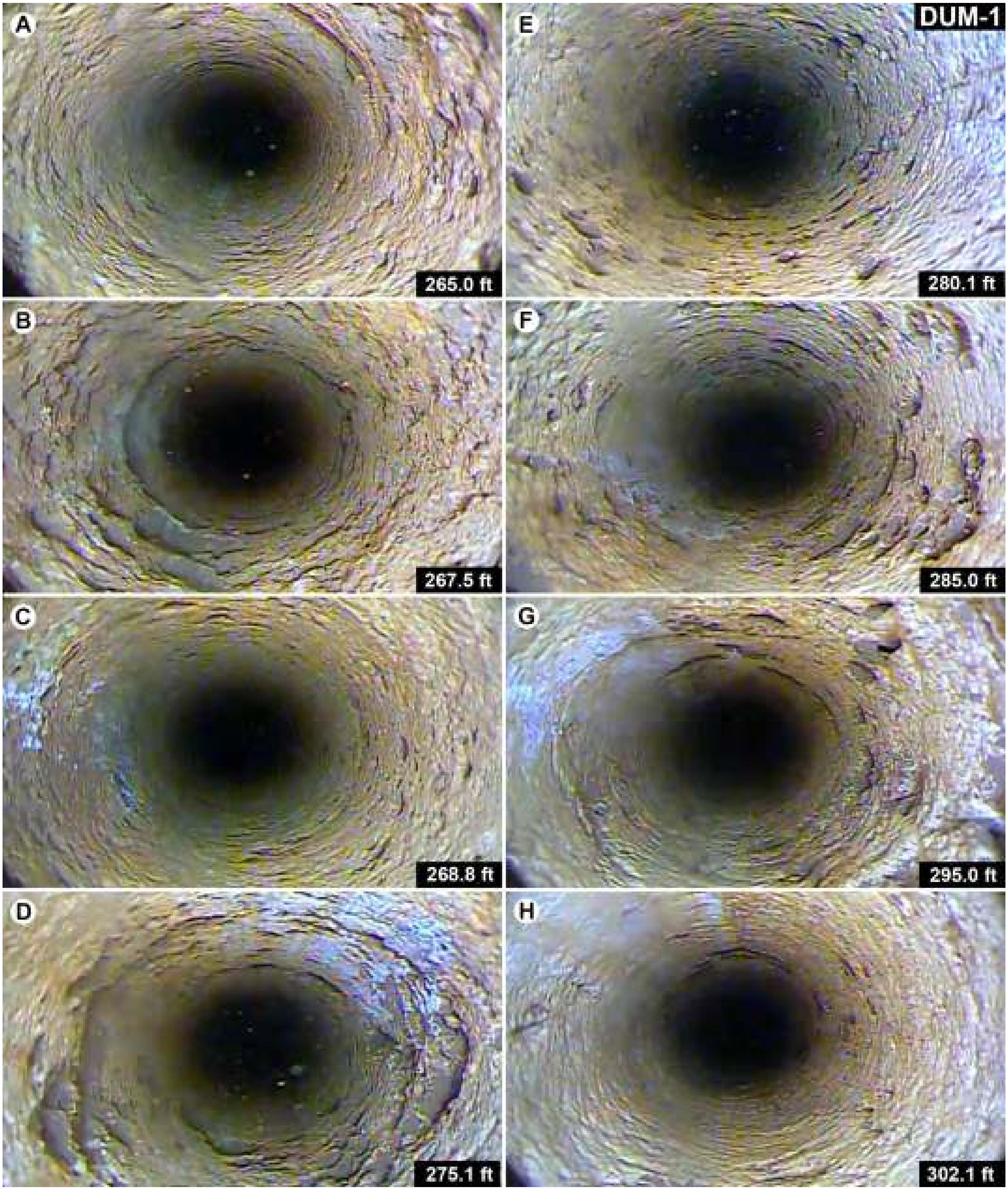


Figure 15: Downhole views of well between 265 ft and 302.1 ft showing appearance of the walls. These images cover the section of the well between core 1 (251-260 ft) that came from the Cayman Formation and core 2 (310-320 ft) that came from the Brac Formation. The exact position of the boundary between the two formations is not evident in the walls of the well. Although the exact diameter of the open borehole is unknown, the extracted core is 4 in (10 cm) in diameter.

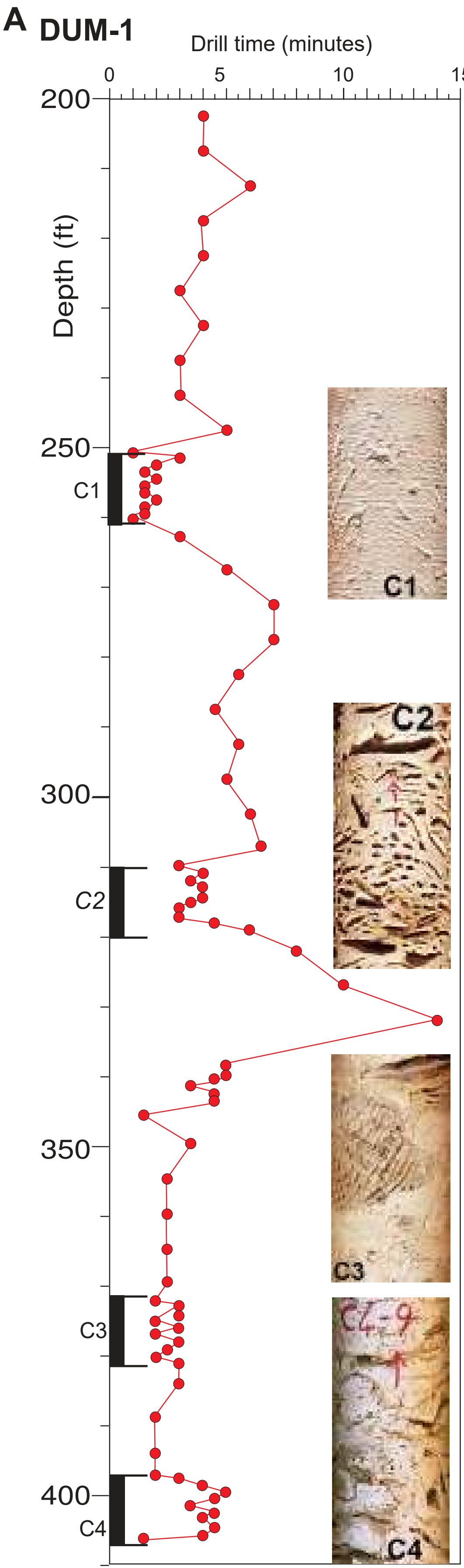
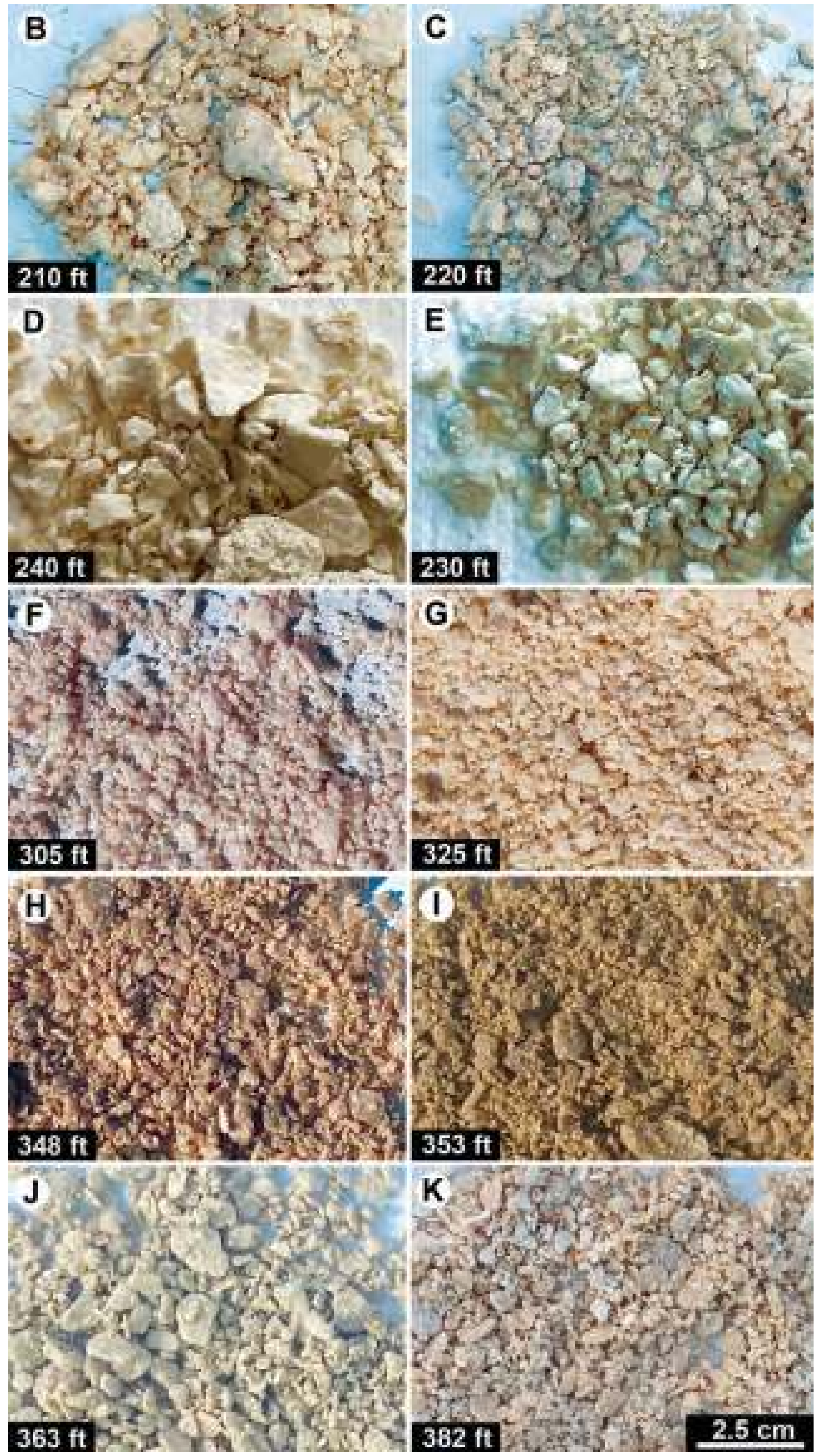


Figure 16: (A) Drill times for DUM-1 from 200 ft to base of well and locations of cores 1 to 4), insets show a segment of each core for comparative purposes. (B-K) Photographs of cuttings at various depths between 210 ft and 382 ft. Boundary between the Cayman Formation and Brac Formation lies somewhere between core 1 and core 2.



Note: *minor differences in colours in panels B to K probably reflect differences in lighting rather than the true colours of the rock fragments.*

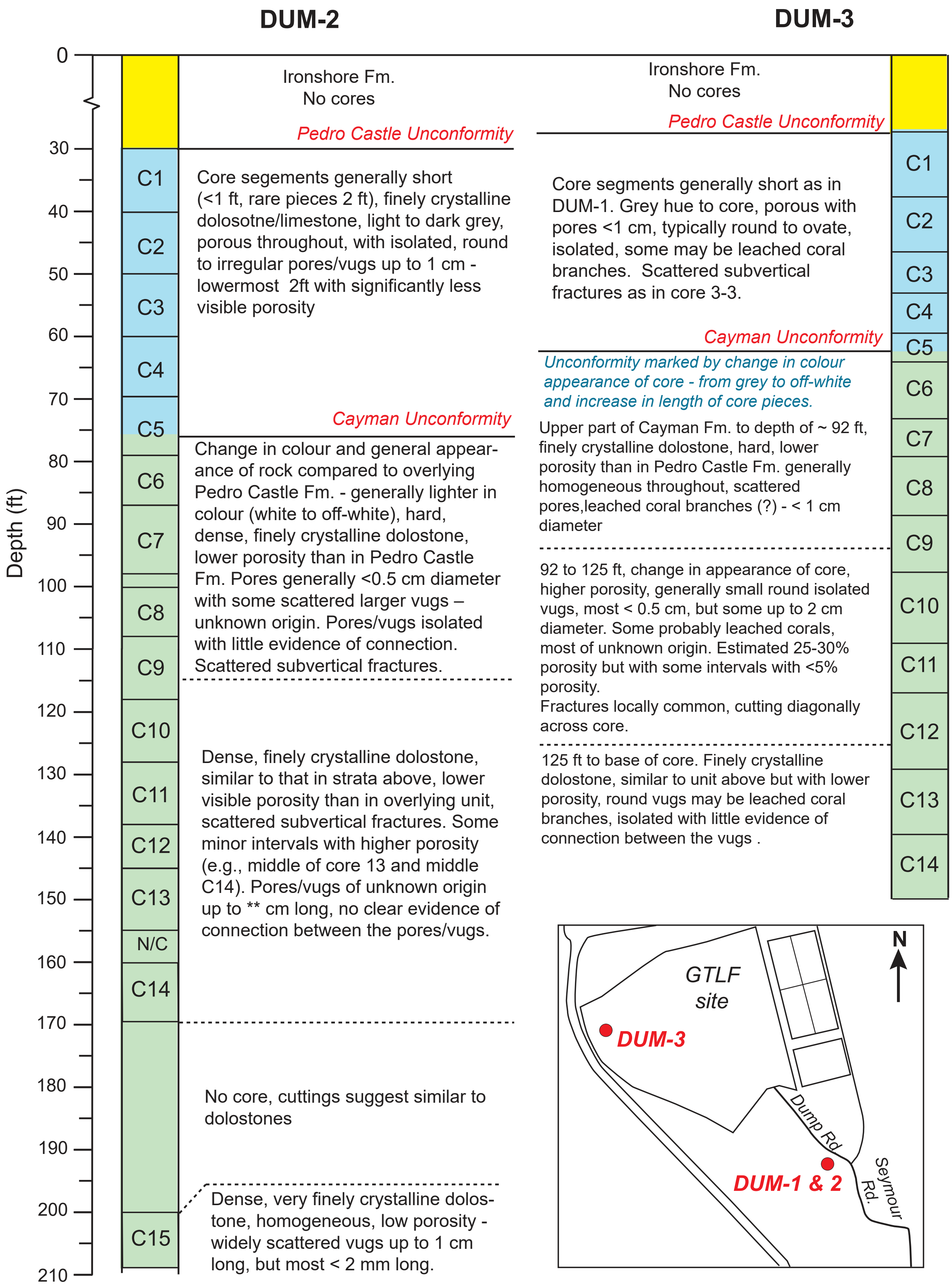


Figure 17: Correlation between wells DUM-2 and DUM-3 with summary descriptions of the cores from both wells.

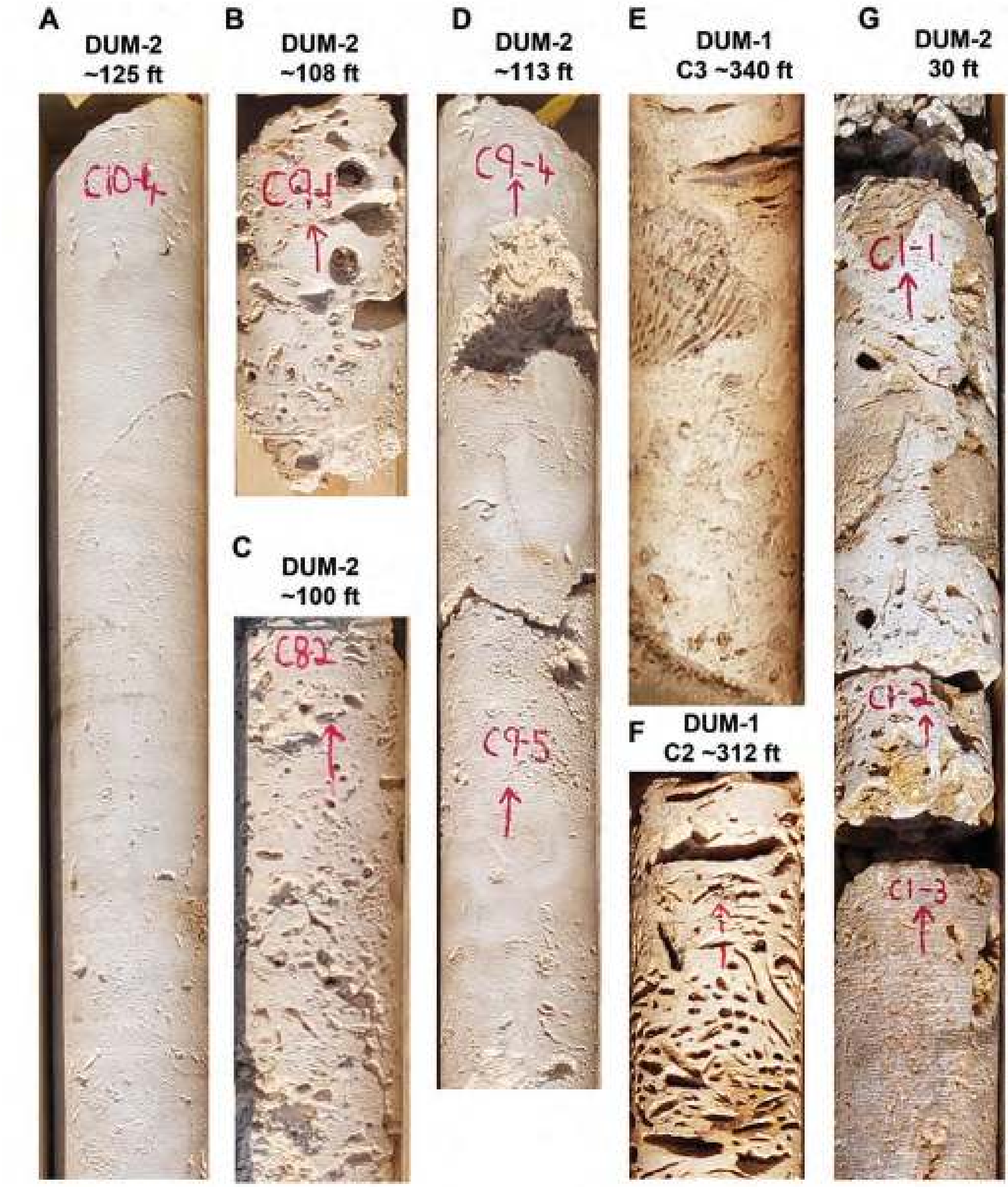


Figure 18. Examples of different styles of porosity in cores from wells DUM-1, DUM-2, and DUM-3. Locations are specified as well number, core number (e.g. C2) and depth (below drill table that is ~ 3 ft above ground level). (A) Dolostone with low porosity, pinpoint pores only. (B) Dolostone with vuggy porosity of unknown origin. (C) High porosity with pores and small vugs of unknown origin. (D) Dolostone with low porosity and leached coral (top). (E, F) examples of high fossil-mouldic porosity created by leaching of corals. (G) Upper part of Pedro Castle Formation with vugs of various sizes, some of larger vugs subsequently filled by cavity-filling sediment. All cores are 4 in (~10 cm) diameter.

DUM-2, and DUM-3, as well as many surface and subsurface samples from across Grand Cayman and Cayman Brac, shows that the following styles of porosity are present in these formations.

- ***Intercrystalline and pinpoint porosity*** (Fig. 18A). The morphologies of the intercrystalline (< 10 µm long) and pinpoint pores (> 10 µm but < 1 mm long) are controlled largely by the packing of the dolomite crystals that form the groundmass. In many cases, low permeabilities are associated with this style of porosity because there is little connection between the pores.
- ***Vuggy porosity***. This type of porosity, which developed through the late-diagenetic dissolution of the bedrock, has no obvious relationship to any fabric or structural element in the original sediment (Fig. 18B, C). Such cavities, which are generally isolated can be of any size and shape.
- ***Fossil mouldic porosity*** (Fig. 18D, E, F). This type of porosity developed when the aragonitic skeletons of organisms (e.g., corals, bivalves, gastropods) were dissolved before or during dolomitization. The size and shape of these fossil-moldic cavities, reflects the morphology of the original skeletons from which they developed (Fig. 18D, E, F). Small bivalves may lead to pores that are less than 1 cm long whereas dome-shaped cavities up to 3 m high result from dissolution of large coral heads. The distribution of this type of porosity is facies dependent because it reflects the distribution of the animals in their original depositional environment.
- ***Caves and large cavities.*** Caves and large cavities are common features in the Cayman Formation and Brac Formation on Grand Cayman and Cayman Brac. Rare caves have also been found in the Pedro Castle Formation on Cayman Brac. For example, the lower part of the wall in Pedro Castle quarry, (Fig. 6) includes a system of caves in the Cayman Formation, ~15 ft below the Cayman Unconformity, some of which are partly filled with cave precipitates (e.g., flowstone) and sediments. Crystal Caves, found on the north-central coast of Grand Cayman are a spectacular example of an extensive cave system that has developed in the Cayman Formation. Such caves, which are highly variable in size and morphology, are commonly developed just below the unconformities that separate the formations from each other. There is no recognizable pattern to their distribution or morphological development. On Cayman Brac, caves of all sizes are common in the upper part of the Brac Formation and throughout the Cayman Formation. For wells DUM-1, DUM-2, and DUM-3, caves/cavities were recorded by “bit drops” that occurred during drilling (Table 1). Given that these caves/cavities were identified solely by “bit drops” their lateral extent and overall morphology are unknown. Unfortunately, no further information was available from the down-hole video because the water was very cloudy and lateral visibility was very low.
- ***Fractures*** (Figs. 18, 19). Recognition of natural fractures in core can be difficult because the cores commonly break during drilling and/or extraction from the core barrel. Although the breaks between successive pieces of core may be along natural fractures (Fig. 19A), it is usually difficult to determine if that is the case. Assessment of the core from wells DUM-1, DUM-2, and DUM-3, however, indicates that some fractures are present (Fig. 19B). Downhole videos of well DUM-1, which reached a depth of 406 ft, showed that fractures are common between 350 and 406 ft (Fig. 20). These are treated as natural fractures because it is readily apparent that they penetrate into the wall of the borehole. Such fractures were rarely evident in the strata above 350 ft.

Table 1: Distribution of caves and cavities, as recognized by "bit drops" in well DUM-1, DUM-2, and DUM-3.

Well	Depth top (ft)	Depth bottom (ft)	Height (ft)
DUM-1	105	113	8
DUM-1	328.5	329.5	1
DUM-2	40	41	1
DUM-2	98	99	1
DUM-2	108	109	Hole collapse
DUM-2	113	114	6 in cavity
DUM-3	52	53.5	1.5
DUM-3	83	84	0.5
DUM-3	137	138	0.5
DUM-3	145	146	1

There are no recognizable patterns to the distribution of these different types of porosity. The fossil-mouldic porosity is facies controlled given that its distribution is a reflection of the distribution of the different animals (e.g., corals, bivalves) in the original depositional environments. In contrast the vuggy porosity has a random distribution because it formed as a result of diagenetic processes that were mediated by groundwater passing through and dissolving parts of the bedrock.

The situation is further complicated by the fact that some pores, vugs, and/or cavities were later occluded by dolomite and calcite cements and/or internal sediment. In the upper part of core 1 from DUM-2, for example, dissolution vugs were later filled by internal sediments that are readily evident because their colours are different from that of the original bedrock (Fig. 18G). These processes led to a decrease in the porosity of the rocks and may, in some cases, have caused a decrease in the permeability of the limestones and dolostones.

POROSITY IN DUM-1 and DUM-2

Porosity in wells DUM-1 and DUM-2, which penetrated the Pedro Castle Formation, Cayman Formation, and Brac Formation, is assessed from the core from DUM-2 (30 to 210 ft - Appendix B) and the downhole video for DUM-1 from 165 ft to 405 ft (Figs. 21, 22).

Core from DUM-2, which includes the Pedro Castle Formation and the upper part of the Cayman Formation, has variable porosity characteristics. Core from the Pedro Castle Formation (C1 to approximately the base of core 5; 30 to ~76 ft) is formed of finely crystalline dolostones that are generally characterized by high visible pinpoint and vuggy porosity. Porosity is variable throughout this part of the succession. Vugs up to 10 cm but typically < 5 cm long are common throughout. There is no obvious origin to the irregular-shaped vugs.

The Cayman Formation, from ~ 76 ft to the base of the core, is formed of dolostones with variable porosity. Between 76 and 100 ft, it is formed of finely crystalline dolostones with pinpoint and vuggy

Figure 19. Examples of natural fractures in cores from wells DUM-1 and DUM-2 at depths of ~376 ft and ~115 ft, respectively. Core is 4 in (~10 cm) in diameter.

porosity, with most vugs <1 cm long (e.g., C5-2). Below 100 ft, the porosity is more variable. Below 108 ft there are scattered vugs and some fractures (e.g., C9-6) whereas other parts have little visible porosity (e.g., C10-4). Below 115 ft there is a notable decrease in visible porosity with only scattered vugs and pinpoint porosity being evident. Some intervals (typically < 1 ft thick) are characterized by fossil-mouldic porosity, possibly after branching corals (base of C13-3). Low porosity is evident to the base of core 15 at a depth of 205 ft.

The downhole video from DUM-1 shows relatively consistent patterns of porosity from 165 to 405 ft (Figs. 21, 22). Panoramic views of the walls of the borehole show a relatively consistent pattern of pinpoint porosity with small vugs at various depths. Some of the larger vugs probably formed through the dissolution of the aragonitic skeletons of branching corals (e.g, Fig. 21D, J, K, 22D-F). Below ~330 ft there is a notable change in porosity style with thin, elongate pores (long axes parallel to bedding) being dominant (Fig. 22G-R). The origin of these pores is unknown. From 350 ft to the base of the well at 404 ft, there are numerous well-developed fractures (Fig. 20) that contribute to the overall porosity and also provide avenues for water flow.

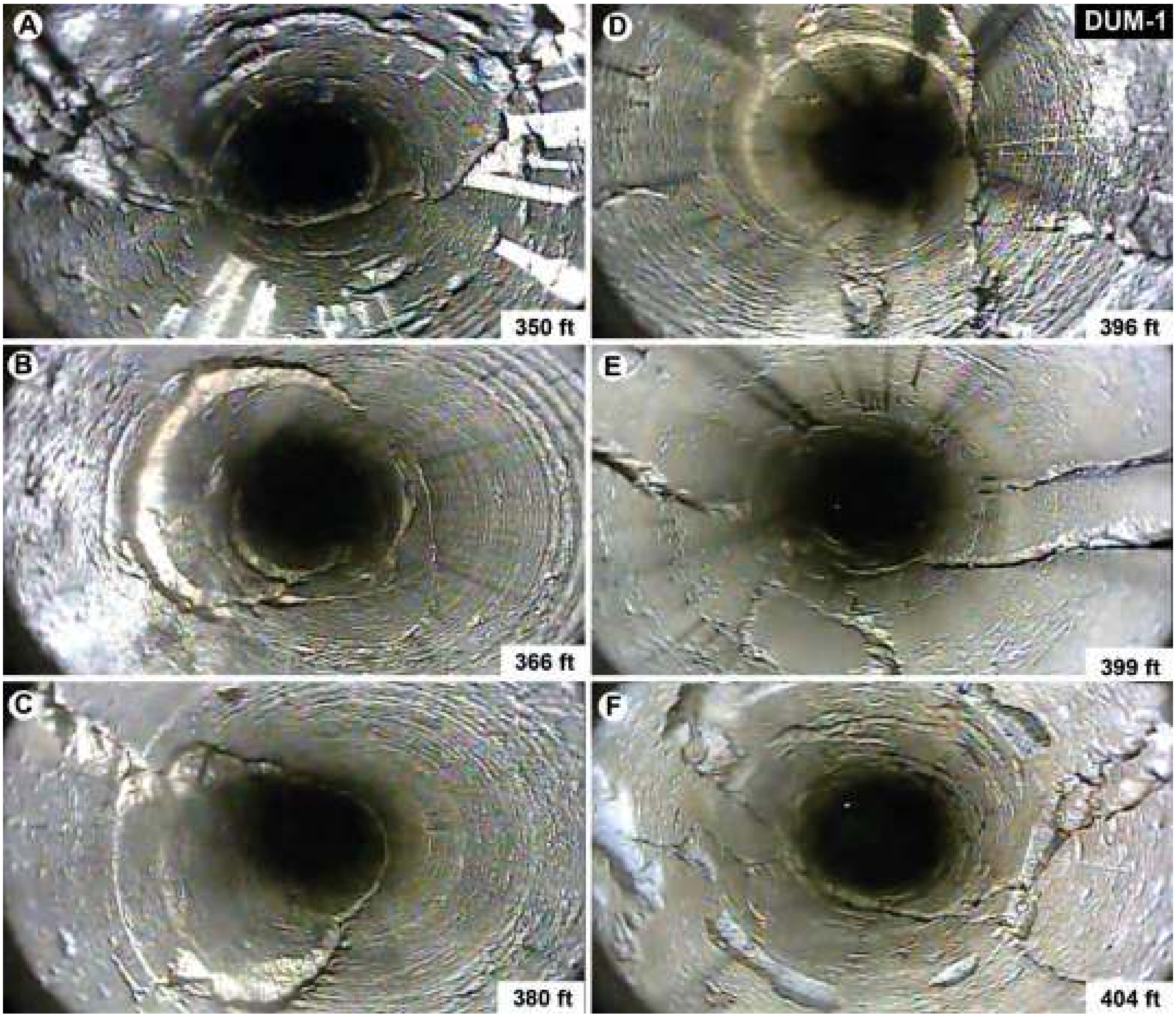


Figure 20. Examples of natural fractures evident in downhole video from DUM-1/2. Specified depths are below ground level.

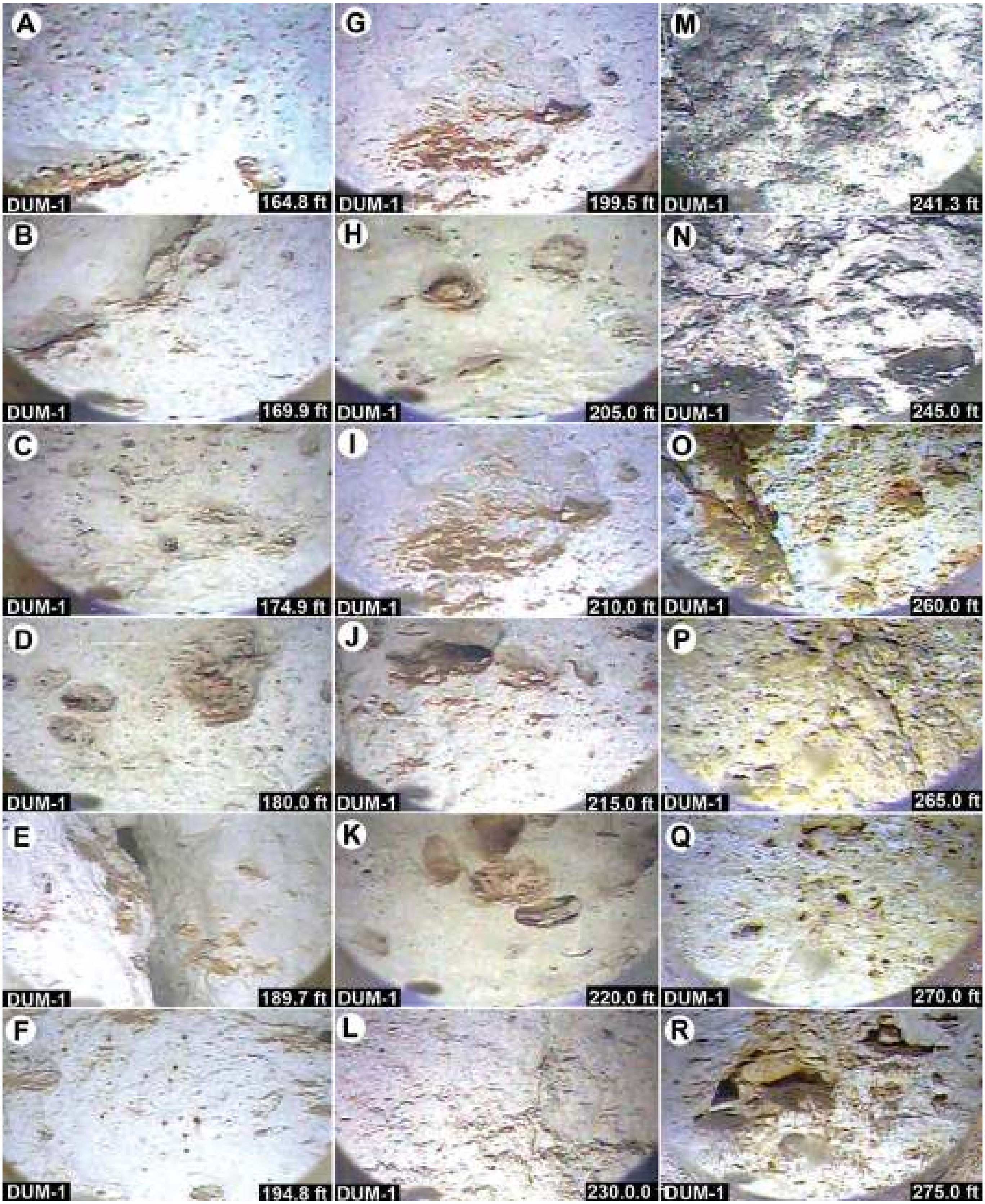


Figure 21. Views of wall of borehole DUM-1 from 164.8 to 275 ft (from downhole video) through Cayman Formation, showing generally homogeneous finely crystalline dolostones with low porosity and scattered, isolated fossil-mouldic porosity (after corals - e.g., panels D and K) and fracture in panel E. Although no scale bar is available for the downhole video, each field of view shown above is estimated to be about 2 in (~ 5 cm) wide. Specified depths are below ground level.

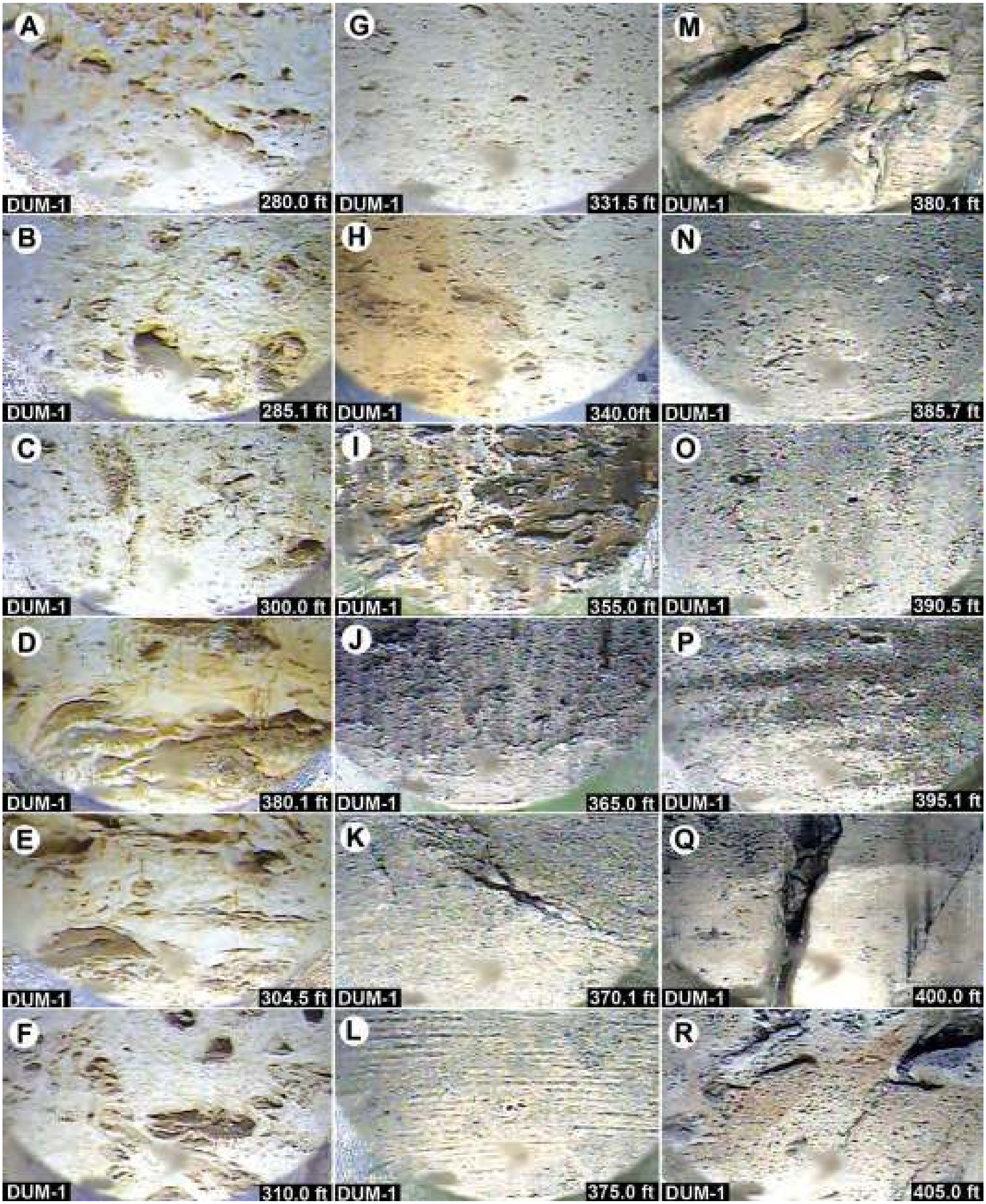


Figure 22. Views of wall of borehole DUM-1 from 280 to 405 ft (from downhole video) through the Cayman Formation and Brac Formation (boundary at ~250 ft), showing variable textures in finely crystalline dolostones with variable porosity that is a mixture of matrix porosity and fossil-mouldic porosity (C to F) and fracture in panels K, M and Q. Although no scale bar is available for the downhole video, each field of view shown above is estimated to be about 2 in (~ 5 cm) wide. Specified depths are below ground level.

TESTED POROSITY/PERMEABILITY

Twenty-eight whole core porosity and permeability analyses were obtained for various core segments from wells DUM-1 (4 samples), DUM-2 (16 samples) and DUM-3 (8 samples). The analyses, performed by Core Laboratories (Houston), included 6 samples from the Pedro Castle Formation, 18 samples from the Cayman Formation, and 4 samples from the Brac Formation (Table 2, Figs. 23-26). For each sample, the permeability (Kmax, K90, Kvert), porosity, and grain densities were determined.

Table 2. Tested porosity, permeability (Kmax, K90, Kvert, porosity, and grain density for selected core samples from wells DUM-1, DUM-2, and DUM-3.

Well	Core Segment	Depth (ft)	Sample Depth (ft)	Kmax (mD)	K90 (mD)	KVert (mD)	Porosity (%)	Grain Density
DUM-2	C1-3	31-40	33	650	275	183	27.7	2.68
DUM-2	C3-7	50-60	57	7590	4550	2170	23.8	2.73
DUM-2	C4-1	60-70	62	116	83.1	6.34	22.2	2.74
DUM-2	C5-1	69.5-79	71	23400	1360	39.7	25.4	2.72
DUM-2	C7-2	87-98	88	3870	3320	1950	39.7	2.81
DUM-2	C8-1	98-108	104	102	23.5	93.3	21.6	2.71
DUM-2	C9-2	108-118	111	15800	6770	17	21.2	2.75
DUM-2	C10-2	118-128	124	1400	20.4	165	14.4	2.78
DUM-2	C10-3	118-128	127	9680	6050	4690	10.5	2.78
DUM-2	C11-4	128-138	137	5300	1160	1840	12.5	2.72
DUM-2	C12-3	138-145	142	91.1	36.2	6.50	13.4	2.71
DUM-2	C13-1	145-155	148	166	13.1	67.4	13.3	2.74
DUM-2	C13-3	145-155	150	305	174	6.83	11.5	2.76
DUM-2	C14-1	160-170	162	1033.5	534.8	182.4	14.4	2.66
DUM-2	C14-4	160-170	169	5	2.87	0.007	11.4	2.66
DUM-2	C15-2	200-208	204	5890	134	53.6	17.3	2.78
DUM-1	C1-2	250.5-260.5	254	281	212	79.7	21.3	2.80
DUM-1	C2-1	310-320	310	23800	15900	0.237	13.4	2.74
DUM-1	C3-1	338.5-346.5	340	5330	824	7.99	10.1	2.68
DUM-1	C4-6	372.5-382.5	379	7670	6580	3990	18.9	2.80
DUM-3	C2-2	37.5-46	38	2220	74	0.122	24.2	2.69
DUM-3	C3-5	46-52	50	82.8	7.66	2.64	18.5	2.70
DUM-3	C6-2A	63-72	66	0.104	0.028	0.014	13.4	2.77
DUM-3	C8-2A	78-88	80	23.5	4.96	3.86	15.8	2.76
DUM-3	C10-3A	97-107	102	442	36	11.1	27.7	27.7
DUM-3	C12-3B	117-127	121	247	77.1	80.6	20.2	2.77
DUM-3	C13-5A	127-137	135	11700	4660	20.8	14.5	2.69
DUM-3	C14-7B	137-147	145	23800	11900	6990	26.0	2.75

Table 3. Summary statistics for permeability (Kmax, K90, Kvert), porosity, and grain density for selected core samples from wells DUM-1, DUM-2, and DUM-3. Full data are given in Table 2.

Sequence		Kmax (mD)	K90 (mD)	Kvert (mD)	Porosity (%)	Grain Density
ALL	Minimum	0.10	0.028	0.01	10.1	2.66
	Mean	5520	2316	828	18.7	2.74
	Maximum	23800	15900	6990	39.7	2.81
	Number	28	28	28	28	28
PCF	Minimum	0.10	0.028	0.014	13.4	2.68
	Mean	4866	907	343	22	2.73
	Maximum	23400	4550	2170	27.7	2.81
	Number	7	7	7	7	7
CF	Minimum	5	2.87	0.01	10.5	2.66
	Mean	4907	2058	983	18	2.74
	Maximum	23800	11900	6990	39.7	2.81
	Number	17	17	17	17	17
BF	Minimum	281	212	0.24	10.1	2.69
	Mean	9270	5879	1019	16	2.75
	Maximum	23800	15900	3990	21.3	2.77
	Number	4	4	4	4	4

It is important to remember that the tested porosity and permeability values do not include any fracture porosity/permeability (Fig. 20) or large cavities that may be present in the system.

Examination of the fabrics evident in the core segments from which the measured porosity and permeability data were determined (Figs. 23-26) clearly demonstrates the difficulty of trying to estimate these parameters on the basis of visual inspection of the cores. Core 1 (C1) and core 2 (C2) from DUM-1 (Figs. 23A and 23B, respectively), for example, have tested porosities of 21.3% and 13.4%, respectively. Visually comparisons, however, might suggest that the opposite was true given that obvious, large vugs evident in core 2 (Fig. 23B). As with many other cores from DUM-1, DUM-2, and DUM-3, much of the porosity is intercrystalline (i.e. pinpoint) and hence difficult to detect in hand samples. This issue is also clearly illustrated in cores from DUM-2 that are formed largely of finely crystalline dolostone and have tested porosities ranging from 11.4 to 39.7% (Figs. 24, 25). The same is also true for the tested cores from DUM-3 (Fig. 26). Comparison of the measured permeabilities and porosities obtained from the samples from the Pedro Castle Formation, Cayman Formation, and Brac Formation shows that there in considerable variation in all parameters with no discernible patterns to those variations (Tables 2, 3). This variation is also clearly evident in the down-hole plots of each of these parameters (Fig. 27).

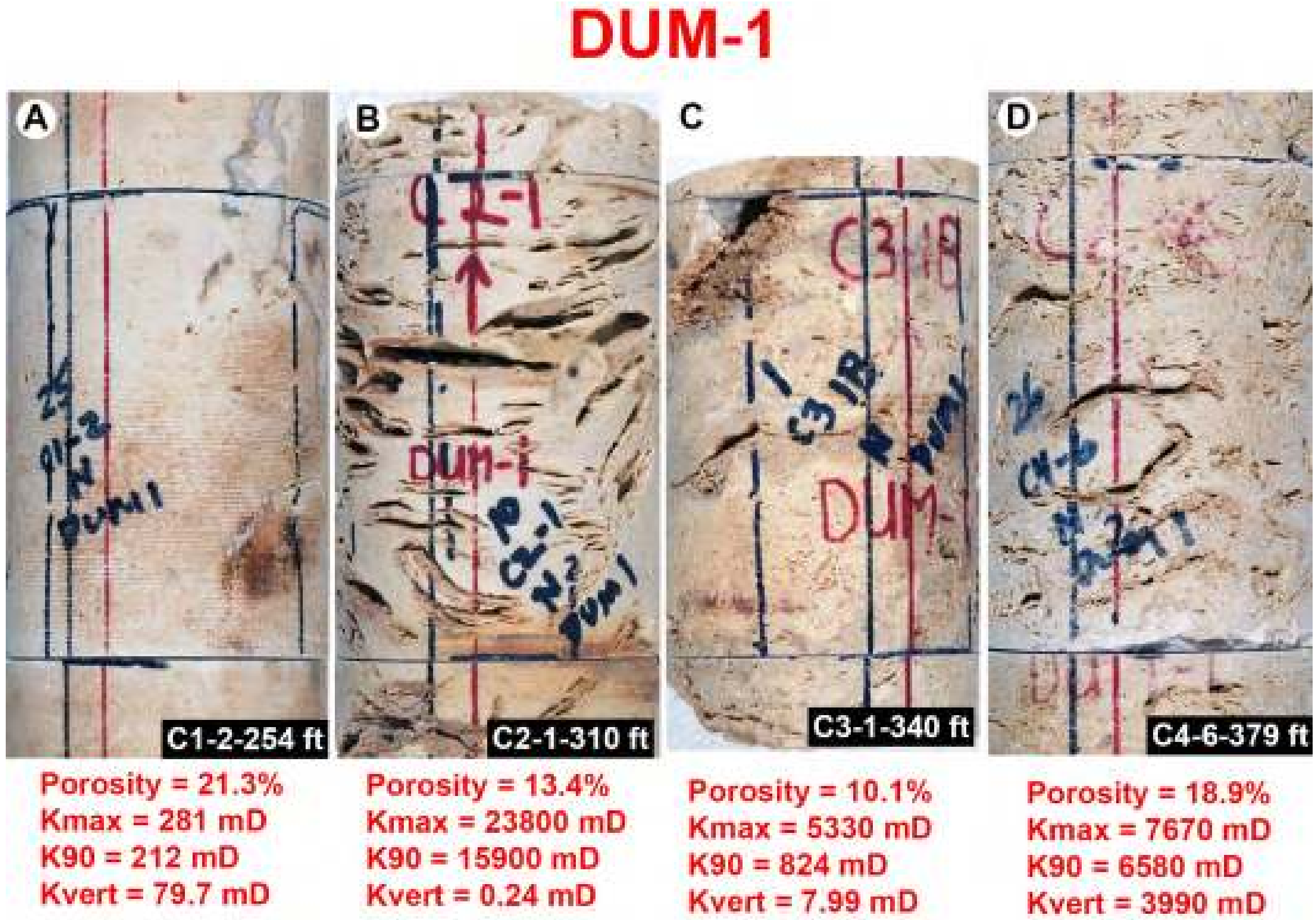


Figure 23. Images of core samples from DUM-1 used for determining tested porosity and permeability. Horizontal cuts across core define limits of core segment used for testing. Positions of core, indicated in bottom right corner of each image gives the core number (e.g., C1-2 and approximate depth of core segment) – see Appendix for images of the entire cores. Markings on core relate to the testing methodology.

Porosity in the samples from the constituent formations ranges from 10 to 40%, with seemingly random variance throughout the succession (Fig. 27). Similarly, Kmax ranges from 0.1 to 23800 mD without any identifiable stratigraphic trends being evident (Fig. 27). Comparison of the porosity and Kmax (Fig. 28) shows that there is no obvious correlation between these two parameters and further emphasizes the degree of variance among these data. The range of permeability (Kmax, K90, Kvert) and porosity values are generally the same for the Pedro Castle Formation, Cayman Formation, and Brac Formation (Table 3).

Collectively, these data indicate that the porosities, as determined from these 28 samples, generally vary from 10 to 40% throughout the succession (Fig. 28). In contrast, the permeability, as measured by Kmax, tends to be less than 5000 mD in most samples with only ten having higher Kmax values (Tables 2, 3, Fig. 28). This is true for all the samples, irrespective of the formation from which they came. For wells DUM-1, DUM-2, and DUM-3, there is no obvious pattern or explanation for the distribution of the layers with high permeabilities.

Figure 24 (next page). Images of core samples from DUM-2 used for determining tested porosity and permeability. Horizontal cuts across core define limits of core segment used for testing. Positions of core, indicated in bottom right corner of each image gives the core number (e.g., C1-3 and approximate depth of core) – see Appendix for images of the entire cores. Markings on core relate to the testing methodology.

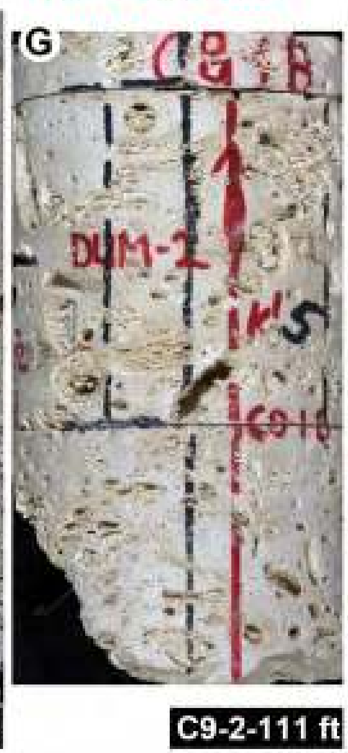
DUM-2

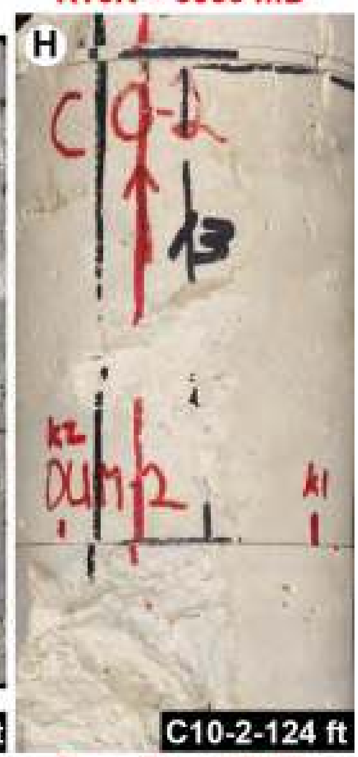
Porosity = 27.7%
Kmax = 650 mD
K90 = 275 mD
Kvert = 183 mD

Porosity = 23.7%
Kmax = 7590 mD
K90 = 4550 mD
Kvert = 2170 mD

Porosity = 22.2%
Kmax = 116 mD
K90 = 83.1 mD
Kvert = 6.34 mD

Porosity = 18.9%
Kmax = 7670 mD
K90 = 6580 mD
Kvert = 3990 mD





Porosity = 39.7%
Kmax = 3870 mD
K90 = 3320 mD
Kvert = 1950 mD

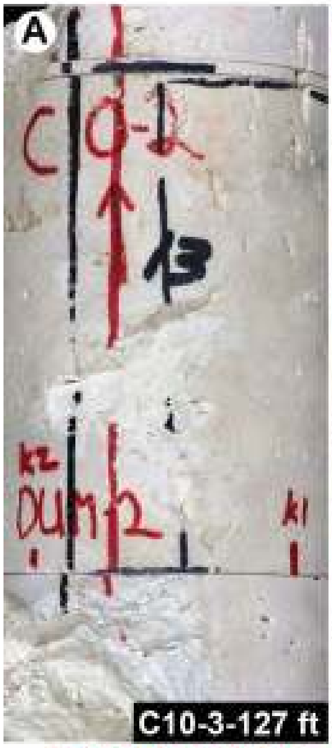
Porosity = 21.6%
Kmax = 102 mD
K90 = 23.5 mD
Kvert = 93.3 mD

Porosity = 21.2%
Kmax = 15800 mD
K90 = 6770 mD
Kvert = 17 mD

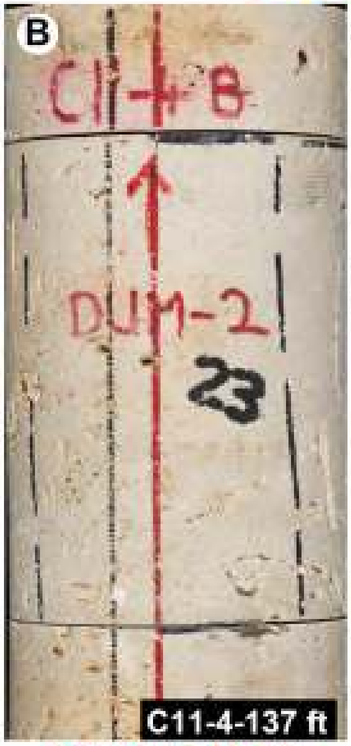
Porosity = 14.4%
Kmax = 4593 mD
K90 = 66.9 mD
Kvert = 541.3 mD

Figure 25 (next page). Images of core samples from DUM-2 used for determining tested porosity and permeability. Horizontal cuts across core define limits of core segment used for testing. Positions of core, indicated in bottom right corner of each image gives the core number (e.g., C1-3 and approximate depth of core segment) – see Appendix for images of the entire cores. Markings on core relate to the testing methodology.

DUM-2



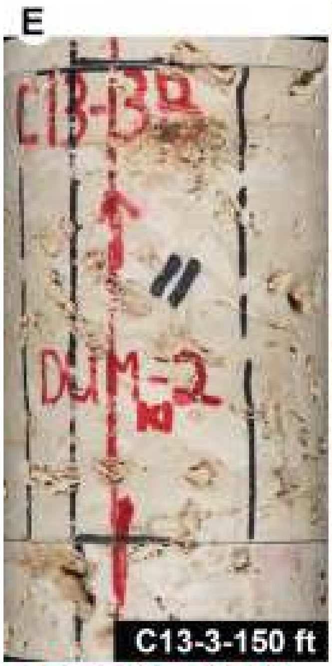
Porosity = 10.5%
Kmax = 9680 mD
K90 = 6050 mD
Kvert = 4690 mD



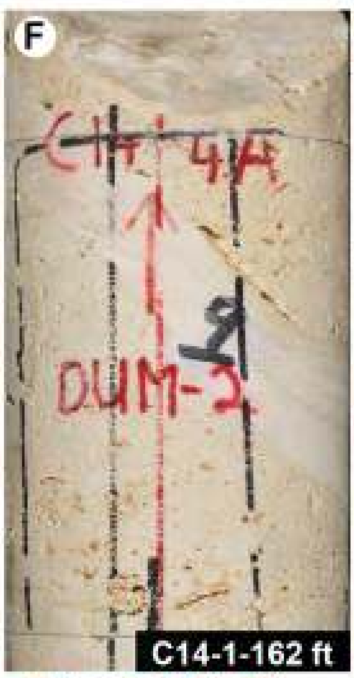
Porosity = 12.5%
Kmax = 5300 mD
K90 = 1160 mD
Kvert = 1840 mD

Porosity = 13.4%
Kmax = 91.1 mD
K90 = 36.2 mD
Kvert = 6.5 mD

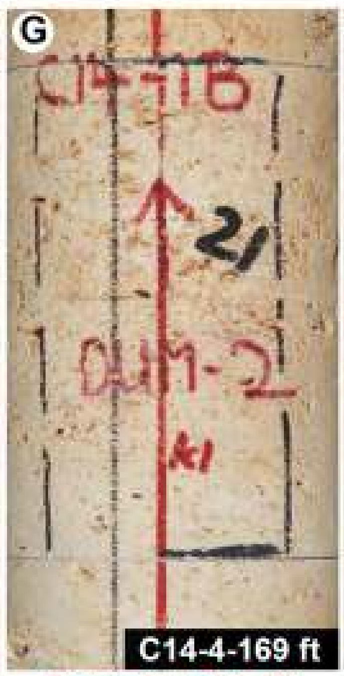
Porosity = 13.3%
Kmax = 544.6 mD
K90 = 43.6 mD
Kvert = 221.1 mD



Porosity = 11.5%
Kmax = 305 mD
K90 = 174 mD
Kvert = 6.83 mD



Porosity = 14.4%
Kmax = 1033.5 mD
K90 = 534.8 mD
Kvert = 182.4 mD

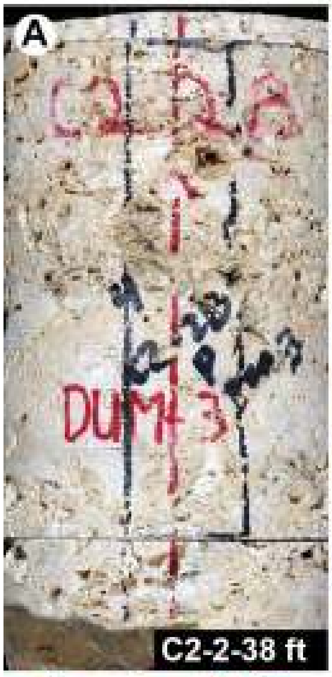


Porosity = 11.4%
Kmax = 5 mD
K90 = 2.87 mD
Kvert = 0.01 mD

Porosity = 17.3%
Kmax = 5890 mD
K90 = 134 mD
Kvert = 53.6 mD

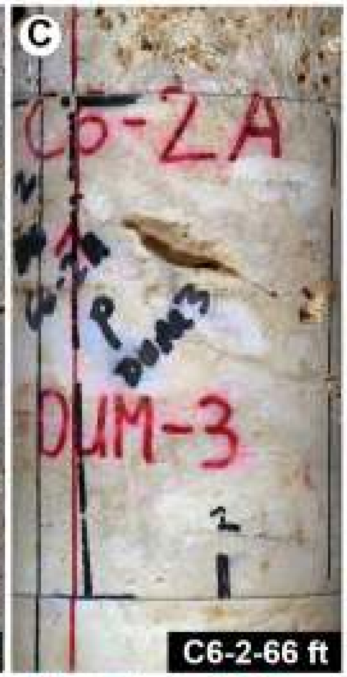
Figure 26 (next page). Images of core samples from DUM-3 used for determining tested porosity and permeability. Horizontal cuts across core define limits of core segment used for testing. Positions of core, indicated in bottom right corner of each image gives the core number (e.g., C2-2 and approximate depth of core segment) – see Appendix for images of the entire cores. Markings on core relate to the testing methodology.

DUM-3



Porosity = 24.2%
Kmax = 2220 mD
K90 = 74 mD
Kvert = 0.12 mD

Porosity = 18.5%
Kmax = 82.8 mD
K90 = 7.66 mD
Kvert = 2.64 mD



Porosity = 13.4%
Kmax = 0.1 mD
K90 = 0.03 mD
Kvert = 0.01 mD

Porosity = 15.8%
Kmax = 23.5 mD
K90 = 4.96 mD
Kvert = 3.86 mD

E

Porosity = 27.7%
Kmax = 442 mD
K90 = 36 mD
Kvert = 11.1 mD

F

Porosity = 20.2%
Kmax = 247 mD
K90 = 80.6 mD
Kvert = 20.2 mD

Porosity = 14.5%
Kmax = 11700 mD
K90 = 4660 mD
Kvert = 20.8 mD

Porosity = 26.0%
Kmax = 23800 mD
K90 = 11900 mD
Kvert = 6990 mD

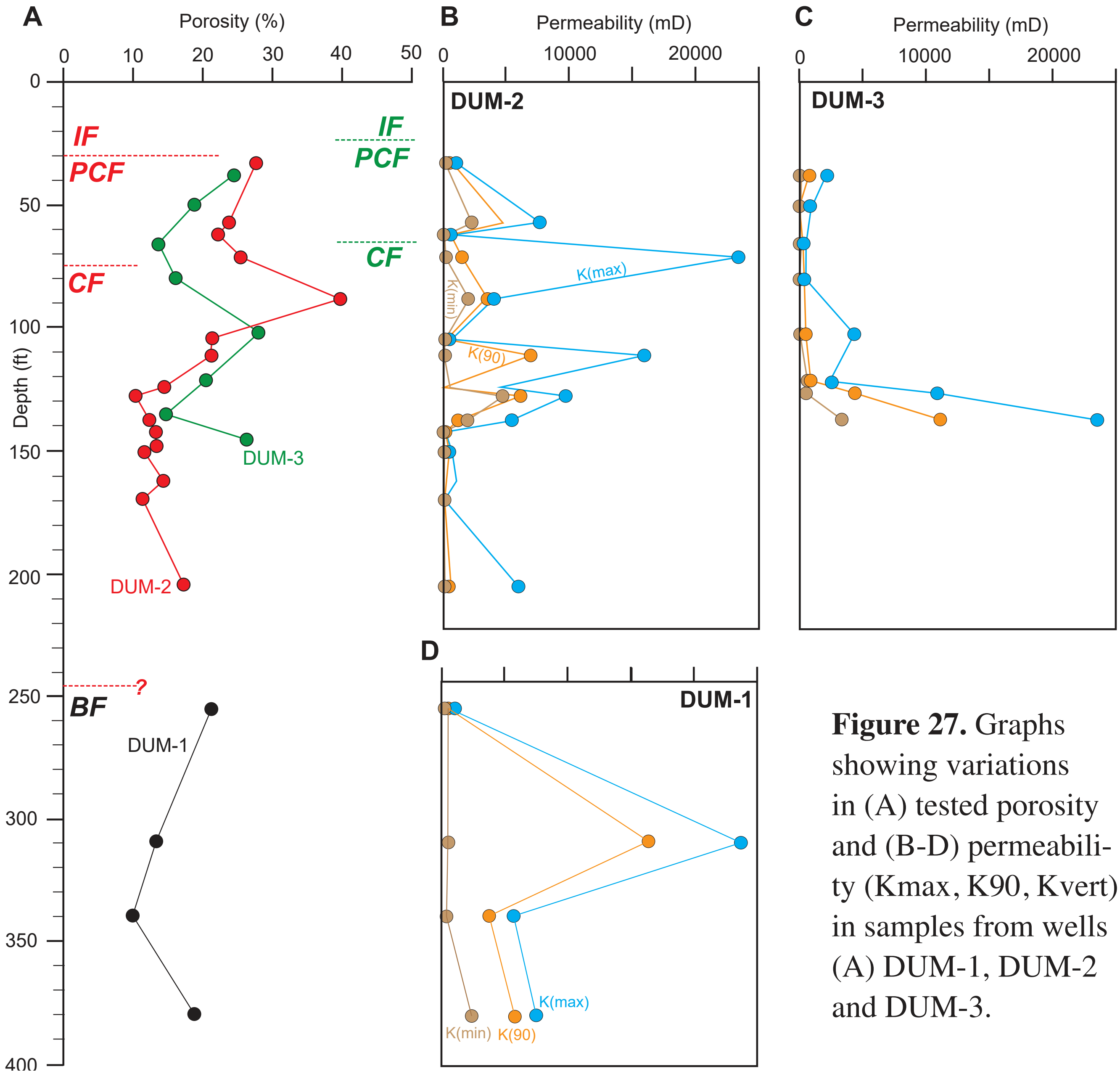


Figure 27. Graphs showing variations in (A) tested porosity and (B-D) permeability (Kmax, K90, Kvert) in samples from wells (A) DUM-1, DUM-2 and DUM-3.

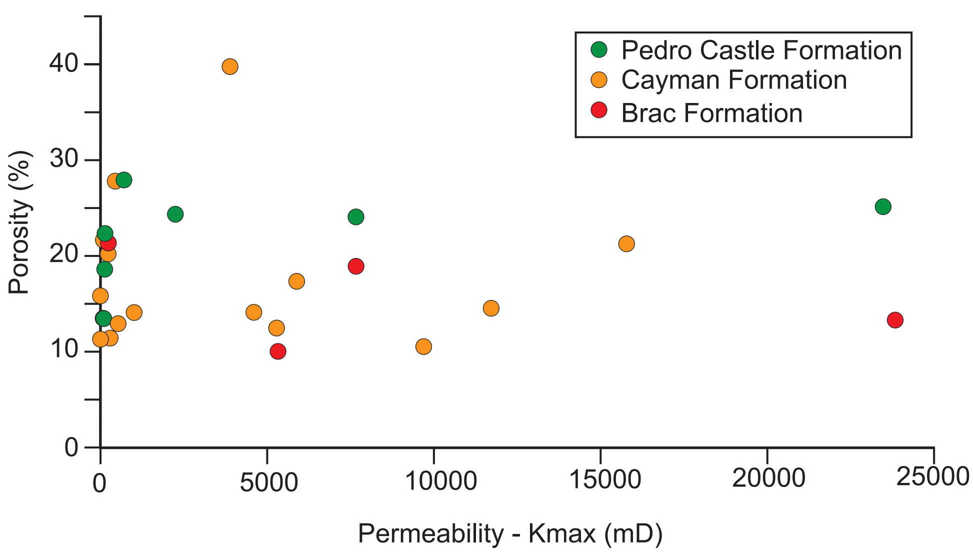


Figure 28
Kmax versus Porosity (%) for all tested samples from the Pedro Castle Formation, Cayman Formation. and Brac Formation in wells DUM-1, DUM-2 and DUM-3.

CORRELATION WITH STRATA IN SURROUNDING AREA

The stratigraphic succession in wells DUM-1 and DUM-2 amd DUM-3 is essentially the same as that seen in the wells that have been drilled elsewhere on the western part of Grand Cayman. There are, however, variations in the thicknesses of the formations and differences in the depths of the formation boundaries. One of the key issues with respect to these wells is the presence/absence of the “cap rock” at the top of the Cayman Formation, which was first identified in well LV#2 based on downhole drilling rates and tested porosity/permeability values (Fig. 5). In the absence of tested porosity/permeability values, identification of the cap rock based solely on drilling rates is complicated by the fact that four different types of drill rigs have been used to drill the wells in the area around the GTLF site and sewerage works. The locations of the cap rock in wells DUM-1 and DUM-2 and DUM-3 are difficult to delineate because there is little downhole variance in the drilling rates (Figs. 10, 11). The wells drilled to the north of the old sewerage work site were drilled using a wire-line system without drilling times being recorded. Accordingly, the identification of the cap rock in the DUM wells and nearby wells must be treated with some caution.

Well SHT#4, drilled 650 ft to the northeast of DUM-1 and DUM-2 is important because it is the deepest well drilled in the area (480 ft), it was fully sampled with the collection of cuttings and numerous cores. Tested porosity and permeability values were obtained from many of the cores (Fig. 8). In that well, the Pedro Castle Unconformity was at a depth of 30 ft, the Cayman Unconformity was at 50 ft, and the Brac Unconformity was tentatively placed at ~260 ft. Based on drilling rates and low tested porosity/permeability values in the upper part of the Cayman Formation, the lower boundary of the “cap rock” was placed at about 105 ft, but it should be noted that it was not clearly defined. In SHT#4, all tested porosities were below 15% for the Pedro Castle Formation and Cayman Formation to a depth of 210 ft and for most of the Brac Formation (Fig. 29). High porosities (>15%) and permeabilities were only found in the basal part of the Cayman Formation between 210 and 260 ft (Figs. 29, 30).

Comparison of the DUM wells with two other wells on the western part of Grand Cayman further illustrates the highly variable nature of the “cap rock”, and the porosity and permeability of the constituent formations. Well GET#1 was drilled 1.7 km to the SSW of the DUM wells, whereas well GTH#1 was drilled 1.7 km to the NNW of the DUM wells (Fig. 1). In well GET#1, the Ironshore Formation was ~10 ft thick, whereas the base of the Cayman Unconformity is at ~80 ft and the base of the Brac Unconformity is at ~240 ft (Fig. 29). For this well, 22 samples from 8 cores (up to 3 samples were taken from individual cores that were up to 10 ft long) showed that the Cayman Formation and Brac Formation were characterized by low porosity (<20% with most <10%) and permeability values (Figs. 29, 30). High porosity and high permeabilty values were only recorded from one core (3 samples) that came from the Pedro Castle Formation (Fig. 29). The “cap rock” in the Cayman Formation was not identified in this well, partly because no drilling records were kept for that well.

For well GTH#1, 1.7 km NNW of the DUM wells, the pattern of porosity and permeability is different from that in GET#1 (Figs. 29, 30). In that well, the Ironshore Formation is ~10 ft thick, the

Cayman Unconformity is at ~38 ft, and the Brac Unconformity is at ~250 ft (Figs. 29, 30). Porosity and permeability values were determined for 14 samples from 9 cores from the Cayman Formation and Brac Formation (Figs. 29, 30). All of the samples from the Cayman Formation (6 samples) and Brac Formation (8 samples) had porosities between 10 and 30% except for one sample from the Cayman Formation and one sample from the Brac Formation that had porosities of 5 to 10% (Fig. 29). With the exception of one sample from the lower part of the Cayman Formation and two samples from the basal part of the well (Brac Formation) permeabilities for all samples were high. The "cap rock" in the Cayman Formation was not identified in this well.

All of the available evidence from the wells at the ReGen site and nearby areas indicate that the general pattern in the Brac Formation, Cayman Formation, and Pedro Castle Formation is of a sequence with generally low porosity and permeability values, but with intermittent units that have high porosity and high permeabilities (Figs. 29, 30). Some caution must be added to this conclusion because of the following considerations:

- The overall patterns of porosity and permeability are based on few samples relative to the depth of each well.
- The core pieces used for determining porosity and permeability are selected so that they do not have any fractures or cavities that cut through the entire diameter of the core. Downhole videos show that fractures are common in some parts of the succession in the ReGen site (Fig. 20). Such fractures will play a major role in the lateral movement of groundwater.
- Caves and large cavities, which are present at various depths, are not captured in tested porosity and permeability values.

In the simplest sense, the succession is characterized by strata with low porosities and low permeabilities but with some strata having high porosities and high permeabilities (Figs. 23, 29, 30). The situation is further complicated by the fact that the pores/vugs in many parts of the succession are isolated with little or no connection between them. There is, however, no clearly identifiable pattern to the distribution of the layers that have both high porosity and high permeability.

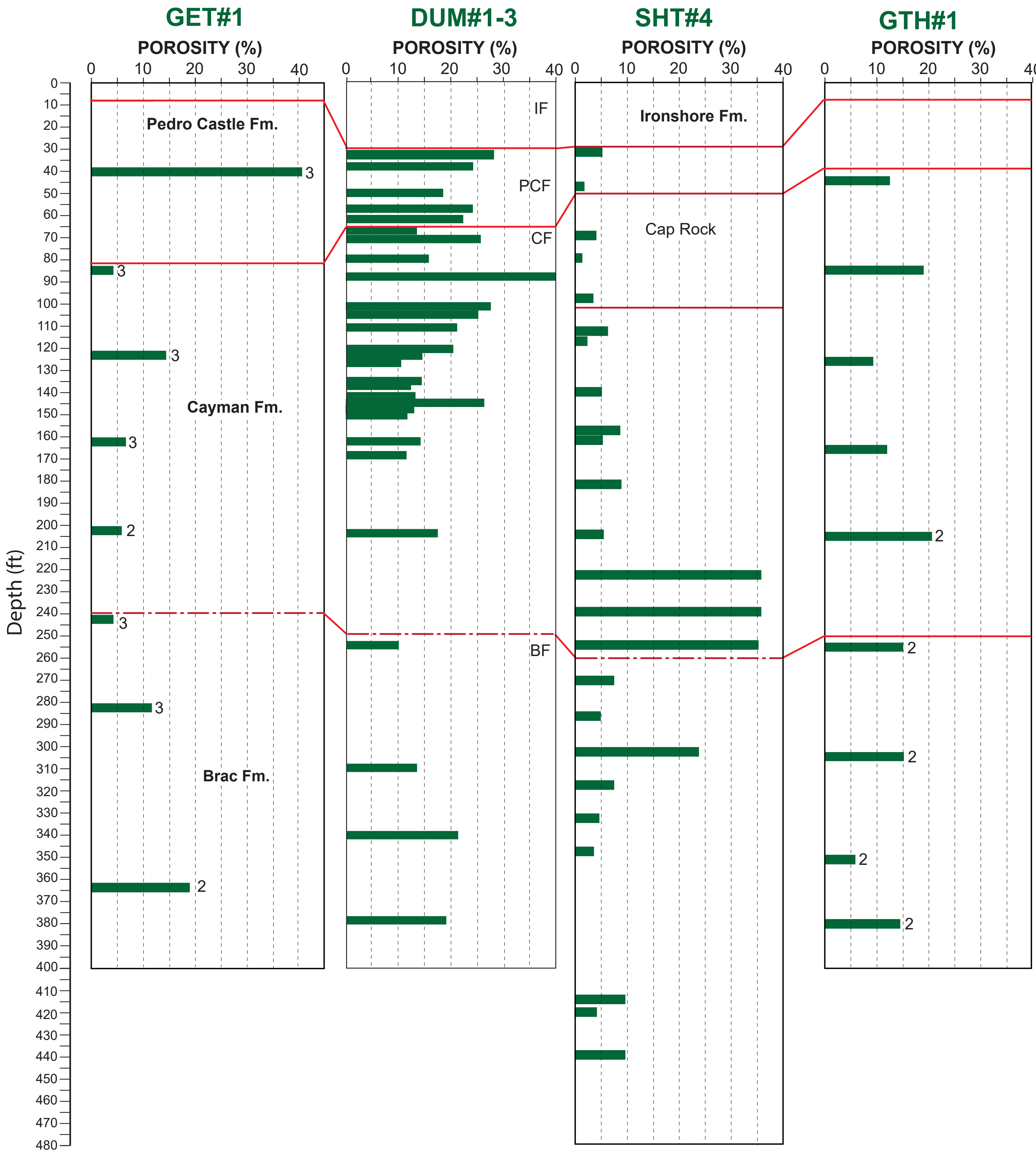


Figure 29. Comparison of porosity values for strata in wells GET#1, DUM1-3 (combined for wells DUM-1, DUM-2, and DUM-3), SHT#4, and GTH#1 (see Fig. 17 for location of wells). See Table 2 for raw data. See Figure 1 for location of wells GET#1 and Fig. 9 for location of well SHT#4. Number on right side of porosity bar indicates number of porosity values obtained from the 10 ft core at that depth - porosity value is average of those samples.

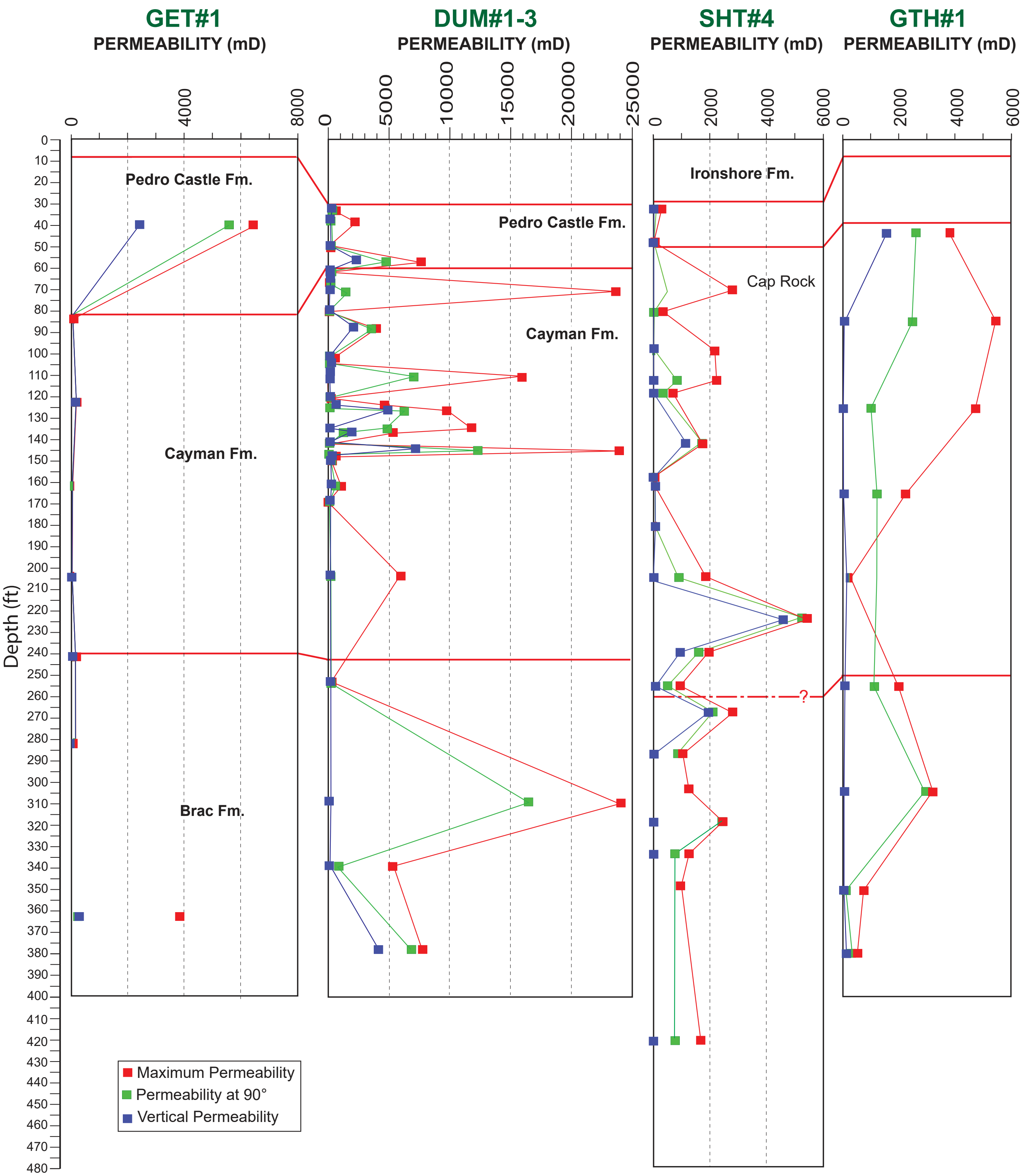


Figure 30. Comparison of permeability (Kmax, K90, and Kvert) values for strata in wells GET#1, DUM1-3 (combined for wells DUM-1, DUM-2, and DUM-3), SHT#4, and GTH#1. See Figure 1 for location of wells GET#1 and GTH#1. See Fig. 9 for location of well SHT#4.

APPENDIX
Core Photographs
DUM-1, DUM-2, DUM-3

CATALOGUE OF CORES FROM WELLS DRILLED AT REGEN SITE

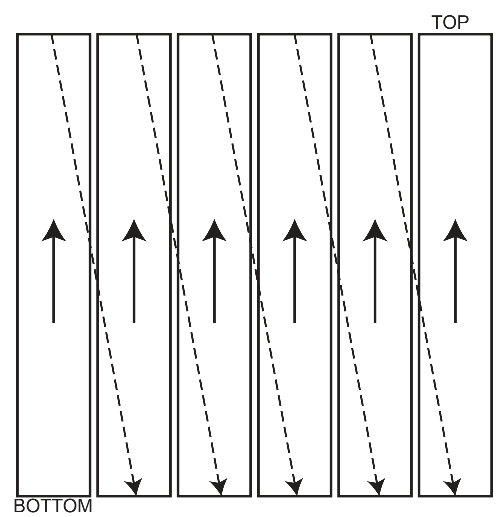
This Appendix provides a systematic documentation of the basic information obtained from wells DUM-1, DUM-2, and DUM-3 that were drilled at the ReGen site.

The photographs of the core are intended to give an overall view of the cores and provide a visual impression of the general lithologies, porosity, and permeability pathways. In viewing these cores the following points should be noted.

- All photographs were taken by APEC Engineering Ltd. while the core was still in the field. The variable light conditions led to variations in some false colors, shadows, and some highlights.
- The core was not cleaned prior to being photographed. Thus, the surface colours evident in the core photographs cannot be treated as being fully indicative of the true rock colour. Some of the discolouration, for example, is probably a surface stain that may have been inherited from the drilling and the core barrel.
- Every effort was made to maintain a consistent scale for all of the cores. Nevertheless, some variance can be expected because of the angles of the cores relative to the camera and the fact that in any single photograph of the core there will be a slight variance in the scale between the centre of the image and the edges of the image.

Order of Cores

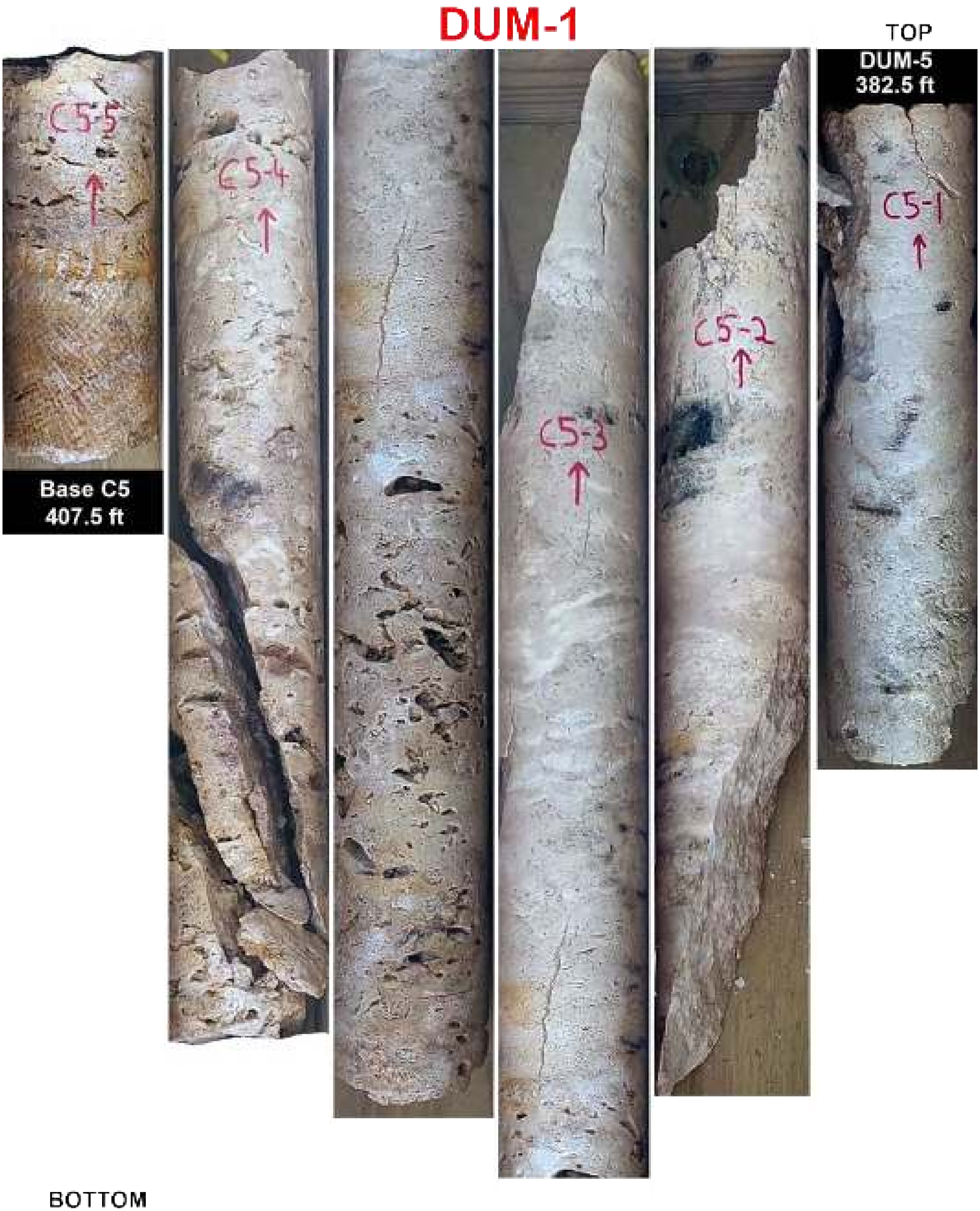
In the following photographs of the cores, the core is consistently ordered as shown on the right.
The top of the core is always in the upper right corner and the bottom of the core is always in the lower left corner.




DUM-1
TOP
DUM-1
C1-250.5 ft
C2-2
C2-310.0 ft
C2-3
C2-1
C2-2
BOTTOM


DUM-1
TOP
DUM-1
C2 - cont'd
C3-2
C2-10
C2-11
C2-8
C2-9
C2-5
C2-6
C2-7
C2-3
C2-4
Base C2
310.0 ft
Base C3
338.5 ft
C3-1
BOTTOM


DUM-1
TOP
DUM-1
C3 - cont'd
C3-3
C3-4
Base C3
346.5 ft
Top C4
372.5 ft
C3-5
C4-1
C4-2
C4-3
C4-4
C4-5
C4-6
C4-7
C4-8
C4-9
C4-10
Base C4
382.5 ft
BOTTOM

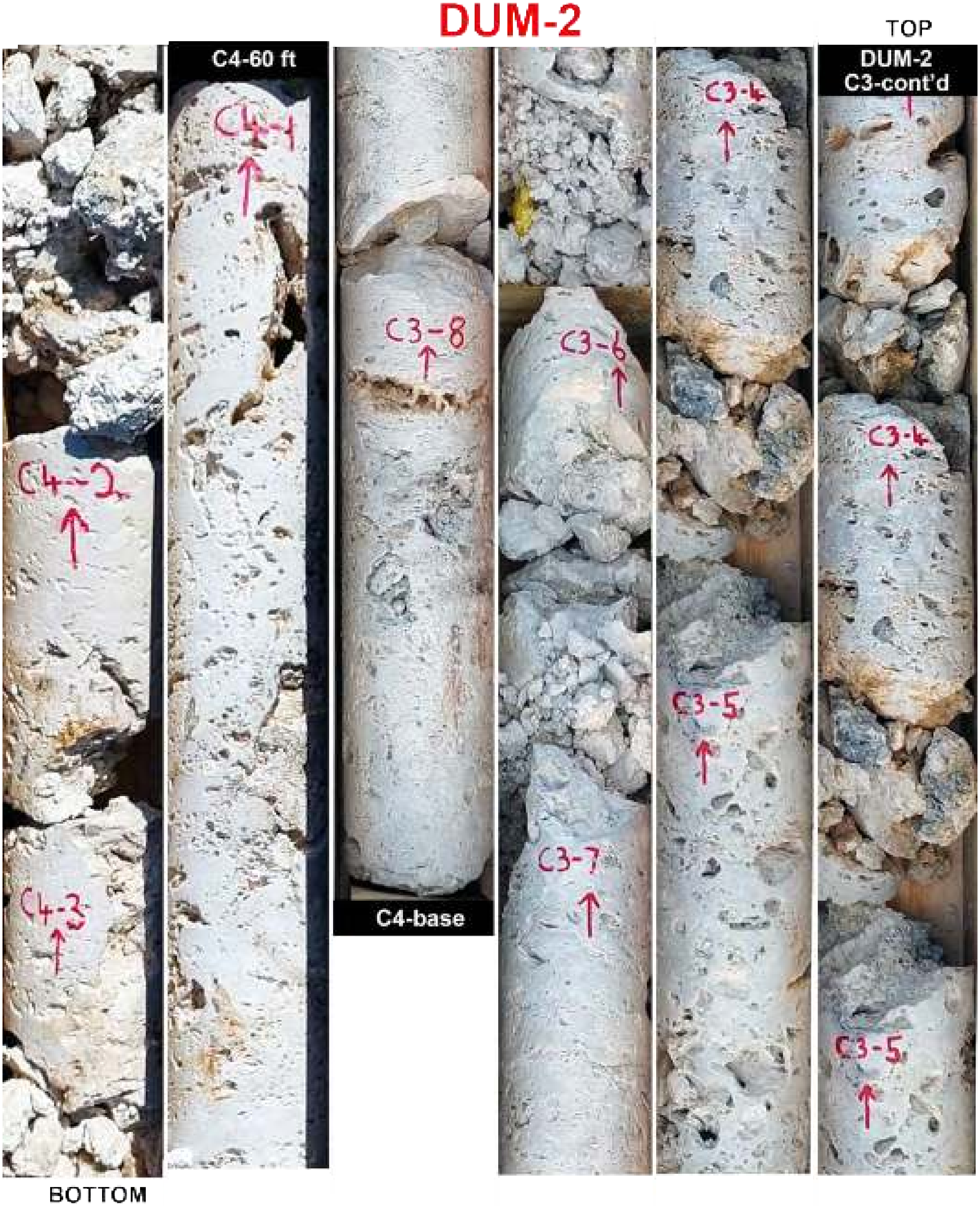

DUM-1
TOP
DUM-5
382.5 ft
C5-1
C5-2
C5-3
C5-4
C5-5
Base C5
407.5 ft
BOTTOM

DUM-2

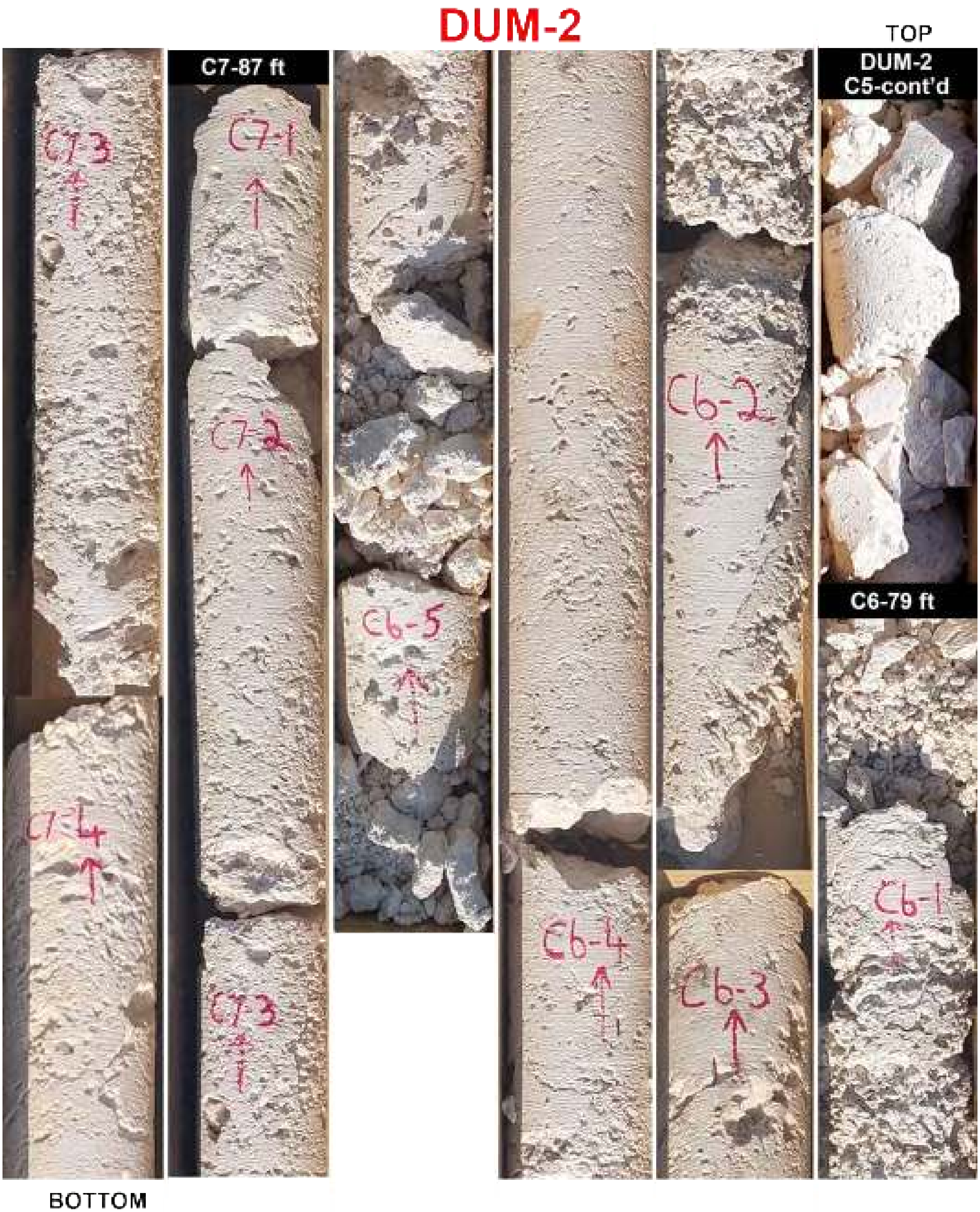
TOP

BOTTOM

DUM-2


TOP
C4-60 ft
DUM-2
C3-cont'd
C4-1
C3-8
C3-6
C3-4
C3-4
C4-2
C3-5
C3-7
C4-3
C3-5
C4-base
BOTTOM


DUM-2
TOP
C5-69.5 ft
DUM-2
C4-cont'd
C5-3
C5-1
C4-7
C4-4
C4-5
C5-4
C4-8
C5-2
C4-6
BOTTOM


DUM-2
TOP
DUM-2
C5-cont'd
C6-79 ft
C7-87 ft
C7-3
C7-4
C7-1
C7-2
C7-3
C6-5
C6-4
C6-2
C6-3
C6-1
BOTTOM

DUM-2

TOP

BOTTOM

DUM-2


TOP
DUM-2
C9 -108 ft
C10-118 ft
C10-1
C10-2
C10-3
C9-1
C9-2
C9-3
C9-4
C9-5
C9-6
C9-7
BOTTOM

DUM-2


TOP
C11-128 ft
DUM-2
C10-cont'd
C11-1
C11-2
C11-3
C11-4
C10-4
C10-5
C10-6
BOTTOM

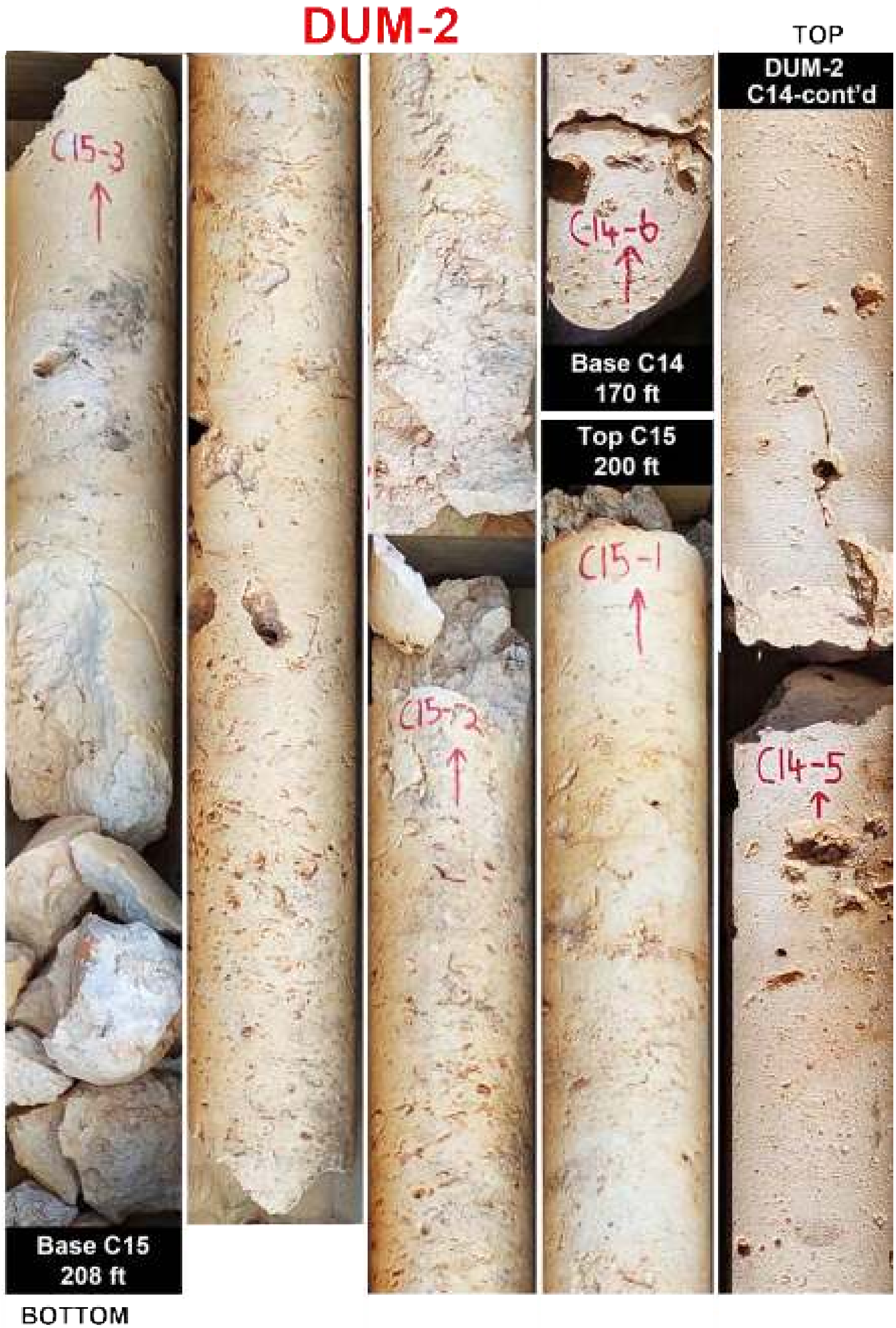
DUM-2


TOP
DUM-2
C11-cont'd
C11-5
Base C11
138 ft
Top C12
138 ft
C12-1
C12-2
C12-3
C12-4
C12-5
C12-6
Base C12
145 ft
Top C13
145 ft
C13-1
C13-2
C13-3
BOTTOM

DUM-2


TOP
DUM-2
C11-cont'd
C11-5
Base C11
138 ft
Top C12
138 ft
C12-1
C12-2
C12-3
C12-4
C12-5
C12-6
Base C12
145 ft
Top C13
145 ft
C13-1
C13-2
C13-3
BOTTOM

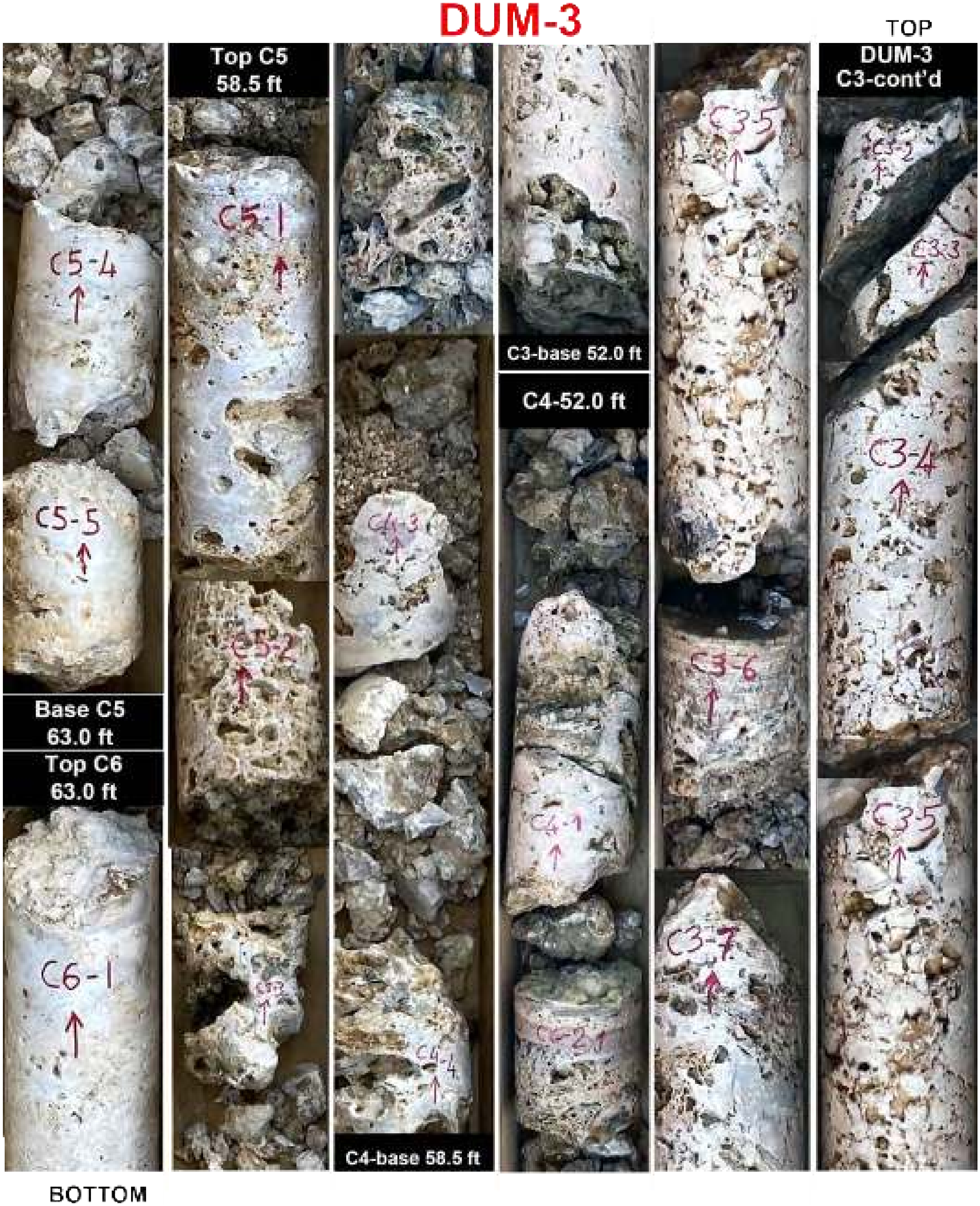

DUM-2
TOP
DUM-2
C13-cont'd
C14-4
C14-3
Top C14
160 ft
C14-1
C14-2
C13-5
Base C13
155 ft
C13-4
BOTTOM



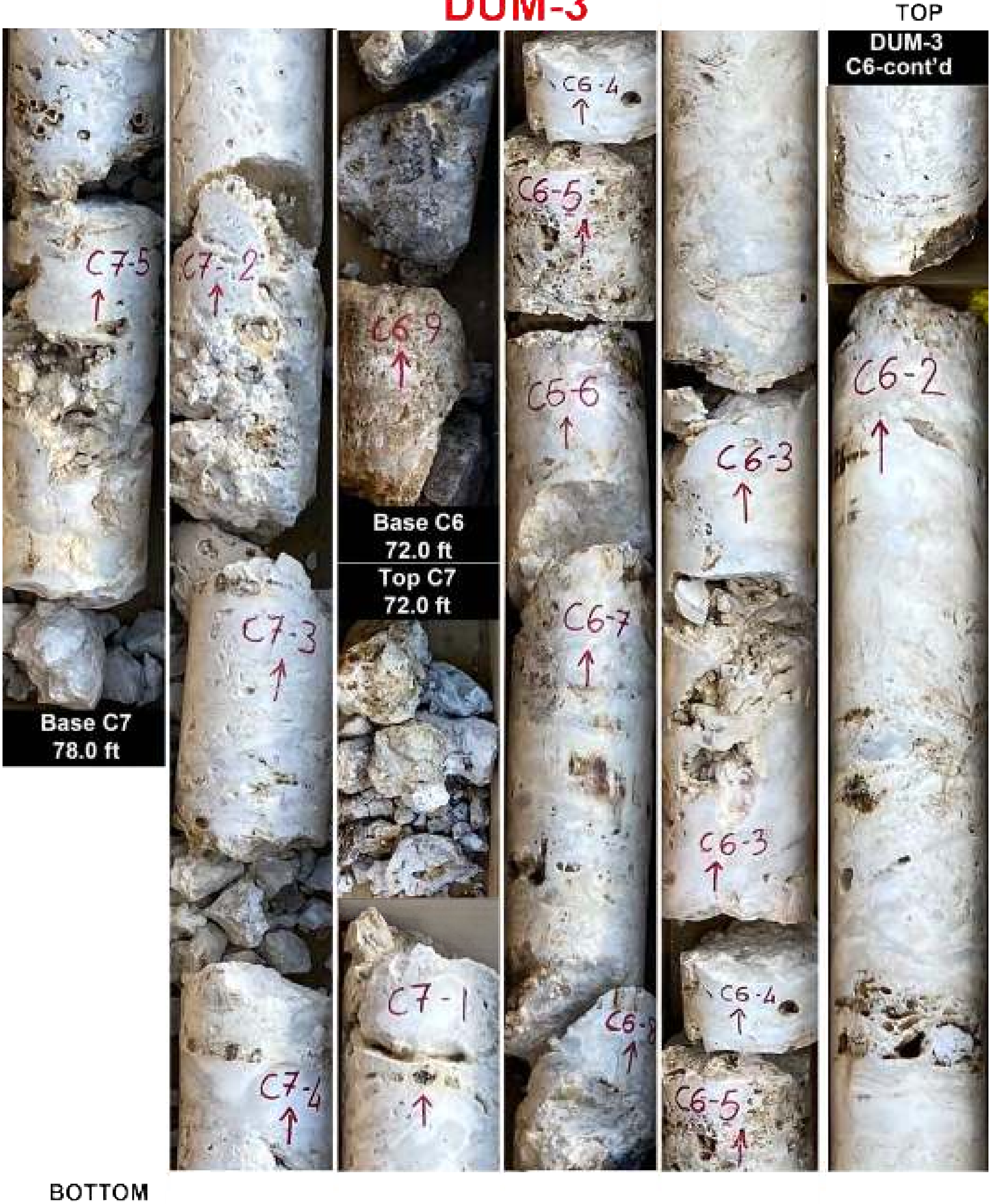
DUM-2
TOP
DUM-2
C14-cont'd
C15-3
C14-6
Base C14
170 ft
Top C15
200 ft
C15-1
C15-2
C14-5
Base C15
208 ft
BOTTOM


DUM-3
TOP
DUM-3
C1-28.5 ft
DUM-3
C2-37.5 ft
Base C2
46 ft
Top C3
46 ft
C2-4
C2-1
C2-2
C2-3
C3-1
C1-1
C1-2
C1-3
C1-4
C1-5
C1-6
C1-7
C1-base 37.5 ft
BOTTOM

DUM-3


TOP
DUM-3
C3-cont'd
C3-2
C3-3
C3-4
C3-5
C3-5
C3-6
C3-7
C3-base 52.0 ft
C4-52.0 ft
C4-1
C4-2
C4-3
C4-4
C4-base 58.5 ft
Top C5
58.5 ft
C5-1
C5-2
C5-4
C5-5
Base C5
63.0 ft
Top C6
63.0 ft
C6-1
BOTTOM

DUM-3

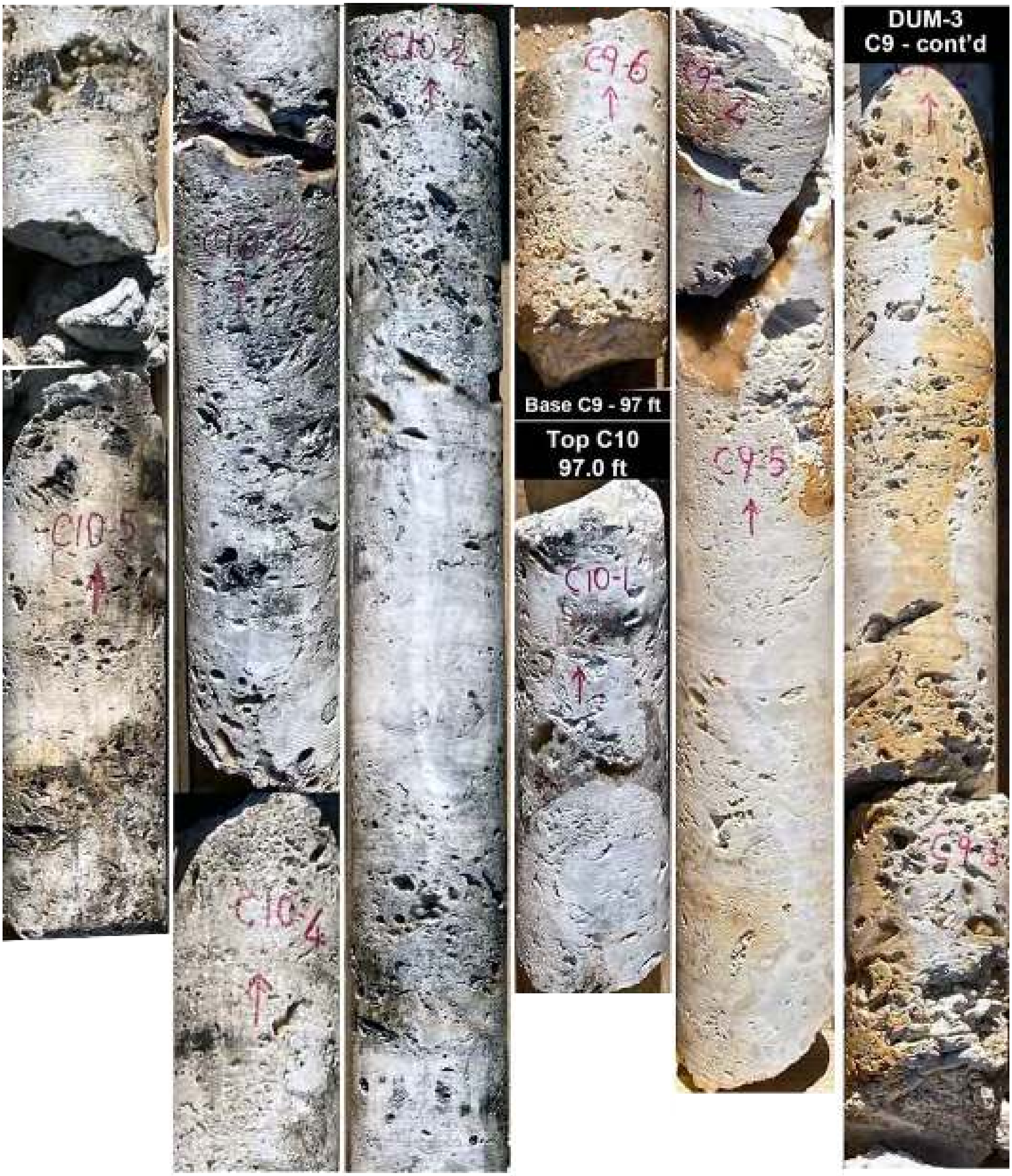

TOP
DUM-3
C6-cont'd
C6-2
C6-3
C6-3
C6-4
C6-5
C6-4
C6-5
C6-6
C6-7
C6-8
C6-9
Base C6
72.0 ft
Top C7
72.0 ft
C7-1
C7-2
C7-3
C7-4
C7-5
Base C7
78.0 ft
BOTTOM

DUM-3


TOP
DUM-3
C8-cont'd
C8-1
C8-2
C8-3
C8-4
C8-5
Base C8 - 78 ft
Top C9
88.0 ft
C9-1
BOTTOM

DUM-3

TOP



BOTTOM

DUM-3

TOP

BOTTOM

DUM-3

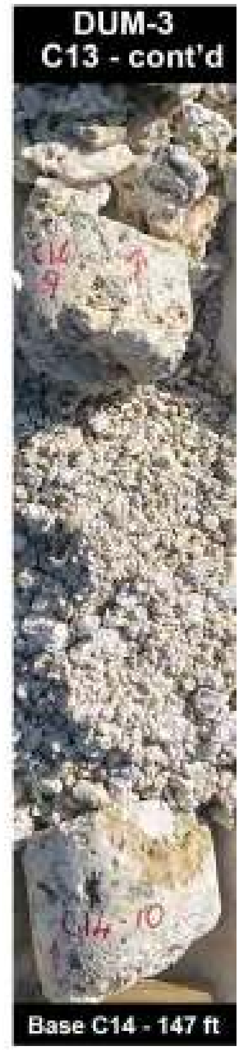

TOP
DUM-3
C12 - cont'd
Top C13
127.0 ft
C13-1
C13-2
C13-3
C13-4
C12-3
C12-4
C12-5
C12-6
C12-7
C12-8
C12-9
Base C12 - 127 ft
BOTTOM

DUM-3

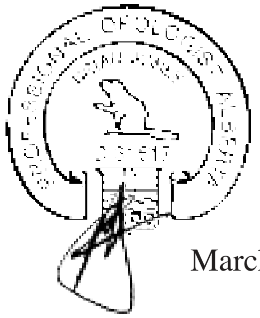
TOP
DUM-3
C13 - cont'd
C13-5
C13-6
C13-7
Base C13 - 137 ft
Top C14
137.0 ft
C14-1
C14-4
C14-5
C14-6
C14-7
C14-8
BOTTOM

DUM-3

TOP



BOTTOM



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Appendix 9.A

Land Quality Assessment

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Appendices

Appendix A	Landfill Gas Collection System Plan
Appendix B	Grand Cayman Proposed Integrated Waste Management System, ReGen, Geotechnical Investigation and Report. AEC, July 2023

1. Introduction

1.1 Purpose of this report

ReGen ('the proponent') is seeking approval for the development of an Integrated Solid Waste Management System (ISWMS) in the Cayman Islands ('the project'). Construction and operation of the Project is proposed to allow the existing George Town Landfill (GTLF) to be closed, remediated, and replaced with an integrated waste management philosophy based on the core principles of the international waste hierarchy.

The purpose of this report is to identify geotechnical and land quality issues that may affect the proposed development.

1.2 Overview of the proposed development

Each year, approximately 115,000 tons of solid waste is produced in the Cayman Islands, with the overwhelming majority of the material presently being managed by the GTLF. This landfill capacity is, however, finite and in accordance with the provisions of both the National Solid Waste Management Strategy for the Cayman Islands (2016) and the National Planning Framework (draft for public consultation) (2018), the ToR has been prepared in relation to the proposed development of a replacement ISWMS for the Cayman Islands.

The proposed ISWMS site is located to the north of central George Town towards the western coast of Grand Cayman, immediately south-west of the existing GTLF. The proposed ISWMS is a multi-facility development, including an energy recovery facility (ERF) and supporting non-ERF waste processing, treatment, and disposal facilities. Construction and operation of the ISWMS would allow the existing landfills in George Town, Cayman Brac and Little Cayman to be closed and remediated.

1.3 Study area

1.3.1 Spatial scope

The proposed ISWMS solution is described in detail in Chapter 4 - Proposed Project & Overview.

The ISWMS will be located to the north of central Georgetown towards the western coast of Grand Cayman (the "Site"). The proposed boundary and layout of the ISWMS is shown in Figure 1.

The Study Area considered within this report encompasses the entire footprint of the ISWMS and some of its environs. The ISWMS will include the following elements:

– Energy Recovery Facility (ERF)
– Non-Energy Recovery Facilities:
  - Site weighbridges
  - Green Waste Processing Facility (GWPF)
  - Construction and Demolition Waste Processing Facility (C&DWPF)
  - Bottom Ash Processing Facility (BAPF)
  - Abandoned and End of Life / Scrap Metal Processing Facility (ELV/SMPF)
  - Medical Waste Facility
  - Materials Recycling Facility
  - Household Waste Recycling Centre
  - Landfill Gas Facility (LGF)
  - Residual Waste Landfill (RWL)
– Ancillary Facilities:
  - Admin Building
  - Maintenance Building
  - CUC Substation

The Study Area also includes surrounding land within approximately 250 yards, which could potentially be affected by, or contribute to, the migration of ground gases, vapours or wind-blown dusts etc. According to the ToR (Wood, 2021), this includes:

– The existing GTLF, which lies immediately north and east of the Site;
– Parts of the land owned by the Water Authority Cayman to the east of the Site, which comprises four large former wastewater treatment lagoons (now used for sludge storage), current wastewater treatment plant, some buildings and four smaller basins;
– The mangrove and industrial and commercial development (including a concrete batching plant and a concrete block and paver stone manufacturer) to the south of the Site; and
– The Esterly Tibbetts Highway and the land immediately adjacent to it (including parts of the Lakeside Development[1]), which lies to the west of the Site.

For the avoidance of doubt, this land quality assessment excludes:

– Potential contamination effects to, or from, ground- or surface-waters, which are assessed separately elsewhere
– Potential effects resulting from the operation and subsequent closure of the existing landfills on each of the three islands (including the GTLF).

1.3.2 Sub-areas of the Site

In considering the potential geoenvironmental effects, within this report the ISWMS site has been considered as 4 sub-areas as shown in Figure 2:

– **Area 1**: Consists of the northern third of the main ISWMS site, which will include the Residual Waste Landfill (including the hydrated lime and bottom ash weathering areas), the Medical Waste Facility and Leachate Management Facility. It is assumed that, in general, workers will predominantly be outdoors in this area with minimal above-ground buildings and structures (in which gases and vapours may accumulate) and that appropriate PPE and working practices will limit exposure to any soil contamination;
– **Area 2**: All other ISWMS components in the south of the main ISWMS site, including the ERF and admin areas etc. It is understood that this area will include above ground buildings and structures and that workers may be indoors and have no or limited PPE;
– **Area 3**: The CUC Substation, where it is not anticipated that workers will be present except for infrequent maintenance; and
– **Area 4**: Landfill Gas Facility (LGF) will be constructed on the 'Old Landfill' but full details of the facilities construction and operation are not currently available.

1.3.3 Temporal scope

The temporal scope considered within this report covers the construction, operation and decommissioning of the ISWMS. GHD understands that the design life of the new facilities is 25 years.

[1] This development comprises 12 three-storey residential apartments with car parking and leisure/landscape areas (including a small lake)

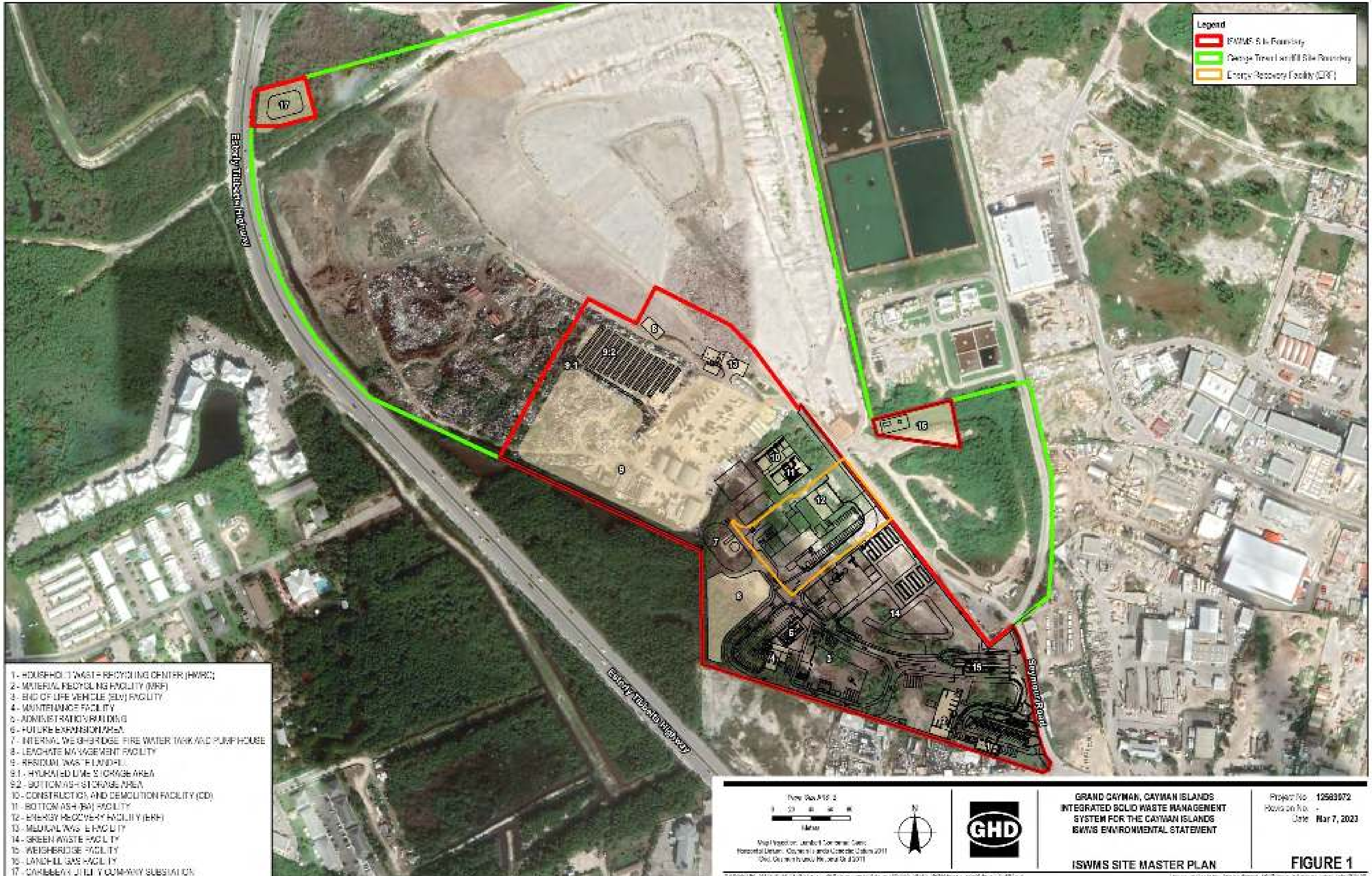

Figure 1 ISWMS Site Master Plan

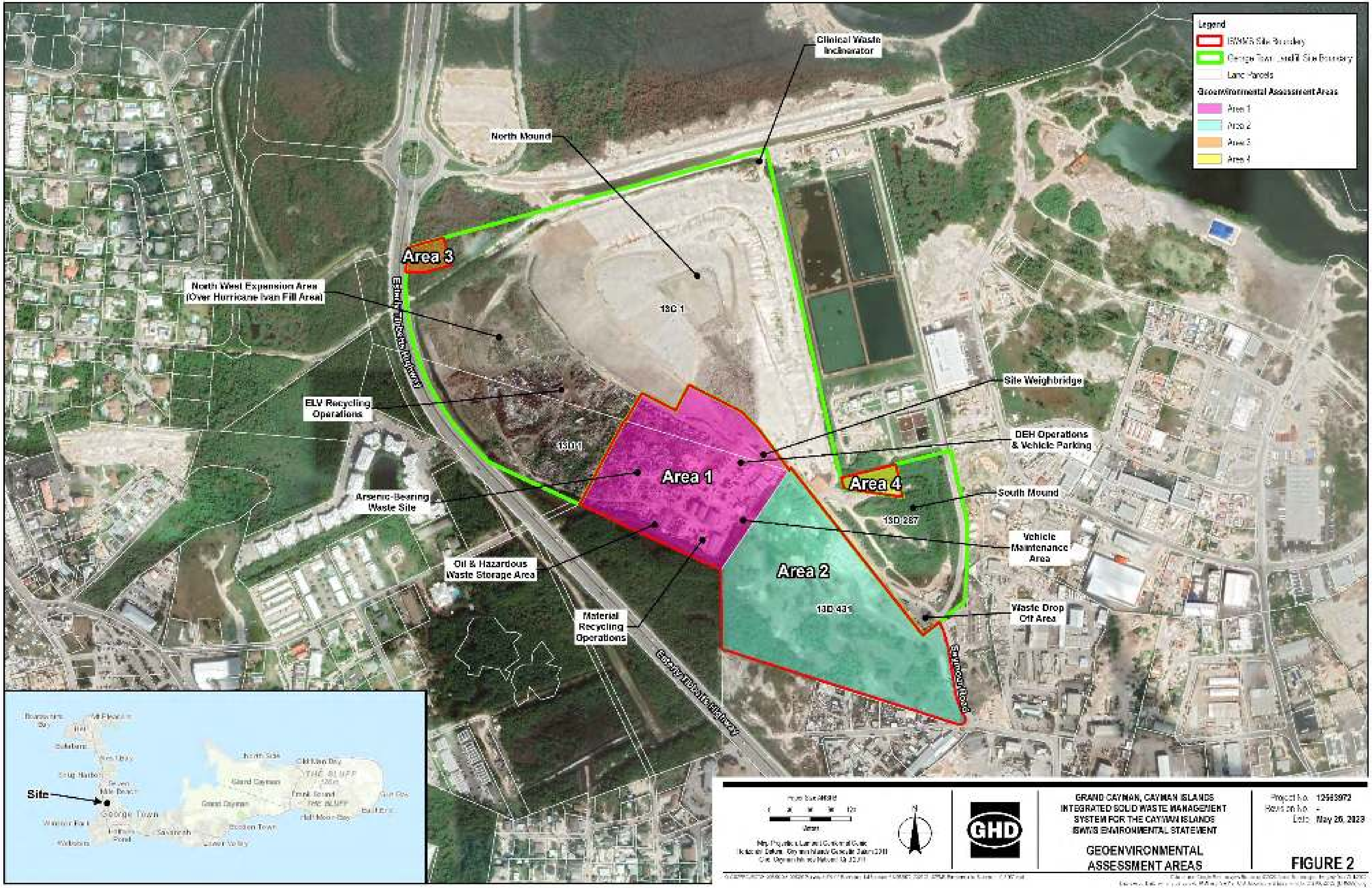

Figure 2 *Showing the four sub-areas considered during the geoenvironmental assessment.*

2. Methodology

2.1 Relationship with other sections of the EIA

This Land Quality Assessment in part overlaps with matters considered in other assessments within the EIA. In particular, as highlighted within the ToR (Wood, 2021) "*The land quality baseline is also inter-related with, and uses information from, other sections of this ToR, particularly … Hydrology (including flood risk) and hydrogeology*". The hydrology and hydrogeology chapter of the EIA are now also being prepared by GHD and due regard has been given to coordinate these chapters. However, land contamination-related dust and odour issues may also be relevant to the Air quality and greenhouse gases emissions assessment.

2.2 Potential receptors

The ToR (Wood, 2021) identified the main potential land quality receptors that could be affected by the proposed development. No additional potential receptors have been identified during this assessment.

However, it should be noted that the most significant receptor for any land contamination is likely to be the water environment (ground and surface waters), which are excluded from the remit of this assessment. The potential effects on surface and ground water receptors are considered within a separate hydrology and hydrogeology assessment.

Table 1 Potential land quality receptors identified in the ToR (Table 5.22 in Wood 2021)

Receptor	Location
Site staff, construction workers and visitors (human health)	Proposed development site
ISWMS infrastructure	Proposed development site
Surrounding land users e.g. residential, commercial/industrial, schools* (human health)	Surrounding land

Notes: * Some surrounding land users may be too far away for there to be any relevant potential contaminant linkages.

2.3 Assessment methodology

The assessment methodology was based on that prescribed within the ToR (Wood, 2021).

The geotechnical and geoenvironmental assessments are generally addressed under separate sections within this Land Quality Assessment.

2.3.1 Consistent terminology

To assist the reader, consistent terminology has been adopted within this Land Quality Assessment. In particular, the word 'effect' is used to describe the consequence of environmental changes that are caused by development-related activities. The word 'impact' should not be used other than in the phrase EIA or where it appears in references).

2.3.2 Review of existing conditions

Available secondary sources of information were collected and reviewed to characterize the existing land quality conditions within the Study Area. A number of documents were identified within the ToR (Wood, 2021) but, in preparing this Land Quality Assessment, GHD identified additional relevant documents. All documents referred to have been cited within the text and fully referenced in Section 11.

It should be noted that where data (e.g., contaminant analysis results) required extraction from the electronic documents (e.g., PDF) provided, this has been done on a 'best endeavours' basis. Where necessary, scanned images were converted using optical character recognition (OCR) technology. However, GHD has not cross-checked the accuracy of the original 3rd party data nor the fidelity of any OCR or transcription, whether manual or digital.

The following sources of secondary information (listed chronologically) have been considered in relation to geology and ground conditions (geotechnical matters):

– Cruise Berthing Terminal for Cayman Islands - Final EIA Terms of Reference (Mott MacDonald, 2013)
– Grand Cayman Waste Management Facility Draft Environmental Statement (Carddno ENTRIX, 2013)
– Landfill Site Environmental Review Task 1: Environmental Investigations and Risk Assessments (Amec Foster Wheeler, 2016a)
– Landfill Site Environmental Review Task 2: Environmental Investigations Interpretative Report, (Amec Foster Wheeler, 2016b)
– Grand Cayman Proposed Integrated Solid Waste Management Facility: Energy Recovery Facility -Geotechnical Investigation and Report (APEC 2021)
– Integrated Solid Waste Management System for the Cayman Islands: Environmental Impact Assessment- Terms of Reference (Wood, 2021)

The following sources of secondary information (listed chronologically) have been considered in relation to land quality, contamination and ground gases (geoenvironmental matters):

– Memorandum: Environmental tests carried out at hurricane debris sites, CIRO (2005)
– Landfill Site Environmental Review Task 1: Environmental Investigations and Risk Assessments (Amec Foster Wheeler, 2016a)
– Landfill Site Environmental Review Task 2: Environmental Investigations Interpretative Report, (Amec Foster Wheeler, 2016b)
– National Solid Waste Management Strategy for the Cayman Islands (Amec Foster Wheeler, 2016c).
– Grand Cayman Residual Waste Composition Analysis 2016 (Amec Foster Wheeler, 2016d).
– Grand Cayman Waste Management Facility Draft Environmental Statement (Carddno ENTRIX, 2013)
– Technical note: Georgetown and Cayman Brac Landfills: Review of DEH Monitoring Report, 31 January 2017 (Amec Foster Wheeler, 2017b)
– Technical note: Georgetown Landfill Site: Surface Emissions Survey September 2016 (Amec Foster Wheeler, 2017a)
– Technical note: Georgetown Landfill Site: Surface Emissions Walkover Survey, April 2018 (Wood, 2018)
– *Cayman Island's Landfill Report Summary 2020: Supplementary Information,* EHL (2020)
– *Cayman Island's Landfill Report Summary 2020: Supplementary Information,* EHL (2021)
– Integrated Solid Waste Management System for the Cayman Islands: Environmental Impact Assessment- Terms of Reference (Wood, 2021)
– Georgetown Landfill: Environmental Risk Based Assessment (GHD, 2021a)
– Georgetown Landfill: Remediation Options Report (GHD, 2021b)

2.3.3 Site visits, inspections and investigations

It was not possible for GHD to undertake bespoke site visits or surveys nor undertake any additional site investigations during the preparation of this Land Quality Assessment. Consequently, the geotechnical and geoenvironmental assessments are based on pre-existing environmental investigation and assessment reports relating to the Study Area.

2.3.4 Geotechnical (land stability) assessment

Based on the information reviewed, the assessment of potential geotechnical effects involved:

– Describing the baseline geotechnical conditions at the Site and the variability within them;
  - Outlining the regional tectonic and seismic information;
  - Identifying factors that may affect the future baseline.
– Assessing any land instability risks to identify any significant effects;
  - Details of the method adopted to determine the significance of each effect is presented in Section 2.3.7.
– Consideration of the influence of any cumulative effects
– Presenting relevant mitigation measures for any significant effects following accepted engineering practice standards with clear confirmation that the proposed mitigative solutions are technically and environmentally sound.

2.3.5 Geoenvironmental (land contamination and ground gases) assessment

Based on the information reviewed, the assessment of potential geoenvironmental effects involved:

– Describing the development history of the Site;
– Describing baseline geoenvironmental conditions[2];
  - Identifying factors that may affect the future baseline
– Assessing any land contamination risks to identify potentially significant effects;
  - Details of the method used to assess each risk (presented in Section 2.3.5.1);
  - Details of the method adopted to assess the significance of each effect (presented in Section 2.3.7).
– Assessing any ground gas or vapour risks to identify potentially significant effects; and
  - Details of the method used to assess each risk (presented in Section 2.3.5.2);
  - Details of the method adopted to assess the significance of each effect (presented in Section 2.3.7).
– Consideration of the influence of any cumulative effects; and
– Presenting relevant mitigation measures for any significant effects following accepted engineering practice standards with clear confirmation that the proposed mitigative solutions are technically and environmentally sound.

2.3.5.1 Land contamination risk assessment

As requested in the ToR (Wood, 2021), the assessment of land contamination was conducted, where possible, in line with UK Environment Agency's online Land Contamination Risk Management (LCRM) guidance[3], which:

– Adopts the sources-pathways-receptors paradigm;
– Requires the development and incremental refinement of a Conceptual Site Model (CSM); and
– Relies heavily on BS10175 (BSI, 2017).

Very little quantitative soils quality data relevant to the Site is available. In line with LCRM, where such data is available, Generic Quantitative Risk Assessment has been undertaken using appropriate Generic Assessment Criteria (GAC).

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2 Very limited quantitative data related to the levels of contamination with the soils and emissions of ground gases and vapours within the footprint of the ISWMS were identified. The baseline presented is therefore based mainly on a qualitative assessment of the available information.

3 https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm . Accessed 7th Sept 2021

The ToR (Wood, 2021) states that the Florida Administrative Code (FAC) (State of Florida, 2005), Contaminant Cleanup Target Levels (CCTL) are the GAC for potential human health risks relevant to the Cayman Islands *"considering geography, climate and given that the FAC levels also consider marine surface water criteria, which is an important factor for the islands*". Given the nature of the waste treatment and landfill facilities of the ISWMS, the CCTL for 'Commercial/Industrial' landuses ($CCTL^{comm}$) are considered the most appropriate for use at the Site.

Although a detailed assessment of risks to groundwater is outside the scope of this report, it is considered appropriate to also screen against GAC for potential risks to the water environment on a precautionary basis. In line with earlier assessments (Amec Foster Wheeler 2016b, GHD 2020a), the Florida's CCTL for the protection of "*groundwater of Low Yield/Poor Quality*" ($CCTL^{GW}$) have been adopted. The CCTLs for such ground waters are generally higher (i.e. 10-times) than those for more sensitive groundwaters. According to Chapter 62-780 of the Florida Administrative Code (State of Florida, 2005), 'Poor quality' means "*groundwater within the affected monitoring zone with background concentrations, as defined in subsection 62-780.200(3), F.A.C., that exceed any of Florida's Primary or Secondary Drinking Water Standards referenced in Chapter 62-550, F.A.C.*" and 'Low yield' means "*groundwater that is contained in an aquifer that has an average hydraulic conductivity of less than one foot per day, determined by performing slug tests or an equivalent method for determining hydraulic conductivity on a minimum of three monitoring wells in each affected monitoring zone; and a maximum yield of 80 gallons per day, determined by pumping a four-inch well screened across the cross-section of the plume, for a minimum of two hours*". Even in the absence of such yield measurements, given the brackish nature of the groundwater beneath the Site and lack of any nearby abstractions, the use of these criteria at the site would seem reasonable.

Consequently, where contaminant concentrations are available, risk screening has been undertaken using the lower, and therefore more stringent, of the CCTL for 'Commercial/Industrial' land uses ($CCTL^{comm}$) and the CCTL for "*groundwater of Low Yield/Poor Quality*" ($CCTL^{GW}$).

2.3.5.2 Ground gas and vapour risk assessment

The assessment of ground gases and vapours was conducted, where possible, in line with British Standard BS 8576:2013 (BSI, 2013). As no quantitative data relevant to the gas regime beneath the footprint of the ISWMS is available, this principally constitutes the development of a gas conceptual site model (gCSM), which includes consideration of the sources of ground gases and vapours in and around the Site, pathways for gas migration and the potential receptors.

Where gas emission data is available its evaluation has been undertaken using British Standard BS 8485 (BSI, 2019), which has superseded CIRIA C665 (S.A Wilson et al., 2007) and the Ground Gas Handbook (S Wilson et al., 2009).

Where ground vapours have been documented due regard has been given to C682 The VOCs Handbook (Baker et al., 2009).

2.3.6 Future baseline

The future baseline should take account of any changes that would occur in the absence of the Project going ahead. For example, any natural processes that would modify the current baseline during the equivalent period as the lifetime of the Project or any enacted changes in legislation or business practices at surrounding sites, which may reduce (or increase) their industrial emissions to the environment.

Where such unavoidable changes are identified in relation to the land quality assessment, these are reflected in suitable amendments to the current baselines in the relevant section of this report.

2.3.7 Significance evaluation

Significance evaluation used a significance test to assess which of the identified potential effects are sufficiently serious to warrant additional mitigation during project planning. The conclusion that is made using the significance test is based upon professional judgement, with reference to the project description, and available information about:

– The magnitude and other characteristics of the potential changes that are expected to be caused by the proposed development;
– The sensitivity of receptors to these changes;
– The effects of these changes on relevant receptors; and
– The value of receptors (where relevant).

The generic approach taken to significance evaluation within this EIA is described in Section 4 of the ToR (Wood 2021). This uses a combination of professional judgement and a topic-specific significance evaluation methodology based on available documents and data.

Within this Land Quality Assessment, the significance of any given effect was assessed using Table 2. Magnitude and Value/Sensitivity scores are defined in Table 3 and Table 4, respectively. Significant effects are those identified as 'High. 'Medium' effects have the potential to be significant, and indeed they would normally be deemed to be significant, but there may be some exceptions depending on the environmental topic and the application of professional judgement.

Table 2 ***Classification of effects (after Table 5.24 in Wood 2021). This table is specifically for assessing the potential geotechnical and geoenvironmental effects identified within this Land Quality Assessment***

Magnitude	Value and Sensitivity of Receptor		
	High	**Medium**	**Low**
High	High	High	Medium
Medium	High	Medium	Medium
Low	Medium	Medium	Low
Negligible	Low	Low	Negligible

2.3.7.1 Value and sensitivity of receptor

The main receptors anticipated are human health and infrastructure (buildings and services etc.) (see Section 2.2). The criteria used to assess the value and sensitivity of these receptors in this Land Quality Assessment are shown in Table 3.

The ToR states that "*The sensitivity of human health receptors should generally be considered as high although it can be less sensitive with, for example, health and safety controls in industrial areas*". Consequently, within this assessment the sensitivity of on-site human health receptors (*i.e.,* Site staff, construction workers and visitors at the ISWMS) has been considered to be medium, while for off-site human health receptor (*i.e.,* surrounding residential, commercial/industrial, schools) it has been considered to be high.

Table 3 ***Definition of the sensitivity assessment criteria for receptors (after Table 5.22 in Wood 2021). This table is specifically for assessing the sensitivity of the land quality receptors.***

Activity	Example Receptor Definition
High	The environmental parameter is fragile, and an effect is likely to leave it in an altered state from which recovery would be difficult or impossible.
Medium	The parameter has a degree of adaptability and resilience and is likely to cope with the changes caused by an effect, although there may be some residual modification as a result.
Low	The parameter is adaptable and is resilient to change.

2.3.7.2 Magnitude

The general criteria used to assess the magnitude of each effect in this Land Quality Assessment are shown in Table 4. No relevant quantitative data was identified regarding soil and ground gas concentrations upon which a quantitative risk assessment could be based. In the absence of such data, uncertainty remains about if, and to what extent, soil contamination and the ground gas regime pose a risk at the Site. Consequently, in assigning magnitude assessment criteria to each potential soil quality and ground gas effects, professional judgement has been used to derive a magnitude score that considered both a likely 'worst case' consequence and the likelihood of such an event arising. For example, where the consequence could potentially be "high" but is considered unlikely or very unlikely to occur, a magnitude of "medium" or "low" were ascribed, respectively.

Table 4 ***Definition of the magnitude assessment criteria for any land quality effects (after Table 5.23 in Wood 2021).***

Activity	Example Receptor Definition
High	Short term, acute effect on human health affecting both site users and users of sites in the vicinity, arising from contamination on the proposed development site, or chronic damage to human health affecting users of both the site and other sites in the vicinity arising from contamination on the proposed development site. Catastrophic damage to buildings or property on the proposed development site arising from contamination or geotechnical risks.
Medium	Chronic damage to human health of users of the proposed development site. Significant damage to buildings or property from contamination or geotechnical risks.
Low	Non-permanent effects to human health e.g., short-term intermittent nuisance such as odours not hazardous to human health. Minor damage to buildings or property from contamination or geotechnical risks.
Negligible	Minimal economic or social uses. Repairable effects of damage to buildings, structures and services e.g., staining or discoloration of building materials.

2.4 Cumulative effects

The ToR (Wood, 2021) identified two potential future developments in the vicinity; the Planned Area Development for Camana Bay; and the proposed Cruise Berthing Facility.

However, due to the nature of geotechnical and geoenvironmental risks, which are unlikely to extend beyond the Site boundary, GHD do not consider that there are likely to be any cumulative effects on land quality due to these potential future developments and so not cumulative affects have been considered within this report.

3. Current baseline: geotechnical

The most relevant geotechnical information available for the approximately 30 acre Site is presented in the APEC Report titled 'Grand Cayman Proposed Integrated Waste Management System, ReGen, Geotechnical Investigation and Report' dated July 2023 (included as Appendix B). A total of 42 geotechnical soundings were performed across the whole Site for this investigation (15 boreholes and 27 test pits). The geotechnical baseline presented hereafter is mainly based on the information provided in the APEC report.

3.1 Topography

According to the ToR (Wood, 2021):

– Site elevation ranges approximately between 7 and 20 ft above mean sea level.
– The surrounding land is mainly flat and low lying, with the exception of the GTLF, and, where developed, is formed from reclamation of former mangrove swamp.
– The GTLF North Mound is approximately 100 ft AMSL and the South Mound is approximately 40 ft AMSL.

3.2 Geology

The three islands, Grand Cayman, Cayman Brac, and Little Cayman are emergent peaks of the generally submerged Cayman Ridge that forms the southern margin of the North American Plate. The islands mainly comprise Pleistocene age cemented corals locally known as the Ironshore Formation overlying Oligocene-Miocene karstic dolomitised limestone Bluff Formation of unknown thickness that in turn overlies igneous granodiorite that forms the core of Cayman ridge.

A review of the APEC report shows that the subsurface stratigraphy at the Site within the normal influence zone of a building foundation likely comprises 4 stratigraphic units: 1) Man Made Deposits, 2) Organic peat, 3) Ironshore Formation (Marl) and 4) Karstic Limestone (Dolostone). These stratigraphic units are briefly described in the following subsections.

3.2.1 Man-made deposits

According to the APEC Report, the man made deposits at the Site consist of two types of materials 1) waste materials interbedded with marl layers (probably placed as daily cover) and are covered with a veneer of topsoil forming the existing ground surface, and 2) shot rock. The APEC test pit and borehole logs show that the waste and marl man made deposits are present in the central and eastern portion of the Site and range in thickness from 0.9 m (3 feet) to 4.9 m (16 feet), with thicker deposits generally encountered along the eastern portion and northern margin of the eastern half of the Site.

The western, junk yard, portion of the Site is generally covered with shot rock although waste material was also encountered at the location of Borehole B-15. The shot rock was approximately 2.4 m (8 feet) to 3.7 m (12 feet) thick.

Additionally, there is a small (approx. 1 acre) geomembrane lined and capped area in the eastern part of the GTLF, within the footprint of the proposed RWL. This area reportedly contains ash, a by-product of Hurricane Ivan timber waste that was burned. The ash is reported to have arsenic content arising from insecticides originally used to treat the timber. No construction records are available for this area but there are some marker posts indicating its position on the ground. The geoenvironmental impact of this containment cell is considered further in Section 8.3.1.

3.2.2 Organic Peat

The presence of a highly compressible organic material (peat) is reported at some locations, in particular in the central part of the site. This 0.3 m (1 foot) to 2.7 m (9 feet) thick layer is either present at the soil surface or mixed and buried beneath the above-described man-made deposits. As reported by APEC (2021), deeper pockets of peat may be present at other locations on the site which may not be detected, if at all, until earthwork for the proposed development commences.

3.2.3 Ironshore Formation

According to Matley (1924, 1926) as reported in Jones (1994) late Pleistocene Ironshore Formation was initially colloquially referred to as the Ironshore due to its indurated calcrete crusted nature and presence along the shoreline, the term that is now used to identify these deposits across the Caymans. The Ironshore Formation was probably deposited in lagoonal, shoal, beach ridge, and reef settings, and is characterized by poorly consolidated friable limestone, calcarenites, and marl/calcite cemented oolitic limestone, when the sea level was approximately 120 m (400 feet) below the present sea level during the Ice Age. Oolitic limestone is made up of small spheres called ooiliths cemented together by lime mud. They form when calcium carbonate is deposited on the surface of sand-sized grains rolled (by waves) around on a shallow sea floor.

APEC (2021) borehole and test pit logs show that the Ironshore Formation extends to depths ranging from approximately 4 m (13.5 feet) to 6 m (20 feet) below ground level (bgl) corresponding to thicknesses of 1.8 m (6 feet) to 3.7 m (12 feet). According to the published geology, the Ironshore Formation encountered on the Island is up to 9 m (29 feet) thick.

Cavities are present in this Formation and typically found in a zone called *epikarst* and located at or near the interface with the Bluff Formation briefly described below.

3.2.4 Bluff Formation - Pedro Castle/ Cayman/ Brac Formations

The Ironshore Formation overlies the middle Oligocene to Pliocene Bluff Formation of karstic dolomitic limestone/ dolostone/ limestone lithologies, which are further subdivided into Pedro Castle Formation, Cayman Formation and Brac Formation in order of increasing depth (Jones 1994).

These formations are characterized by spectacular examples of filled and unfilled karst features[4]. Surficial karst is characterized by cavities and holes giving the Bluff Formation surface a honeycombed appearance. The presence of surficial karst at the Site is strongly indicated by relatively large cavities encountered directly below the Ironshore Formation ranging in depth from 0.9 m (3 feet) to 2.7 m (9 feet) bgl.

3.3 Groundwater table

Groundwater on the Site is globally at a depth ranging from 0.6 m (2 feet) to 1.4 m (4.5 feet) below the existing grades - corresponding to elevation 0 m AMSL. During Mean High Water Spring (MHWS) tide the groundwater elevation reaches higher elevation estimated to approximately 0.6 m (2.0 feet) AMSL.

3.4 Seismicity

3.4.1 Seismic site class

The Cayman Islands use the 2009 International Building Code (IBC), which in turn refers to ASCE 7 for Seismic Site classification.

ASCE 7 requires the assignment of a Seismic Site Class for calculations of earthquake design forces and the structural design based on a two percent probability of exceedance in 50 years. According to ASCE 7, the Seismic Site Class is a function of soil profile and is based on the average properties of the subsoil strata to a depth of 30 m

[4] Jones B, Smith D.S. (1988): Open and Filled Karst Features on the Cayman Islands: Implications for the Recognition of Paleokarst; Canadian Journal of Earth Sciences, 25, p1277 - 1291

(100 feet) below ground level. ASCE 7 provides the following three methods to obtain the average properties for the top 30 m (100 feet) of the subsoil strata:

– Average shear wave velocity
– Average Standard Penetration Test (SPT) N-values (uncorrected for overburden) or
– Average undrained shear strength

The APEC investigations extended to maximum depth of 7.9 m (26 feet) below the existing grades. The SPTs carried out in the Ironshore Formation are not considered representative due to the nature of materials being neither soil nor rock. Based on the criteria listed in Table 20.3.1 of ASCE7-16, and the discussion on local geology above, a Seismic Site Class 'C' can be used for preliminary design purposes pending shear wave velocity measurements.

According to APEC, the following Site coefficients can be used for design purposes.

Table 5 Seismic Coefficients (Source APEC)

Seismic Parameter	Coefficient
Short-period Site Coefficient F_a	1.136
Long-term Site coefficient F_v	1.5
Spectral response acceleration at short period S_{MS}	1.136 x 0.659 = 0.749g
Spectral response acceleration at period of 1 second S_{M1}	1.5 x 0.300 = 0.450g

3.4.2 Earthquakes

Grand Cayman is located on and along a fault line. A major 6.8 magnitude earthquake occurred on December 14, 2004, approximately 20 miles (32 km) south of Georgetown, without causing any damage on the island. A more recent 7.7 magnitude earthquake occurred on January 28, 2020 in the Cayman Islands area with its epicentre located farther and approximately 160 miles (250 km) from Grand Cayman.

A lack of strong events in Grand Cayman in the past 300 years could mean that seismic energy is accumulating in the fault and it may be released in the form of a large magnitude earthquake, estimated to be between Mw 7.2 and 7.5 based on the magnitudes of the three largest events over the past 100 years (Novelo-Casanova, 2010).

3.4.3 Liquefaction

No liquefiable soils are identified at or in the vicinity of the Site.

3.5 Slope stability

The Site is relatively flat, and no slope stability issues are expected.

3.6 Foundation recommendations

The existing waste and marl mix material is not considered suitable for foundation support. The proposed structures may potentially be founded either into the Ironshore Formation or into the Bluff Formation. However, due to the seismic design requirements, most of these structures would likely be required to be supported in the underlying karstic Bluff Limestone.

Different foundation types and site preparation techniques may be used for the construction of the proposed structures. The foundation type and corresponding site preparation to first consider will depend on the structure type (architecture and loads) and the depth of the bearing stratum in the footprint of this structure. The usable foundations features are presented and discussed later in Section 9.1.

4. The George Town Landfill (GTLF)

Based on the available information, contamination within the proposed ISWMS footprint is most likely to be associated with historical waste activities at the GTLF, which is understood to be owned by CIG and operated by the Department of Environmental Health.

4.1 Historical development of the GTLF

Amec Foster Wheeler (2016a) summarised the history of the landfill largely based on an earlier report by Post Buckley Schuh & Jernigan. Observations made during site visits have also been reported by Amec Foster Wheeler (2016a, 2016c).

Amec Foster Wheeler (2016a) state that *"Waste disposal at the site began in the mid 1960's when GIS [sic] leased a 20 acre parcel of land. Canals and dykes were constructed to drain the site and the indigenous mangroves cleared. Some waste was placed below the water table in dredged areas 3 to 6 feet (0.9m – 1.8m) deep where marl was recovered to obtain fill for roads and as cover to the waste deposits. Up until around 1985 the volume of waste deposited in the landfill was reduced by burning. The old landfill area is therefore likely to comprise ash towards the base"*. GHD understand that this refers to the 'Old Landfill Area' shown in Figure 3. **All of the proposed ISWMS footprint, <u>except for Area 4 (Landfill Gas Facility)</u>, appears to lie outside of the Old Landfill Area.**

The majority of the land within the current GTLF footprint, including the Main Landfill Area (Figure 3), was acquired in 1989. It "i*s characterized by a mound rising to 77 ft. (23.6 m) above mean sea level (MSL) and was formed by tipping over an area of former mangrove swamp which was partially excavated to recover the underlying marls (calcareous soils)*" *(*Amec Foster Wheeler, 2016c). In 1989, landfill operations involved *"placing and compacting the solid waste with heavy equipment and covering the waste with soil on a daily basis. The cover soil is generally marl excavated from on-site sources, or supplied by a contractor from off-site sources" (*Amec Foster Wheeler, 2016a). Elsewhere, Amec Foster Wheeler (2016a) confirm that since ~1990 the limestone of the Ironshore Formation[5] has also been excavated to a depth of 14 ft (4.2 m) below the water table for use as daily cover *(*Amec Foster Wheeler, 2016a). In 1991, further land to the south was acquired giving the current total area of ~73 acres or ~30 hectares *(*Amec Foster Wheeler, 2016a, 2016c). The majority of the GTLF site is likely to have received some degree of waste materials (Amec Foster Wheeler, 2016c), with the exception of the outlying extremities to the west of the highway and to the north of the North Canal (Figure 3). **All of the proposed ISWMS footprint appears to lie outside of the Main Landfill Area.**

The Cayman Islands were heavily impacted by Hurricane Ivan in September 2004 and the GTLF was the ultimate destination for much of the cleanup debris. Amec Foster Wheeler (2016a) reported that *"A flat lying area in the north-western part of the site has largely been infilled with demolition and related wastes from the disaster clean-up operations following Hurricane Ivan in 2004. It originally comprised areas of open water arising from previous marl abstraction"*. There is some confusion and uncertainty regarding the exact location and boundaries of this, and other, areas within the GTLF and various names have been used for them in different reports. Figure 3 suggests that the 'Hurricane Ivan Fill Area' (HIFA) extends over most of the land to the west of the Main Landfill Area, but Figure 4 (which is assumed to be based on subsequent clarification of waste locations) suggests that wastes were only deposited in the northern half of the HIFA shown in Figure 3. Based on the apparent infilling of a marl extraction pit (water filled) between 2004 and 2005 (Figure 8 A and B), it seems likely that Hurricane Ivan debris was used to infill this excavation and that the HIFA is limited to that indicated in Figure 4 rather than Figure 3. **All of the proposed ISWMS footprint appears to lie outside of the HIFA.**

The area immediately to the south of the HIFA is not labelled on Figure 4, but Amec Foster Wheeler (2016a, 2016c) reported that during site visits in 2014-2015, scrap metal and tyres were stockpiled in this area. Consequently, within this report we have referred to this area as the 'Old Scrap and Tyre Stockpile Area" (OSTSA). **Apart from parts Area**

5 The Ironshore formation (Cayman Islands) has marl sediment in some places and coral type limestone elsewhere

1 (Residual Waste Landfill and Hydrated Lime and Bottom Ash Storage Areas), most of the proposed ISWMS footprint appears to lie predominantly outside of the OSTSA.

Amec Foster Wheeler (2016a) also reported that *"An arsenic contaminated waste containment pit, which comprises a small geomembrane lined and capped area; is located in the eastern part of the Hurricane Ivan in-fill. Amec Foster Wheeler understands that this contains ash from the burning of treated timber waste arising from the post Hurricane Ivan clean up. The ash is reported to have a high arsenic content due the insectides/fungicides [sic] originally used to treat the timber. No construction records were made available for this area but there are some marker posts indicating its position which were observed on the ground".* Different documents refer to this pit by a variety of names; in Figure 3 it is labelled as the 'Arsenic Containment Pit', and in Figure 4 as the 'Arsenic Fill Site'. Within this report, we have adopted the term "Arsenic Containment Cell".

Figure 4 also shows the anticipated expansion of the Main Landfill Area on to the "NW Extension Area" in order to accommodate wastes received prior to the completion of the ISWMS. **The Arsenic Containment Cell will lie within the ISWMS footprint (Area 1) and will be located beneath the proposed Residual Waste Landfill.**

To the south of the Arsenic Containment Cell areas lies the 'Equipment Storage Area' (ESA) (Figure 3). In relation to this area, Amec Foster Wheeler (2016c) reported that "*Both operational and redundant site plant is stored on a flat stoned area in the southern part of the site. The operational plant includes excavators, a refuse compactor and hook lift trucks. Skips and shipping containers are also stored in this area. There are a number of steel sheeted buildings used variously for the storage of materials (e.g. aluminium cans), the storage of equipment (e.g. a bailer) and for plant maintenance*". Figure 4 refers to these buildings as the "Recycling Compound".

Also in this area, both Figure 3 and Figure 4 identifies an 'Oil and Hazardous Waste Storage Area' (OHWSA) but there is a discrepancy in the exact location of this facility between the two. Amec Foster Wheeler (2016c) noted that this area consisted of:

– *"A waste oil storage area. Waste oils and fuels are stored within a concrete surfaced and bunded hard standing where they are tested and segregated before being pumped into larger shipping tanks prior to export for subsequent off-island recycling or treatment;*
– *Covered and fenced hazardous waste storage compound. This is used for the storage of hazardous waste such as paints and household chemicals. These are subsequently transferred off-island for treatment/disposal; and*
– *On site laboratory used for the testing of waste oils and chemicals delivered to the site"*.

The majority of Area 1 coincides with the ESA and OHWSA, but most of the other areas of the proposed ISWMS footprint appear to lie outside of these areas.

Figure 3 ***Boundary and layout of the Georgetown Landfill according to Amec Foster Wheeler (After Figure 2.2, 2016a)***

Figure 4 Layout of the Georgetown Landfill according to GHD (2021b)

4.2 Current leachate emissions

The GTLF may represent an offsite source of contamination that could affect the ISWMS. GHD is not aware of any relevant soil concentration data but monitoring for CIG (EHL, 2020) includes sampling leachate taken from a "*Ditch at west side of working face*" (Figure 5), which we assume to be indicative of the potential runoff that may reach the ISWMS. However, it is assumed that such migration will be reduced once the GTLF has been closed and restored.

EHL (2020) present metal concentration data for 2016-2020 (Box 1), which demonstrate that both arsenic and chromium consistently exceed Florida cleanup standards for groundwater. Such temporal trends were not presented for other parameters, but data for the leachate sample analysed in 2020 are summarised in Table 6. These values are substantially higher than corresponding data for ground and surface water samples.

Figure 5 ***Surface water sampling locations, including the leachate sampling point located on the west of the main landfill.***

Box 1: Metal concentrations (ug/L) in samples collected at the leachate collection point over a 4-year period. Concentrations that exceed the relevant Florida cleanup standard are highlighted (extract from Table 14 in EHL 2020)

Analyte	*Florida GW Reg 1*	Leachate		
		2016	2019	2020
Arsenic	**10**	27	79	90
Barium	**2000**	130	120 J	160
Cadmium	**5**	<DL	1.1	0.3J
Chromium	**100**	190	320 J	120
Cobalt	**140**	8.1	21 J	9.4
Copper	**1000**	54	420	110
Lead	**15**	12	68	16
Nickel	**100**	66	< DL	57
Selenium	**50**	1.7J	1.6 J	< DL
Silver	**100**	<DL	0.75 J	0.15J
Vanadium	**49**	77	37	15
Zinc	**5000**	60	< DL	200

Note: "j" indicates "*Result is less than the RL but greater than or equal to the Method Detection Limit (MDL) and the concentration is an approximate value*"

Table 6 Summary of analytical data (excluding metals) for a leachate sample collected in 2020 (EHL, 2020)

Analyte	Concentration	Analyte	Concentration
Biological oxygen demand (BOD)	**<MDL**	Petroleum Hydrocarbons*	**<MDL**
Chemical oxygen demand (COD)	1300 mg/L	Total Organic Carbon (TOC)	470 mg/L
Nitrate - nitrite	16 mg/L	Acetone	9.7 µg/L
Nitrite	11 mg/L	Phenol	3.0 µg/L
Total Kjeldahl Nitrogen	490 mg/L	Toluene	1.0 µg/L
Total Nitrogen	510 mg/L	Ethylbenzene	0.54 µg/L
Total Phosphorus	1.9 mg/L	Xylene	0.82 µg/L
pH	8.1	Naphthalene	2.0 µg/L
Sulphate	5.5 mg/L	Endosulphan 1	0.042 µg/L
Ammonia	350 mg/L	Delta BHC	0.025 µg/L
Unionised ammonia	25 mg/L	Faecal Coliform bacteria	69100 mpn/100 ml
Total hardness	1800 mg/L		

Notes: MDL=Method Detection Limit; Petroleum hydrocarbons were analysed using the Total Petroleum Hydrocarbon Criteria Working Group (TPHCWG) method

4.3 Current gas and vapour emissions

Although a landfill gas extraction system is proposed to feed into the ISWMS, GHD is not aware of any contemporary landfill gas monitoring. Amec Foster Wheeler (2016b) stated that no historical gas monitoring data exists but presented monitoring from six "*gas probes*" (GP1-GP6) and three surface flux boxes in and around the main landfill mass (Figure 6).

The "*gas probes*" generally showed emissions typical of landfill gas (~50-60% methane, ~25-45% carbon dioxide and ≤2% oxygen). More detailed laboratory analysis of these gases generally showed an absence of carbon monoxide, ethane, ethylene, propane and propene at any location; hydrogen was only detected at a single location. Hydrogen sulphide was present at all locations (0.46-2,300 ppm). A number of non-methane volatile organic compounds (NMVOC) were present at more than three of the locations including:

– 1,2,4-Trimethylbenzene
– 1,3,5-Trimethylbenzene
– 2-Butanone (MEK)
– Acetone
– Benzene
– Carbon disulphide
– Ethylbenzene
– *m, p* and *o*-Xylenes
– Methylene Chloride
– Styrene
– Toluene

However, a single round of flux box measurements showed no detectable methane emissions from the landfill surface.

Further surveys, including monitoring of GP1, occurred in September 2016 by Amec Foster Wheeler (2017a) and in April 2018 by Wood (2018). However, GP1 is located in older wastes and methane concentrations equivalent to <1%

v/v were recorded on both occasions. These surveys included monitoring the surface emission of methane; the results of the most recent survey is presented in Figure 7, but this is outside of the proposed ISWMS footprint.

Due to the unlined nature of the GTLF, subsurface lateral migration of landfill gases and vapours from the landfill does represent a potential risk to the ISWMS but given the elevated nature of much of the GTLF, the distance between the active (North Mound) area of the GTLF and ISWMS facilities, the existing and planned installation of an active gas management system within the North Mound of the GTLF and the presence of the RWL between the North Mound and the remainder of the ISWMS facilities, the likelihood of any meaningful subsurface migration from the GTLF to the ISWMS facilities is considered to be minimal.

Figure 6 ***Location of the "gas probes" installed by Amec Foster Wheeler (2016b)***

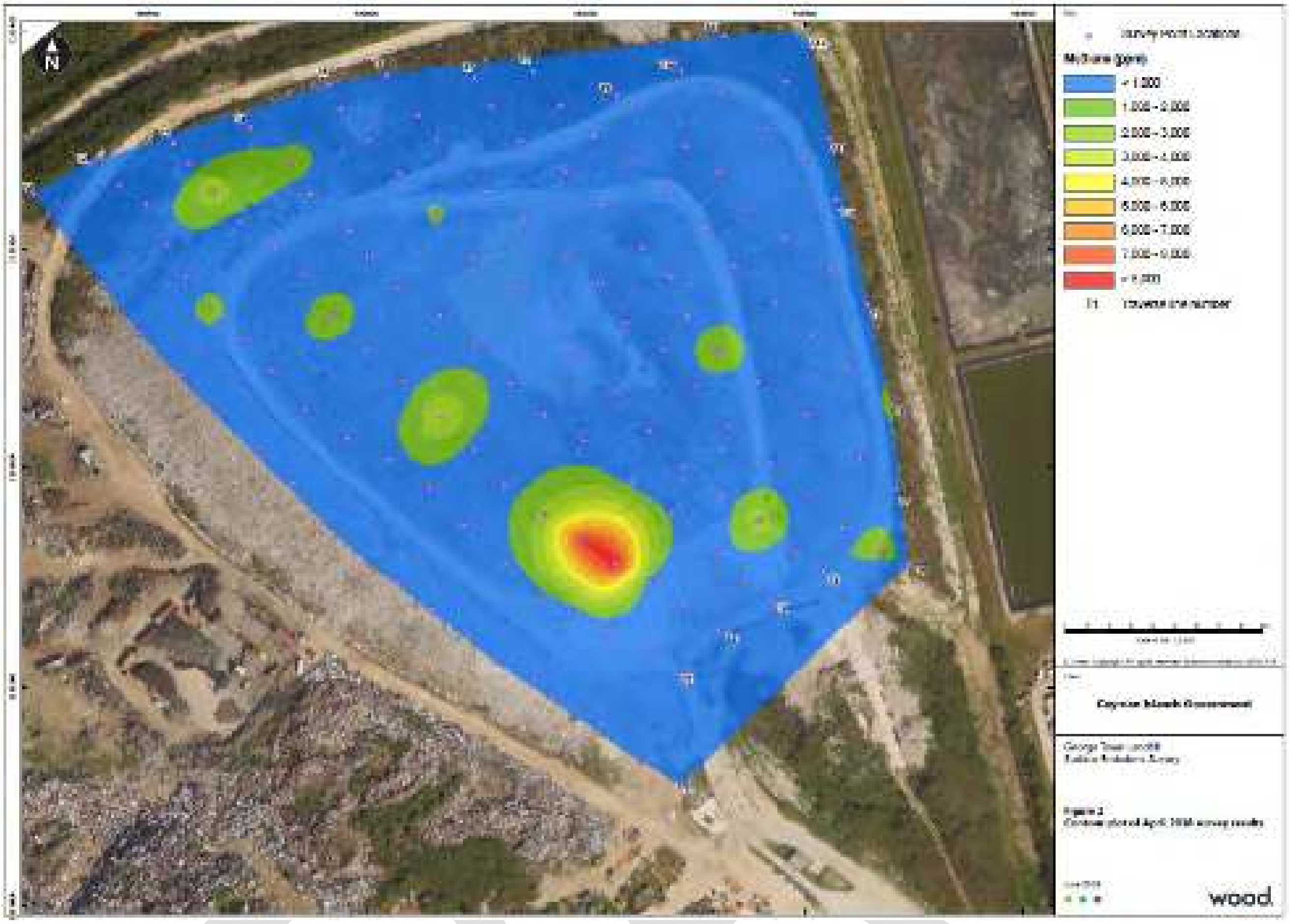

Figure 7 ***Results of a survey of methane surface emissions at the main landfill area of the Georgetown Landfill (After Figure 2 in Wood, 2018)***

4.4 Future of the GTLF

The waste management strategy for the Islands (Amec Foster Wheeler, 2016c) outlined the inadequacies and non-sustainability of contemporary waste management practices on each island, including the GTLF on Grand Cayman.

The current GTLF generally operates on outdated 'dilute and disperse' principles and lacks most environmental mitigations commonly applied to modern landfill facilities in the US and UK. For example, Cardno ENTRIX (2013) report that it lacks "*a basal liner, leachate collection and disposal system, and master stormwater treatment and disposal system".* As a result, leachate emissions have been "*identified by local regulators as one of the main sources of contamination to North Sound"* (Cardno ENTRIX, 2013) and Amec Foster Wheeler (2016c) identified this as a substantial driver for the ISWMS development.

The waste management strategy (Amec Foster Wheeler, 2016c) anticipates the closure of the GTLF but states that it "*is expected to continue to be in operation while the new Integrated Solid Waste Management System is developed and implemented through the procurement and construction of alternative waste management facilities. During this time the footprint of the site will continue to expand*".

A number of options for the remediation and restoration of the GTLF have been proposed (Amec Foster Wheeler, 2016c), including landfill mining and capping options. A review of these options (GHD, 2021b) concluded "*that a landfill cap with an active landfill gas management system is required to be provided over the North Mound to reduce its impact on the surrounding environment, but is not required for the older, less active South Mound*".

As part of the pre-commencement works on the ISWMS project, the northern half of the North Mound (Phase 1) has already been capped and that landfill gas extraction wells have been installed (Appendix A). Extraction of gas from these wells will supply, in part, the Landfill Gas Facility as part of the ISWMS. However, landfilling will continue to expand westwards (Phase 2) while the ISWMS is constructed, before this area is also capped and gas extraction installed (Appendix A) leading up to and immediately following commencement of the ISWMS operations.

5. Current baseline: geoenvironmental

5.1 Satellite imagery timeline

Satellite imagery presented within Google Earth Pro (Figure 8) suggests that the entire ISWMS site was undeveloped and heavily vegetated prior to September 2004, with the exception of small areas along the margins of the Site that were already utilised as roadways and compounds associated with the adjacent GTLF. The site has been progressively cleared from the north since this time.

– The northern third of the site was initially cleared between September 2004 and November 2005, presumably in the aftermath of Hurricane Ivan (see Section 4.1). The Hurricane Ivan Fill Area, OSTSA and Arsenic Containment Pit (see Section 4.1) are clearly visible by November 2005.
– The land immediately to the south of this was cleared and excavated between December 2005 and February 2007, when ponds and open water is present in this area. This was presumably to provide daily cover for the landfill (see Section 4.1).
– However, this area had been infilled and levelled by March 2008 when the ‘Equipment Storage Area’ (see Section 4.1) begins to be evident. The OHWSA (see Section 4.1) has been added by March 2013.
– The remainder of the Site remains undeveloped and heavily vegetated until 2020-21 when extensive site clearance, but no development, becomes evident.

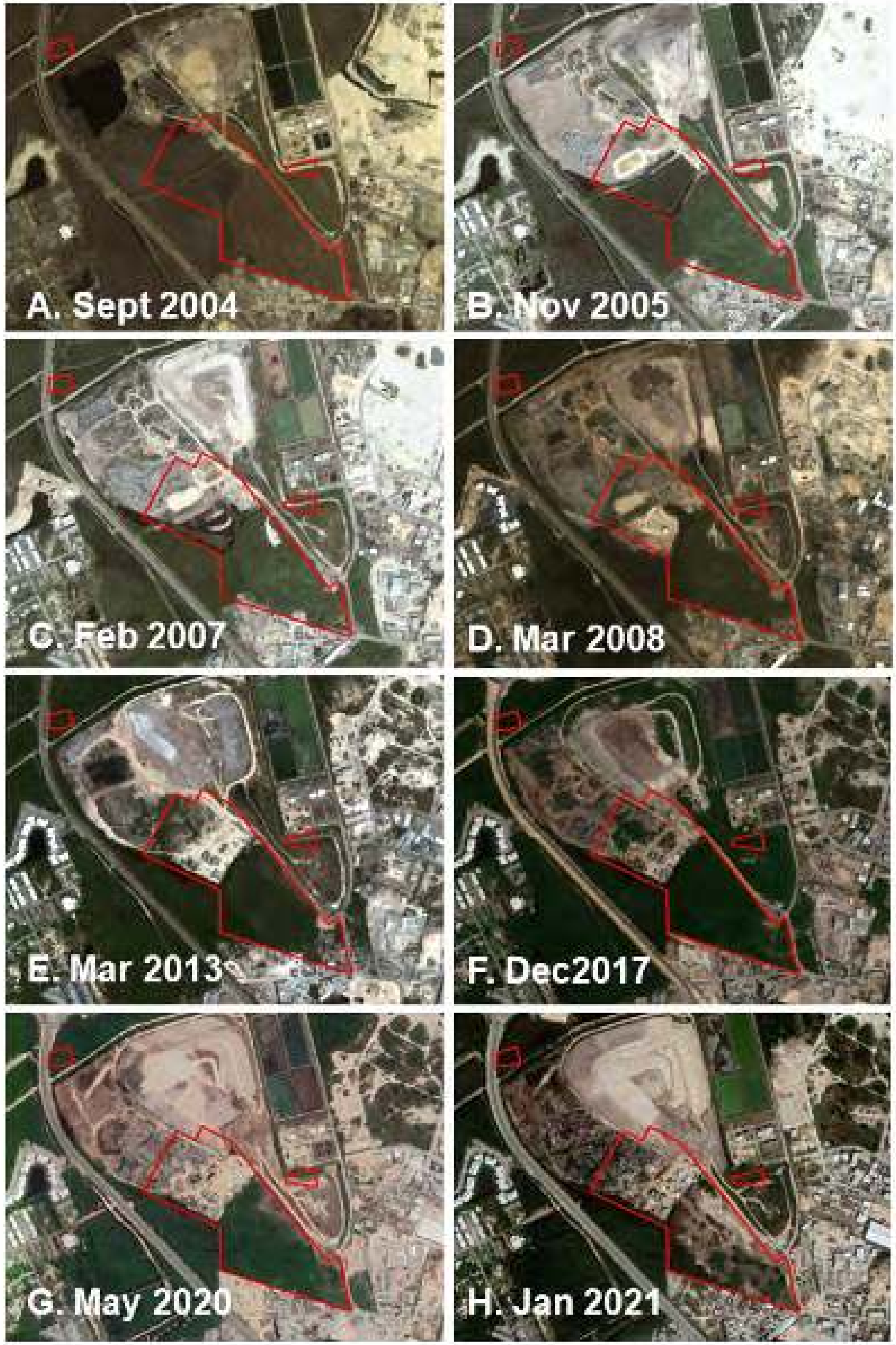

Figure 8 ***Selected satellite images between Sept 2004 and Jan 2021 obtained from Google Earth Pro (Image © 2021 Maxar Technologies) showing the development of the Site over time. The approximate boundary of the ISWMS Site is outlined. Images not to scale.***

5.2 Known or potential sources of contamination

Based on the available information, contamination within the proposed ISWMS footprint is most likely to be associated with historic waste treatment and disposal activities including those at the GTLF. However, the risks from such contamination is likely to vary at different areas of the ISWMS.

The known or potential sources of contamination associated with each area of the Site are outlined below.

5.2.1 Area 1

As discussed in Section 0, it seems likely that disposal of Hurricane Ivan debris was limited to the HIFA, which is outside the footprint Area 1. However, the disposal of wastes beneath this area prior to 2004 cannot be discounted.

Based on the currently proposed master plan (Figure 1) it is assumed that the footprint of Area 1 will include some or all of the following potential sources of contamination. The potential contaminants that may be anticipated are summarised in Table 7.

5.2.1.1 Old Scrap and Tyre Stockpile Area (OSTSA)

Satellite imagery from 2005 and 2007 (Figure 8) clearly shows apparent mounds of a grey material within the OSTSA. Such mounds are less distinct in subsequent images and it is unclear if these mounds are scrap/tyres or remaining hurricane debris. However, Wood (2016a, 2016c) have reported that during site visits in 2014-2015, scrap metal and tyres were stockpiled in this area (Figure 9). Consequently, it seems unlikely, but possible, that wastes (including hurricane debris) are present beneath the OSTSA.

GHD has not been provided with a full description of the source and nature of the scrap metal stored in the OSTSA, nor of any depollution process applied prior to stockpiling. So it is possible that the stockpiles may have contaminated the underlying ground.

Figure 9 ***Storage of scrap metals and tyres presumed to be at the Old Scrap and Tyre Stockpile Area (After Figure 3.11 in Wood 2016c)***

5.2.1.2 Arsenic containment cell

The damage caused by Hurricane Ivan resulted in large amounts of debris, which included natural vegetation and wooden timber. It is understood that this was collected together at a number of Debris Sites around Grand Cayman (CIRO, 2005) and burnt and/or used to produce mulch. It is understood that the debris included timber treated with preservatives, including chromated copper arsenate (CCA). Subsequent analysis showed that the ash was not suitable to be left at the various debris sites or for reuse (CIRO, 2005).

GHD understands that the ash from all the Debris Sites (~4,133 cubic yards in total) was ultimately disposed of in a custom-built cell within the GTLF site. This is designated as the Arsenic Containment Pit in Figure 3, but elsewhere is referred by various names including the 'ash pit' or 'ash disposal cell' etc.; the term Arsenic Containment Cell has been adopted within this report. Design drawings suggest that it is:

– Built upon the underlying "solid rock" but surrounded by "existing waste";
– 100ft (30.5m) wide by 250ft (76.2m) long;
– Sunk to a depth of ~6ft below ground and is mounded to a height of ~12ft above ground;
– Enclosed (top and bottom) within an engineered containment system including drainage layer and composite liner;
– Covered in a seeding layer and grass.

It is assumed the cell contains leachate retained within the liner, but there is no current sampling or leachate recovery wells or system. GHD understands that it has also been suggested that arsine gas may be present within the cell.

5.2.1.3 Equipment storage area (including the OHWSA)

The timeline presented in Figure 8 clearly indicates that extraction activities (presumably borrow pits for the extraction of marl for daily cover at the GTLF) occurred in this area after 2005 but that surface levels had been reinstated prior to 2008. This required the infilling of the void areas. GHD is not aware of any details of the nature and source of these fill materials (i.e. potentially waste materials).

5.2.1.3.1 Equipment storage area

This area has a diverse usage, including the storage of current and redundant vehicles, plant and equipment, storage of certain separated waste streams and equipment maintenance.

5.2.1.3.2 Oil and Hazardous Waste Storage Area (OHWSA)

This area consists of two separate compounds; one for waste oils and fuels and one for hazardous waste (e.g., paints and household chemicals).

Amec Foster Wheeler (2016c) reported that ground water in a monitoring borehole MW16 between western canal and the Waste Oil Storage Area "*was seen to be visually contaminated with black oils*. The location of MW16 is shown in Figure 11. Amec Foster Wheeler (2016b) also quote the Department of Environmental Health (DEH) as stating "*significant hydrocarbon release occurred from the waste oil storage area in 2004 as a consequence of the tidal surge associated with Hurricane Ivan overtopping the containment bund*". This is understood to have contaminated the perimeter canal, which was subsequently remediated (Amec Foster Wheeler, 2016b).

Similar releases from the hazardous waste storage area may not have been visible and so cannot be excluded.

Figure 10 ***Bunded Waste Oil Storage Area at the GTLF (After Figure 3.2 in Amec Foster Wheeler, 2016c)***

Figure 11 ***Location of groundwater monitoring wells at the GTLF (After Figure 1 in EHL 2020)***

Table 7 Summary of the potential sources and associated contaminants identified within, and adjacent to, the study area, which have been considered within this Land Quality Assessment

Area	Potential source	Potential contaminants
Within the study area		
Old Scrap and Tyre Stockpile Area	Any fill or buried wastes[a] (including hurricane debris)	• Metals • Combustion products, including polyaromatic hydrocarbons (PAHs) and dioxins • Asbestos • Landfill/Ground gases
	Subsequent waste storage[a] (including scrap and tyres)	• Metals • Hydrocarbons, including polyaromatic hydrocarbons (PAHs) • Asbestos
Arsenic Containment Cell	Ash material within the cell.	• Metals, especially arsenic and chromium and copper • Combustion products, including polyaromatic hydrocarbons (PAHs) and dioxins • Asbestos • Arsine gas
Equipment Storage Area	Any fill materials (including wastes)[a]	• Metals • Combustion products, including polyaromatic hydrocarbons (PAHs) and dioxins • Asbestos • Landfill/Ground gases
	Storage of vehicles, plant and equipment	• Metals • Hydrocarbons, including polyaromatic hydrocarbons (PAHs)
	Maintenance activities.	• Metals • Hydrocarbons, including polyaromatic hydrocarbons (PAHs) • Paints and solvents etc.
Oil and Hazardous Waste Storage Area	Any fill materials (including wastes)[a]	• Metals • Combustion products, including polyaromatic hydrocarbons (PAHs) and dioxins • Asbestos • Ground gases
	Waste oil store	• Hydrocarbons, including polyaromatic hydrocarbons (PAHs) • Organic vapours
	Hazardous waste store	• Hydrocarbons, including polyaromatic hydrocarbons (PAHs) • Paints and solvents etc. • Pesticides • Polychlorinated biphenyls (PCBs) • Organic vapours

Area	Potential source	Potential contaminants
Adjacent offsite areas		
Georgetown Landfill	Landfilled wastes	• Leachate • Landfill/Ground gases • Organic vapours
Notes: [a] the potential composition of such wastes has not been determine and so the range of likely contaminants cannot be delineated with any degree of certainty.		

5.2.2 Area 2

Based on the currently proposed master plan (Figure 1) it is assumed that the footprint of Area 2 lies outside the boundary of the existing GTLF. Satellite imagery (Figure 8) suggests that this area remained heavily vegetated until late 2020/early 2021 when Area 2 was cleared of vegetation. However, a limited geotechnical site investigation of this area was undertaken in November and December 2020 (APEC, 2021). This identified "*Topsoil 'Marl' fill and municipal waste mix*" present at multiple locations across Area 2. APEC (2021) report that "*Aerial imagery indicates the area was used as a landfill sometime between the 1970s and 1980s. The 1994 aerial photography shows the site as being covered. This is consistent with an environmental assessment report prepared in 1991 by Post, Buckley, Schuh and Jernigan Inc. (PBSJ) which refers to landfilled waste on an adjacent property not owned by CI Government*".

The available information indicates that, while undeveloped, historical waste disposal did occur in this area before it was overgrown with vegetation. The nature, volume and extent of wastes present, and contamination associated with it, is not known. Equally, the gas generation potential of such wastes remains uncertain, but is expected to be minimal due to the age of the waste.

5.2.3 Area 3

The proposed location of the CUC substation is isolated from all other ISWMS components and lies to the north beyond the North Canal (Figure 1). The timeline presented in Figure 8 clearly indicates this area remained vegetated and undisturbed until at least 2021. Consequently, contamination is not anticipated in this area, although the disposal of wastes beneath this area prior to 2004 cannot be completely discounted.

5.2.4 Area 4

The proposed location of the Landfill Gas Facility (LGF) is isolated from all other ISWMS components and lies adjacent to the current wastewater treatment plant. The LGF lies within the footprint of the "Old Landfill" Figure 3 or "South Mound" Figure 4. The "Old Landfill" is believed to have been reduced by burning and so is "*likely to comprise ash towards the base"* (Section 0). Consequently, some level of contamination is expected in this area, but GHD is not aware of any site investigation data that presents data relating to the ground conditions and contaminant concentrations.

5.2.5 Sources of contamination - baseline conclusions

The entire ISWMS footprint, with the possible exception of Area 3, is known or suspected to be on land affected by landfill or waste disposal activities. In addition to any geotechnical hazards posed by potential buried wastes, it is possible that contamination may be encountered, but the significance of such contamination cannot be determined in the absence of suitable and sufficient soil analysis data (Section 5.3.6). In addition to any buried wastes, Area 1 is known to have been affected by releases from the OHWSA and potentially other activities in this area.

5.3 Available soil analysis data

Although a substantial amount of ground and surface water data (including limited amounts of sediment sampling) are available for the GTLF site, little or no soil analysis data is available relevant to the proposed footprint of the ISWMS. For example, the APEC (2021) geotechnical report describes site investigation activities but no soil analysis or ground gas measurement was undertaken.

5.3.1 Area 1

Amec Foster Wheeler (2016b) describe limited soil monitoring conducted by CIG-DEH (the "DEH Data") who collected samples "*from surface soils adjacent to some of the MW monitoring point locations. Forty datasets are available for the period 2011-2013*". Three of these samples were from within Area 1 and a further four relate to the HIFA and, while not directly relevant to Area 1 may be indicative of similar conditions (Table 8). All the available analysis data for these locations are presented in Table 10 for inorganic contaminants, Table 11 for PCBs and Table 12 for various pesticides. The relevance of this data and any other data to each area of the Site is discussed below.

Table 8 Locations at which surface soil samples have been collected by DEH. Each location has been allocated to the relevant part of the Site. Locations that are within the likely footprint of the ISWMS are highlighted in bold

Location	Part of Site	Location	Part of Site
SW1	(Location unknown)	**MW9**	**HIFA (outside ISWMS)**
SW2	Main landfill area	**MW9 B**	**HIFA (outside ISWMS)**
SW3	**HIFA (outside ISWMS)**	MW10	Old landfill
SW7	(Location unknown)	MW11	Main landfill area
SW12	**Hazardous waste storage Area**	MW12	Main landfill area
Drain 1	(Location unknown)	MW13	Old landfill
Drain 2	(Location unknown)	**MW14**	**Arsenic containment cell and OSTSA**
MW1	(Location unknown)	**MW15**	**Arsenic containment cell and OSTSA**
MW1 B	(Location unknown)	**MW17**	**HIFA (outside ISWMS)**
MW5	Main landfill area	MW18	Main landfill area
MW8	Main landfill area		

5.3.1.1 Old Scrap and Tyre Stockpile Area (OSTSA)

The soils at the OSTSA are poorly characterised. However, all the DEH surface soil data presented in Table 10, Table 11 and Table 12 are relevant to the OSTSA except for that for SW12. This includes four locations from the HIFA located further north and outside the footprint of Area 1 (Table 8).

With respect to inorganic contaminants, Table 10 suggests that there are no substantial risks to human health or ground water from the current surface soils in this area. The exceedances of the CCTL^{comm} for arsenic mainly relate to results apparently subject to inexplicably high MDLs. Only one sample above the relevant MDL marginally exceeds the CCTL^{comm} (see Section 5.3.5).

PCBs (7 congeners only) were not detected above the MDL in any sample (Table 11). However, the MDLs used were all more than an order of magnitude greater than the CCTL^{comm}, meaning that no conclusions can be drawn regarding PCB risks in relation to the surface soils in this area.

Samples were also tested for a range of pesticides (Table 12). The only pesticide detected above the relevant MDL was endrin (2 samples only) and the concentrations detected did not exceed the CCTL^{GW}. However, the MDLs for 9 of the pesticides exceeded the relevant CCTL and so no conclusions can be drawn regarding these compounds in surface soils in this area.

In addition to the DEH data, Amec Foster Wheeler (2016b) reports that "*Seventeen samples of surface soil were collected from across the Hurricane Ivan fill area*[6] *for asbestos analysis. No asbestos was detected in any of the samples*".

It should be noted that this surface sampling does not demonstrate that contamination (including asbestos) is not present within any underlying fill/wastes.

5.3.1.2 Arsenic containment cell

The cell contains ash from the burning of Hurricane Ivan debris at various sites across the Grand Cayman. Prior to disposal, sampling of ash from several sites found that the mean arsenic concentration was 65.4 mg/kg (n=13) and as a result was not suitable to be left or reused (CIRO, 2005). The ash analysis data is presented in Table 9.

In addition to total concentrations, leachability was also determined as TCLP (SW-846 Test Method 1311: Toxicity Characteristic Leaching Procedure) and SPLP (SW-846 Test Method 1312: Synthetic Precipitation Leaching Procedure). The mean leachate concentration of arsenic was 0.24 mg/l (n=13) and 0.03 mg/l (n=2), respectively (CIRO, 2005).

Table 9 ***Concentrations (mg/kg) of various metals in samples of ash created by the burning of Hurricane Ivan debris at various sites on Grand Cayman (CIRO, 2005). The mean and standard deviation for each metal is also shown.***

	TOTAL METALS (mg/kg)					
	As	Ba	Cd	Cr	Pb	Hg
Ash Samples collected 31 Jan 2005						
JW-1/BURN PITS	71.6	94.6	0.66	74.1	117	0.084
JW-2/NNW-E MAIN PILE	30.4	29.1	0.43	27.3	51.8	0.1
JW-3/SE MAIN PILE	21.7	25.5	0.48	21.4	93.6	0.083
JW-4/NNW-SE MAIN PILE	34.6	30.5	0.4	41.3	31	0.084
SP-1/WEST SIDE LAKES	141	81.2	0.73	79.2	5450	0.08
SP-2/CHAS POWELL SITE	42.4	56	0.49	47.5	93.9	0.093
SN-1/BERM N OF LAKE: E SECT	146	89.5	0.69	81.5	76	0.099
SN-2/BERM N OF LAKE:CTR SECT.	48	50	0.46	57.3	36	0.096
SN-3/PILE NW OF LAKE	39.1	35.2	1.2	53.7	87.8	0.14
NW-1/RIGHT OF ENTRANCE	36.1	56.2	0.55	44.8	88.6	0.087
NW-2/LEFT OF ENTRANCE	43.9	95.9	1	49	122	0.087
Ash Samples collected 3 March 2005						
Frank Sound - Ash from Mulch produced by MC	98.6	44.4	0.81	74.1	148	0.082
Ash Samples collected 7 and 8 April 2005						
Sweetwater Palms - Ash	96.9	406	1.3	74.7	1230	0.084
Mean	**65.4**	**84.2**	**0.7**	**55.8**	**586.6**	**0.1**
SD	**41.3**	**94.4**	**3.2**	**21.4**	**1392.4**	**3.3**

Apart from this pre-disposal data, the material in the Arsenic Containment Cell is poorly characterised. However, the surface soil data for MW14 and MW15 (Table 10, Table 11 and Table 12) is relevant to the characterisation of the surface soils in this area .

[6] This is assumed to include the OSTSA.

With respect to inorganic contaminants, the available data (Table 10) suggest that there are no substantial risks to human health or ground water from the current surface soils in this area. The exceedances of the $CCTL^{comm}$ for arsenic in this area relate to results apparently subject to inexplicably high MDLs (see Section 5.3.5).

The 7 PCB congeners analysed were not detected above the MDL in any sample (Table 11). However, the MDLs used were all more than an order of magnitude greater than the $CCTL^{comm}$, meaning that no conclusions can be drawn regarding PCB risks in relation to the surface soils in this area.

Samples were also tested for a range of pesticides (Table 12). The only pesticide detected above the relevant MDL was endrin (1 samples only) and the concentrations detected did not exceed the $CCTL^{GW}$. However, the MDLs for 9 of the pesticides exceeded the relevant CCTL and so no conclusions can be drawn regarding these compounds in surface soils in this area.

It should be noted that this surface sampling does not demonstrate that contamination (including asbestos) is not present within the ash within the cell, but we understand that current plans involve constructing the RWL over the existing cell, and so the ash will not be disturbed or exposed.

5.3.1.3 Equipment storage area (including the OHWSA)

Although oil contamination has been observed in the vicinity of the Waste Oil storage Area (Section 5.2.1.3), the soil in this area is poorly characterised. The only available data relevant to this area is for surface soil samples collected from SW12 (Table 10, Table 11 and Table 12).

With respect to inorganic contaminants, the available data (Table 10) suggests that there are no substantial risks to human health or ground water from the current surface soils in this area. The exceedances of the $CCTL^{comm}$ for arsenic in this area relate to results apparently subject to inexplicably high MDLs (see Section 5.3.5).

The 7 PCB congeners analysed were not detected above the MDL in any sample (Table 11). However, the MDLs used were all more than an order of magnitude greater than the $CCTL^{comm}$, meaning that no conclusions can be drawn regarding PCB risks in relation to the surface soils in this area.

Samples were also tested for a range of pesticides (Table 12). No pesticides were detected above the relevant MDL in this area. However, the MDLs for 9 of the pesticides exceeded the relevant CCTL and so no conclusions can be drawn these compounds in surface soils in this area.

It should be noted that this surface sampling does not demonstrate that contamination (including asbestos) is not present below the surface in this area.

5.3.2 Area 2

No soil quality data was identified in relation to Area 2.

5.3.3 Area 3

No soil quality data was identified in relation to Area 3.

5.3.4 Area 4

No soil quality data was identified in relation to Area 4.

5.3.5 Background arsenic concentrations

Arsenic occurs naturally in soils at varying concentrations in different geographic regions and, in some areas, natural concentrations can exceed risk-based assessment criteria where such background concentrations have not been considered in the derivation of such criteria.

Little information has been identified in the scientific literature regarding the levels of naturally-occurring arsenic in the Cayman Islands. The only information identified is in an ICENS (2015) report, but we are aware that additional studies have been conducted. ICENS (2015) reported that background arsenic concentrations "*ranged from 11 to 85 µg/g (median, 28.8 µg/g;* mean *38.6 µg/g*)", but it is unclear on how many samples this is based on.

As 1 ug/g is equivalent to 1 mg/kg, this suggests that most Cayman soils will exceed the $CCTL_{Comm}$ for arsenic of 12 mg/kg (Florida DoEP, 2005). It should be noted that the CCTL are derived using a target lifetime excess cancer risk level of 1.0E-6 and the value for arsenic assumes a bioaccessibility of 0.33. In any future risk assessment in relation to arsenic in soils, this background concentration and the applicability of the CCTL for arsenic for use in the Cayman Islands should be considered.

5.3.6 Soil analysis – baseline conclusions

Minimal and poor quality soil analysis data is available with respect to Area 1. The data available does not suggest that substantial contamination will be encountered in this area but there remains considerable uncertainty.

No data has been identified relating to Areas 2, 3 and 4 and so no conclusions can be supported with respect to the levels of soil contamination that may be present in these areas, the risks these represent, nor the need for any mitigation measures.

5.4 Available gas data

Although gas data is available for the adjacent GTLF, no specific data relevant to the ISWMS site (Areas 1,2,3 or 4) has been identified.

No historical gas monitoring data for the GTLF is available prior to 2015 (Amec Foster Wheeler, 2016b) but subsequent gas monitoring has been undertaken. Amec Foster Wheeler (2016b) describes six "*gas probes*", one of which (GP6) is very close to the OSTSA (Figure 6) and could indicate the potential for gas migration towards Areas 1 and 2. However, Amec Foster Wheeler (2016b) only present summary monitoring data (Section 4.3) and it is not possible to establish the gas fluxes measured in GP6 specifically. Further monitoring of the landfill mound was also undertaken in September 2016 by Amec Foster Wheeler (2017a) and in April 2018 by Wood (2018). However, access to GP6 was obstructed on both occasions and no monitoring was possible.

The results of the latest methane surface emission survey (Figure 7) suggest that the emissions outside of the main GTLF will be low (<1% methane) but this does not mean that subsurface migration cannot occur. As noted in Section 4.3, the likelihood of any meaningful migration from the GTLF to the ISWMS facilities is considered to be minimal.

5.4.1 Gas data – baseline conclusions

The GTLF is known to be generating landfill gas and, given the absence of a basal liner, lateral migration of gases from the GTLF could affect the ISWMS. However, the likelihood of any meaningful subsurface migration from the GTLF to the ISWMS facilities is considered to be minimal.

Given that the North Canal, which is likely to prevent lateral gas migration, appears to lie between the GTLF and Area 3, this area is considered unlikely to be affected by ground gases.

Area 4 is to be located on the 'Old Landfill' to the south of the GTLF. No gas data relevant to this area has been identified. However, it is assumed that the gas generation potential of any buried wastes in this area will be minimal and that the landfill gas facility (Area 4) will be designed to be intrinsically safe and to be minimally staffed, and so the risks are likely to be minimal.

5.5 Future baseline

No factors were identified that, in the absence of the Project proceeding, would materially alter the baseline conditions outlined above. Changes to the management practices at the GTLF could conceivably increase or decrease the potential for landfill gas migration on to the ISWMS site, but, again, the likelihood of any meaningful migration from the GTLF to the ISWMS facilities is considered to be minimal.

Table 10 ***Inorganics: Existing surface soil analysis presented by Amec Foster Wheeler (Appendix D in 2016b) relating to sample locations within the footprint of the ISWMS. Data that was reported as being below the relevant Method Detection Limit (MDL) are indicted; actual concentrations could be lower. The lowest relevant Contaminant Cleanup Target Levels for human health ($CCTL^{comm}$) and groundwater ($CCTL^{GW}$) has been used for risk screening. Samples that exceed the lower of the two CCTL have been highlighted.***

Contaminant	unit	$CCTL^{comm}$	$CCTL^{GW}$	SW3			SW12			MW9			MW9B		MW14		MW15	MW17
				2010	2011	2013	2010	2011	2013	2010	2011	2013	2010	2011	2013	2011	2013	2011
Antimony	mg/kg	370	54	3.9 <MDL	3 <MDL	2.3 (<MDL)	2.1 <MDL	2.5 <MDL	2 <MDL	4.6 <MDL	2.4 <MDL	2.4 <MDL	2.4 <MDL	2 <MDL	2 <MDL	2.2 <MDL	1.9 <MDL	2.2 <MDL
Arsenic	mg/kg	12	None set	3.9 <MDL	3 <MDL	4.5 <MDL	2.1 <MDL	5.4	20 <MDL	4.6 <MDL	3.1	4.8 <MDL	2.4 <MDL	13	20 <MDL	9.7	19 <MDL	3.2
Barium	mg/kg	130000	16000	5.4	7.9	12	1.2	3.9	9.9 <MDL	16	9.3	9.8	11	2.4	23	22	12	9
Beryllium	mg/kg	1400	630	0.78 <MDL	0.6 <MDL	0.45 <MDL	0.42 <MDL	0.5 <MDL	0.4 <MDL	0.93 <MDL	0.48 <MDL	0.48 <MDL	0.49 <MDL	0.41 <MDL	0.4 <MDL	0.44 <MDL	0.37 <MDL	0.45 <MDL
Cadmium	mg/kg	1700	75	0.97 <MDL	0.75 <MDL	0.57 <MDL	0.52 <MDL	0.62 <MDL	0.5 <MDL	1.2 <MDL	0.6 <MDL	0.6 <MDL	0.61 <MDL	0.51 <MDL	0.49 <MDL	0.55 <MDL	0.47 <MDL	0.56 <MDL
Chromium	mg/kg	470	380	10	14	19	3.4	18	25	19	10	13	12	6.6	39	27	21	9.1
Cobalt	mg/kg	42000	None set	1.9 <MDL	1.5 <MDL	1.1 <MDL	1.0 <MDL	1.2 <MDL	0.99 <MDL	2.3 <MDL	1.2 <MDL	1.2 <MDL	1.2 <MDL	1.0 <MDL	1.4 <MDL	1.7	0.93 <MDL	1.1 <MDL
Copper	mg/kg	89000	None set	4.9 <MDL	3.7 <MDL	4.9	2.6 <MDL	3.1 <MDL	4.5	9	14	8.3	9	4.3	68	40	21	5.5
Iron	mg/kg	None set	None set	1600	2200	4000	310	2900	4800	3300	1800	2200	2400	4000	8000	9000	3600	2200
Lead	mg/kg	1400	None set	2.7	3.9	8	1.0 <MDL	2.1	3.6	8.1	35	21	13	3.1	120	90	12	11
Magnesium	mg/kg	None set	None set	2900	1800	3300	67000	64000	72000	3700	10000	9500	6100	6400	39000	8900	2700	5900
Nickel	mg/kg	35000	1300	7.8 <MDL	6.0 <MDL	4.5 <MDL	4.2 <MDL	5.0 <MDL	5.7	9.3 <MDL	4.8 <MDL	4.8 <MDL	4.9 <MDL	4.1 <MDL	8	8.1	3.7 <MDL	4.5 <MDL
Selenium	mg/kg	11000	52	4.9 <MDL	3.7 <MDL	2.8 <MDL	2.6 <MDL	3.1 <MDL	2.5 <MDL	5.8 <MDL	3.0 <MDL	3.0 <MDL	3.0 <MDL	2.5 <MDL	2.5 <MDL	2.7 <MDL	2.3 <MDL	2.8 <MDL
Silver	mg/kg	8200	170	1.9 <MDL	1.5 <MDL	1.1 <MDL	1.0 <MDL	1.2 <MDL	0.99 <MDL	2.3 <MDL	1.2 <MDL	1.2 <MDL	1.2 <MDL	1.0 <MDL	0.99 <MDL	1.1 <MDL	0.93 <MDL	1.1 <MDL
Thallium	mg/kg	150	28	4.9 <MDL	3.7 <MDL	2.8 <MDL	2.6 <MDL	3.1 <MDL	2.5 <MDL	5.8 <MDL	3.0 <MDL	3.0 <MDL	3 <MDL	2.5 <MDL	2.5 <MDL	2.7 <MDL	2.3 <MDL	2.8 <MDL
Vanadium	mg/kg	10000	9800	6.9	6.6	9.2	2.1	13	14	9.6	5.1	5.7	6.3	7.5	13	18	8.7	5.7
Zinc	mg/kg	630000	None set	9.4	9.5	26	2.9	9.4	21	78	9600	2600	1100	24	390	150	84	51
Mercury	mg/kg	17	21	0.041 <MDL	0.03 <MDL	0.044	0.035	0.068	0.06	0.053 <MDL	0.035	0.04	0.024 <MDL	0.024	0.056	0.12	0.05	0.024

Contaminant	unit	CCTL^{comm}	CCTL^{GW}	SW3			SW12			MW9			MW9B		MW14		MW15	MW17
				2010	2011	2013	2010	2011	2013	2010	2011	2013	2010	2011	2013	2011	2013	2011
Boron	mg/kg	430000	None set		28	26		110	9.9 <MDL		26	23		10 <MDL	21	16	25	16
Cyanide, Total	mg/kg	11000	8		0.79 <MDL	0.6 <MDL		2.5 <MDL	0.49 <MDL		0.66 <MDL	0.61 <MDL		0.52 <MDL	0.49 <MDL	0.59 <MDL	0.48 <MDL	0.56 <MDL
Sulphate	mg/kg	None set	None set		1600	1500		520 <MDL	100 <MDL		140 <MDL	780		110 <MDL	1000 <MDL	120 <MDL	2200	120 <MDL

Table 11 Polychlorinated Biphenyls (PCBs): Existing surface soil analysis presented by Amec Foster Wheeler (Appendix D in 2016b) relating to sample locations within the footprint of the ISWMS. Data that was reported as being below the relevant Method Detection Limit (MDL) are indicted; actual concentrations could be lower. The lowest relevant Contaminant Cleanup Target Levels for human health (CCTL^{comm}) and groundwater (CCTL^{GW}) has been used for risk screening. Samples that exceed the lower of the two CCTL have been highlighted.

Contaminant	unit	CCTL^{comm}	CCTL^{GW}	SW3			SW12			MW9			MW9B		MW14		MW15	MW17
				2010	2011	2013	2010	2011	2013	2010	2011	2013	2010	2011	2013	2011	2013	2011
PCB-1016	mg/kg	2.6	170		54 <MDL	40 <MDL		170 <MDL	33 <MDL		44 <MDL	40 <MDL		36 <MDL	33 <MDL	39 <MDL	67 <MDL	38 <MDL
PCB-1221	mg/kg	2.6	170		110 <MDL	80 <MDL		340 <MDL	67 <MDL		90 <MDL	82 <MDL		72 <MDL	67 <MDL	79 <MDL	140 <MDL	77 <MDL
PCB-1232	mg/kg	2.6	170		54 <MDL	40 <MDL		170 <MDL	33 <MDL		44 <MDL	40 <MDL		36 <MDL	33 <MDL	39 <MDL	67 <MDL	38 <MDL
PCB-1242	mg/kg	2.6	170		54 <MDL	40 <MDL		170 <MDL	33 <MDL		44 <MDL	40 <MDL		36 <MDL	33 <MDL	39 <MDL	67 <MDL	38 <MDL
PCB-1248	mg/kg	2.6	170		54 <MDL	40 <MDL		170 <MDL	33 <MDL		44 <MDL	40 <MDL		36 <MDL	33 <MDL	39 <MDL	67 <MDL	38 <MDL
PCB-1254	mg/kg	2.6	170		54 <MDL	40 <MDL		170 <MDL	33 <MDL		44 <MDL	40 <MDL		36 <MDL	33 <MDL	39 <MDL	67 <MDL	38 <MDL
PCB-1260	mg/kg	2.6	170		54 <MDL	40 <MDL		170 <MDL	33 <MDL		44 <MDL	40 <MDL		36 <MDL	33 <MDL	39 <MDL	67 <MDL	38 <MDL

Table 12 ***Pesticides: Existing surface soil analysis presented by Amec Foster Wheeler (Appendix D in 2016b) relating to sample locations within the footprint of the ISWMS. Data that was reported below the relevant Method Detection Limit is presented in bold. The lowest relevant Contaminant Cleanup Target Levels for human health (CCTL^{comm}) and groundwater (CCTL^{GW}) has been used for risk screening. Samples that exceed the lower of the two CCTL have been highlighted.***

Contaminant	unit	CCTL^{comm}	CCTL^{GW}	SW3			SW12			MW9			MW9B		MW14		MW15	MW17
				2010	2011	2013	2010	2011	2013	2010	2011	2013	2010	2011	2013	2011	2013	2011
4,4'-DDD	mg/kg	22	58			2 <MDL			1.7 <MDL			2.1 <MDL			1.7 <MDL		3.4 <MDL	
4,4'-DDE	mg/kg	15	180			2 <MDL			1.7 <MDL			2.1 <MDL			1.7 <MDL		3.4 <MDL	
4,4'-DDT	mg/kg	15	110			2 <MDL			1.7 <MDL			2.1 <MDL			1.7 <MDL		3.4 <MDL	
Aldrin	mg/kg	0.3	2			2 <MDL			1.7 <MDL			2.1 <MDL			1.7 <MDL		3.4 <MDL	
alpha-BHC	mg/kg	0.6	0.003			2 <MDL			1.7 <MDL			2.1 <MDL			1.7 <MDL		3.4 <MDL	
beta-BHC	mg/kg	2.4	0.010			2 <MDL			1.7 <MDL			2.1 <MDL			1.7 <MDL		3.4 <MDL	
Chlordane (technical)	mg/kg	14	96			20 <MDL			17 <MDL			21 <MDL			17 <MDL		34 <MDL	
delta-BHC	mg/kg	490	2			2 <MDL			1.7 <MDL			2.1 <MDL			1.7 <MDL		3.4 <MDL	
Dieldrin	mg/kg	0.3	0.020			2 <MDL			1.7 <MDL			2.1 <MDL			1.7 <MDL		3.4 <MDL	
Endosulfan I	mg/kg	7600	38			2 <MDL			1.7 <MDL			2.1 <MDL			1.7 <MDL		3.4 <MDL	
Endosulfan II	mg/kg	7600	38			2 <MDL			1.7 <MDL			2.1 <MDL			1.7 <MDL		3.4 <MDL	
Endosulfan sulfate	mg/kg	7600	38			2 <MDL			1.7 <MDL			2.1 <MDL			1.7 <MDL		3.4 <MDL	
Endrin	mg/kg	510	10			2 <MDL			1.7 <MDL			2.1 <MDL			1.7 <MDL		3.4 <MDL	
Endrin aldehyde	mg/kg	510	10			3.5			1.7 <MDL			2.1 <MDL			1.7 <MDL		7.8	
Endrin ketone	mg/kg	510	10			2 <MDL			1.7 <MDL			2.1 <MDL			1.7 <MDL		3.4 <MDL	
gamma-BHC (Lindane)	mg/kg	2.5	0.090			2 <MDL			1.7 <MDL			2.1 <MDL			1.7 <MDL		3.4 <MDL	

Contaminant	unit	CCTL^{comm}	CCTL^{GW}	SW3			SW12			MW9			MW9B		MW14		MW15	MW17
				2010	2011	2013	2010	2011	2013	2010	2011	2013	2010	2011	2013	2011	2013	2011
Heptachlor	mg/kg	1.0	230			**2** <MDL			**1.7** <MDL			**2.1** <MDL			**1.7** <MDL		**3.4** <MDL	
Heptachlor epoxide	mg/kg	0.5	6			**2** <MDL			**1.7** <MDL			**2.1** <MDL			**1.7** <MDL		**3.4** <MDL	
Methoxychlor	mg/kg	8800.0	1600			**2** <MDL			**1.7** <MDL			**2.1** <MDL			**1.7** <MDL		**3.4** <MDL	
Toxaphene	mg/kg	4.5	310	1		**200** <MDL			**170** <MDL			**210** <MDL			**170** <MDL		**340** <MDL	

6. Conceptual site model (CSM)

BS EN ISO 21365 defines a Conceptual Site Model (CSM) as a "*synthesis of all relevant information about a potentially contaminated site with interpretation as necessary and recognition of uncertainties. The description relies on the concept, of "source-migration pathway-receptor linkages" (sometimes termed «contaminant linkages») that are, or might be, present.*"

6.1 Land contamination (CSM)

This CSM relates to the ISWMS as a whole (Areas 1, 2 and 4 only[7]) and summarises the identified potential pollutant linkages, which each consist of a source/contaminant, pathway and receptor.

The receptors relevant to this assessment are identified in Section 2.2. The potential sources of contamination identified with respect to Area 1 (Table 7) are assumed to also be relevant to Areas 2 and 3. The potential pathways considered to be relevant to this assessment are:

1. Direct ingestion of soils and dusts; and / or
2. Inhalation of soil-derived dusts by individuals while outdoors; and / or
3. Inhalation of tracked-back soil-derived dust in onsite buildings; and / or
4. Direct contact with buildings, building materials and infrastructure; and / or
5. Contaminant migration due to surcharging of historic arsenic waste pit with new RWL; and / or
6. Contaminant migration via windblown dust, flooding or surface runoff.

The consumption of tainted food produce (including fruit, vegetables, meat and other animal products) is not considered a viable pathway at a waste treatment and disposal facility, as it is assumed that no such produce will be farmed on-site.

It should be noted that the assessment of risks to ground and surface waters is outside the scope of this assessment and so the related pathways have not been listed.

Gases and vapours are considered in Section 6.2.

***Table 13** Potential pollutant linkages relevant to non-gaseous contaminants displayed as a matrix showing the pathways (referenced by number) that link each contaminant with the various receptors.*

	Site staff, construction workers and visitors (human health)	ISWMS infrastructure	Surrounding land users e.g. residential, commercial/industrial, schools (human health)
Metals including arsenic	1,2,3,5	4	2, 5
Polyaromatic hydrocarbons (PAHs)	1,2,3,5	4	2, 5
Dioxins etc.	1,2,3,5	4	2, 5
Asbestos	2,3,5	4	2, 5
Hydrocarbons (including fuels)	1,2,3,5	4	2, 5
Polychlorinated Biphenyls (PCBs)	1,2,3,5	4	2, 5

[7] The current information suggests that land contamination is unlikely to affect Area 3 as it has apparently not been used for waste disposal operations and is isolated from gas migrating from the GTLF.

	Site staff, construction workers and visitors (human health)	ISWMS infrastructure	Surrounding land users e.g. residential, commercial/industrial, schools (human health)
Pesticides	1,2,3,5	4	2, 5
Paints and solvents	1,2,3,5	4	2, 5

6.2 Ground gas and vapours (gCSM)

There are two principal sources of ground gases; migration from main GTLF to Areas 1, 2 and 4[8] and gas generated in the underlying naturally occurring soils (i.e., “peat”) or any anthropogenic wastes and made ground *etc.* Risk relating to gas generation within the underlying calcareous strata is considered unlikely and has not been considered.

As outlined in Section 4, the GTLF is primarily a landraise with only limited amounts of wastes below ground level. This, together with the shallow groundwater table (Section 3.3), will limit any lateral migration to the surface (approx. 3.3 ft (1 m) bgl) soils. Although landfill gas can dissolve and migrate within groundwater, this is considered unlikely to occur to a significant extent given the configuration of the GTLF. Lateral gas migration is only likely to be of concern where pressure-driven advective flow occurs but, again, as described in Section 4.3, the likelihood of any meaningful migration from the GTLF to the ISWMS facilities is considered to be minimal; being mitigated by the landfill gas collection system **(Appendix A)** already installed at the currently capped North Mound (Phase 1) and to be installed the ongoing westward expansion (Phase 2), along with the presence of the lined and capped RWL between the GTLF and the remainder of the ISWMS facilities.

With respect to gas generation immediately beneath Areas 1, 2, 3 and 4:

– Area 1 is the RWL and landfill gas generated in this area is unlikely to be of concern;
– There is some evidence of buried wastes in Area 2 but these are understood to be historical and of limited depth and so the gas generation potential of these materials is assumed to be low;
– There is currently no evidence of any materials likely to generate gas beneath Area 3; and
– Although Area 3 is the location of the “old landfill” and so buried wastes are anticipated it is understood that these wastes were generally burnt prior to burial and so their gas generation potential is considered to be low.

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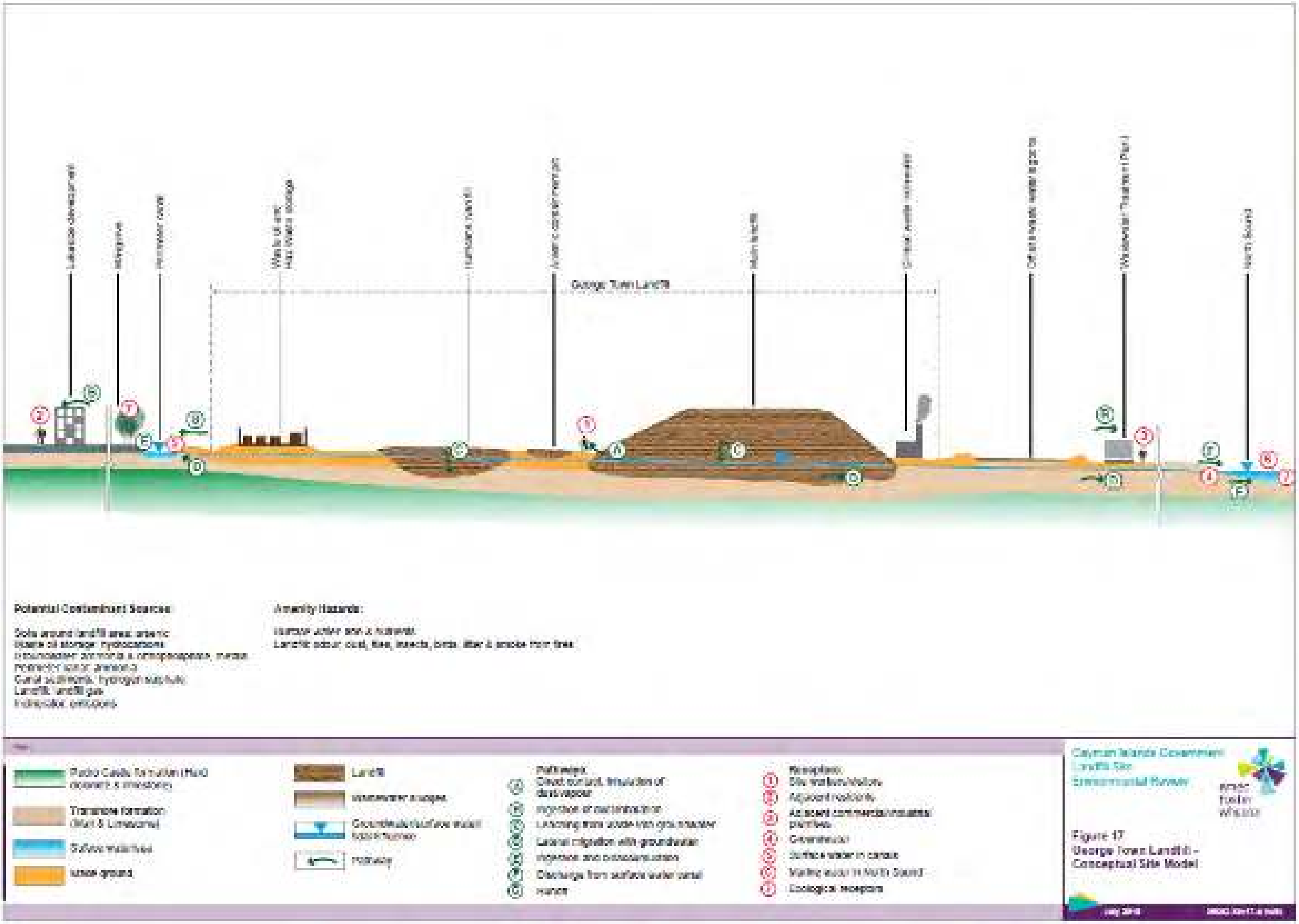

Figure 12 Conceptual Site Model – illustrative cross section with the approximate extent of the ISWMS facilities shown

7. Impact assessment: geotechnical

The likely significant land quality effects related to the geotechnical environment identified both in the ToR and during the assessment are provided in Table 14.

Table 14 Likely significant land quality effects (Geotechnical) that are recommended for assessment

Activity	Effect	Receptor
All phases (construction, operation and decommissioning) – site activities	Existing waste surface layer, which is not suitable to support the proposed development.	ISWMS infrastructure
All phases (construction, operation and decommissioning) - Site activities	Karst features in subsurface such as sinkholes and caves that are unable to adequately support the proposed development leading to geotechnical instability.	Site staff, construction workers and visitors (human health) ISWMS infrastructure
All phases (construction, operation and decommissioning) - seismic/tectonic events	The Cayman Islands sit in an active seismic zone. Earthquakes and tsunamis are significant potential hazards.	Site staff, construction workers and visitors (human health) ISWMS infrastructure

7.1 Impact assessment

The geotechnical hazards can be listed in the following order in terms of their economic impact on the proposed development starting from less severe to most severe.

1. Waste layer, which is deemed unsuitable for support of the proposed development.
2. The Bluff Formation limestone or alternatively improved ground are considered the only suitable foundation supporting stratum.
3. The location of the Site in a high seismic zone.

All three of the above geotechnical hazards have been assessed in the absence of mitigation, as provided in Table 15.

Table 15 Assessment of potential geotechnical effects in relation to the ISWMS

Activity	Receptor	Sensitivity	Magnitude	Significance	Rationale
Development	**ISWMS infrastructure**	**Medium**	**Medium**	**Medium**	**The waste layer has a low bearing capacity. This is considered a Significant Effect.**
Construction on shallow foundations on Ironshore Formation	**Site staff, construction workers and visitors (human health)**	**Medium**	**Medium**	**Medium**	**Geotechnical instability could pose a risk to all on-site persons. This is considered a Significant Effect.**
	ISWMS infrastructure	**Medium**	**Medium**	**Medium**	**Shallow cavities in Ironshore Formation may result in foundation collapse. This is considered a Significant Effect.**
Construction of piled foundations in bedrock of the	**Site staff, construction workers and visitors (human health)**	**Medium**	**Medium**	**Medium**	**Geotechnical instability could pose a risk to all on-site persons. This is considered a Significant Effect.**

Activity	Receptor	Sensitivity	Magnitude	Significance	Rationale
Bluff Formation	**ISWMS infrastructure**	**Medium**	**Medium**	**Medium**	**Cavities in limestone could cause loss of cement being poured to form cast-in-place piles. This is considered a Significant Effect.**
Operation of facility	**Site staff, construction workers and visitors (human health)**	**Medium**	**High**	**High**	**Cayman island seismicity could damage new structures, which could pose a risk to all on-site persons. This is considered a Significant Effect.**
	ISWMS infrastructure	**Medium**	**High**	**High**	**Cayman island seismicity could damage new structures. This is considered a Significant Effect.**

Notes: All potentially significant effects are highlighted in bold

7.2 Summary of findings

As identified in Table 15, potentially significant impacts related to the ground conditions and geological setting of Grand Cayman have been identified in the absence of appropriate mitigation. As discussed in Section 9.1, these potentially significant impacts can be reasonably mitigated for the ISWMS Site.

8. Impact assessment: geoenvironmental

8.1 Imported fill

GHD are aware that fill (e.g., soils or aggregates) will need to be imported during the construction of ISWMS, particularly to Area 3.

In many countries, importing recycled soils and aggregates (*e.g.* crushed concrete and demolition arisings) can represent sources of new contamination at development sites. Recycled aggregate, in particular, can be contaminated with asbestos where all asbestos-containing materials were not removed prior to demolition.

However, GHD have been informed by ReGen that any imported aggregates will be of virgin quarried stone as recycled aggregate is not currently available on the island. Indeed, one of the objectives of ISWMS is to establish a market for recycled secondary aggregate on the island as a more sustainable alternative to quarried stone. GHD also assume that any imported soils will also be uncontaminated and suitable for their intended use.

Consequently, it has been assumed that any imported fill will not pose any contamination risks and so such sources have not been considered within this impact assessment. Notwithstanding the above, it is recommended that the construction phase plan include suitable sampling and testing requirements for all imported soils and aggregates to provide auditable evidence of their quality and suitability.

8.2 Embedded measures

The currently proposed layout, design and operation of the ISWMS is described elsewhere (GHD, 2023) and appears to have already taken some consideration of potential land contamination risks, explicitly or otherwise. Some of these proposed mitigation measures are outlined in more detail in the sections below.

8.2.1 Area 1

Area 1 coincides with a number of known potential sources of contamination and is at greatest risk from gas migration associated with the adjacent GTLF but, in general, also represents the least sensitive uses assuming that the residual waste landfill and other open air storage areas have minimal above ground buildings or structures with enclosed unventilated voids in which gases may accumulate.

8.2.1.1 Medical Waste Facility

According to Chapter 4, "*The Medical Waste Facility will be constructed to receive, store and process medical waste, and occasional other wastes such as expired currency and confiscated illicit drugs and other combustible materials not suited for treatment at the ERF*". The Medical Waste Facility building will be open sided with a roof to protect the equipment beneath, which will help to mitigate any potential landfill gas risks.

8.2.1.2 Residual Waste Landfill (RWL)

According to Chapter 4, "t*he RWL will be an engineered facility with a composite liner, leachate containment, leachate treatment, environmental controls and monitoring*". It will be designed, constructed and/or operated in line with relevant modern US standards, which should include procedures to manage leachate, dusts, odours and landfill gas, such as:

– Resource Conservation and Recovery Act (RCRA) (Sub-Title D Non-Hazardous Rules and Sub-Title C Hazardous Rules)
– RCRA Subtitle D (258) Seismic Design Guidance for Municipal Solid Waste Landfill Facilities.
– 40 Code of Federal Regulations
  - Part 258 – Criteria for Municipal Solid Waste Landfills
  - Part 264 – Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
  - Part 265 – Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, And Disposal Facilities
– Standards for the GTLF design (remediated as part of the ISWMS project):
  - Florida Administrative Code No. 62-701.500: Landfill Operation Requirements
  - Florida Administrative Code No. 62-701.600: Landfill Final Closure

The nature of the residual waste (principally post-combustion residues from the ERF) will limit its leachability and putrescibility but, if fully complied with, such standards will further ensure that any leachate or landfill gas emissions are appropriately mitigated.

8.2.2 Area 2

Area 2 represents probably the most sensitive land uses at the ISWMS, including administration and maintenance buildings and public access areas. However, it is also located farther from the GTLF than Area 1 and so is shielded to a greater or lesser degree from any potential leachate or gas migration. However, although satellite imagery suggest Area 2 may be previously undeveloped, virgin land, initial investigations (APEC, 2021) suggest some degree of earlier waste disposal may be present in this area.

8.2.2.1 Energy Recovery Facility (ERF)

According to Chapter 4, "t*he ERF will be a state of the art controlled combustion (mass burn) facility that will render combustible, non recyclable waste to an inert ash and reduce the volume of incoming waste by 90 percent"*:

- "*Advanced air pollution control (APC) and continuous emissions monitoring (CEM) systems will ensure that ERF emissions are able meet current and future standards and not pose an adverse effect to the environment*" minimising the risks from any aerial deposition.
- The ERF will generate two residual waste streams; bottom ash (Section 8.1.2.4) and air pollution control residues (APCR); "*The bottom ash will be managed via the proposed Bottom Ash Recycling Facility. The APCR and boiler ash will be stabilised with cement and / or pozzolan by means of a pan mixer at the ERF and thereafter discharged to a concrete mixer truck for transfer to and disposal at the proposed RWL*".
- It is anticipated that cooling will use abstracted groundwater "*from an array of three 425 ft deep borehole wells beneath the ISWMS Site. Once passed (non-contact) through the condensers, the 'spent' cooling water will then be returned to groundwater using a further array of three 725 ft deep discharge wells.*" This arrangement, involving physically separated primary and secondary cooling circuits, minimises the risk of the released cooling water being contaminated.

8.2.2.2 Green Waste Processing Facility

According to Chapter 4, the facility "*will receive and process source segregated Yard Waste and will store the resulting compost and mulch products for onward resale into the Cayman marketplace*" and will operate to recognised standards (*i.e.*, Resale secondary Yard Waste materials – Florida Administrative Code FAC 62 709.550). Achieving such standards should necessitate adequate quality control procedures with respect to the contamination of the received green wastes.

8.2.2.3 Construction and Demolition Waste Processing Facility

According to Chapter 4, processing "*allow for the recycling, recovery and diversion of construction and demolition wastes into aggregates, scrap metals and combustible material (using a shredder for bulky materials) for energy production in the ERF*". It will be located away from sensitive receptors but no relevant environmental controls are specified. It will be designed, constructed and/or operated in line with relevant modern standards.

8.2.2.4 Bottom Ash Processing Facility

According to Chapter 4, "*The Bottom Ash (BA) Processing Facility will be designed to process bottom ash from the ERF into a recovered aggregate which is suitable for use on the Cayman Islands and recovered ferrous and non ferrous metals that can be recycled through overseas markets for those materials*". The facility will be enclosed to provide complete containment to reduce dust emissions during operations. It will be designed, constructed and/or operated in line with relevant modern standards.

8.2.2.5 Abandoned and End of Life / Scrap Metal Processing Facility

According to Chapter 4, the facility will "*allow for the recycling, recovery and diversion of vehicles that have been abandoned or surpassed their useful life, as well as the processing of bulky scrap metals*". ELVs "*will be received, inspected, stripped of batteries, catalytic converters, airbags, tyres, etc. before being depolluted of all coolants, oils, and fuels to allow the recyclable components of the vehicles to be separated for re-use*". It will be designed, constructed and/or operated in line with relevant modern standards.

8.2.2.6 Materials Recycling Facility (MRF)

According to Chapter 4, the facility will "*be constructed to allow for the diversion and recovery of dry mixed recyclables (DMR) from Contract Waste in Grand Cayman and the Sister Islands; receiving, processing, baling and/or storing DMR for onward resale into local and off island recycling markets*". An indoor area will allow storage of baled "weather-sensitive DMR (e.g. baled paper and card, or UV sensitive baled plastic)", all other materials will be stored in bales outside or in shipping containers.

8.2.2.7 Household Waste Recycling Centre (HWRC)

According to Chapter 4, this will be "*the public's central drop-off point for recyclable/non-recyclable household waste, including specialist waste items such as hazardous household wastes*" and will "*comprise two distinct areas: a covered, single level re-use centre and an open, split level recycling centre close to the Project Site main entrance*". The HWRC will be fully concreted.

8.2.3 Area 3

Area 3 consists solely of the **CUC substation**. According to Chapter 4, this "*will be a pre-fabricated building(s) with specialized switchgear for connecting to the grid"* and "*The typical occupancy will be 1-2 people for monitoring and service"*. Area 3 will also require the importation of fill materials to provide adequate flood protection and vehicle access.

Area 3 is located to the north of the North Canal, which should isolate it from any contaminant or gas migration from the GTLF. Furthermore, this area is not suspected to have been subject to previous contaminative activities (e.g. waste disposal activities), although no data exists to confirm this.

8.2.4 Area 4

Area 4 consists solely of the **Landfill Gas Facility (LFG)**. According to Chapter 4, the LGF "*will be constructed to allow for the capture and destruction of LFG from the North Mound of the GTLF*" and "*Landfill gas will be extracted from the GTLF using a conventional gas extraction system of vertical wells bored into the landfill site, operating under slight negative pressure*". Depending on the location and design of the extraction system, the LGF should reduce or eliminate the potential for gas migration from the GTLF affecting other elements of the ISWMS. It will be designed, constructed and/or operated in line with Florida Administrative Code No. 62 701.530: Gas Management Systems.

The currently proposed gas collection system for the currently capped North Mound (Phase 1) and the ongoing Western Expansion (Phase 2) is presented in Appendix A. This shows the location of each extraction well and an estimate of their zone of influence. The design suggests that negative pressure could be established within the deepest areas of waste, but that this may not extend to the shallower sloping sides of the landfill, including those adjacent to Area 1.

8.2.5 Construction Environmental Management Plan (CEMP)

According to Chapter 4, a CEMP will be prepared prior to any construction activities. This will define the specific environmental mitigation measures to be applied in order to demonstrate application of the relevant pollution prevention Legislation and Good Industry Practice.

It is currently intended that:

- The use of locally available material in construction will be maximized (including C&D waste).
- Extents of the existing arsenic pit will be carefully defined and marked out and thereafter prepared to receive the overlying RWL.

It should be noted that, prior to construction, further geotechnical investigations and surveys are scheduled in order to "*provide detailed geological and geotechnical information for layers of made ground (which will be used mainly for road design), peat and unconsolidated limestone and characteristics of the underlying Dolostone bedrock (which will be used mainly for foundation design)*". It is recommended that these investigations also consider the nature and extent of any contamination and, in particular, the gas generation and migration potential of any underlying madeground (including buried wastes).

8.3 Potential risk management options

Until suitable and sufficient site investigation data is available regarding the levels of soil contamination present, the need for, and specification of, any risk management options (*i.e.* remediation) cannot be ascertained. However, given the nature of the development it is likely that substantial concentrations of contamination would need to be present before any risks would be considered unacceptable (*i.e.* remediation warranted)[8]. This is likely to limit the possibility and scope of any remediation required.

If risk management is required, an options appraisal exercise will be needed to identify the most appropriate remediation option or combination of options. The selection of the wide-range of potential options will depend on a variety of factors, including:

- Cost (including on-island availability);
- Available time-scale
- Nature of the contamination:
  - Organic or inorganic (including biodegradability)
  - Gross or light contamination
  - Localised or wide-spread.
- Nature of the receptor(s) at risks:
  - human health or infrastructure[9]
  - on-site or offsite

However, given the pollutant linkages outlined in the CSM (Section 6) and the low sensitivity of the development, it is likely that relatively low-risk and low-complexity remediation options would be appropriate. For example:

- Most risks to construction workers could probably be addressed by avoiding disturbance of heavily contaminated areas or, where necessary, adopting appropriate occupational hygiene practices (*e.g.* suitable welfare facilities, appropriate PPE and, if needed, respiratory protection).
- Most risks to site staff and visitors (i.*e.* on-site human health) and surrounding land users (i.*e.* off-site human health) could probably be addressed through targeted excavation to a limited depth and disposal in the RWL, changes to the layout of hardstanding and building footprints to avoid or cover the contamination and/or application of a layer of clean capping (*i.e.* soils, aggregates or hardstanding).
- Most risks to "ISWMS infrastructure" could probably be addressed by modifying its design/specification (*e.g.* specifying contaminant-resistant concrete for in-ground structures, or contaminant resistant drinking water pipe materials).
- Risks to from ground gases and vapours would be limited to internal voids and spaces within buildings and structures and could probably be addressed through adequate consideration during foundation design (*e.g.* specifying naturally or mechanically ventilated sub-slab voids, gas and vapour membranes within foundations and/or gas alarms).

8.4 Impact assessment

Due to the current unsustainable design and practices at the GTLF and resulting effects on soil (and groundwater) quality, it is likely that the construction of the ISWMS will result in net environmental benefits. However, there is the potential for shorter-term land contamination effects during the construction, operation and residual effects following the ultimate decommissioning of the ISWMS. These effects have been assessed in the following sections.

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8 In addition to any requirement to mitigate harmful effects from contamination, remediation could also be required for aesthetic (*e.g.* odour) or geotechnical reasons.

9 The need for soil remediation could also be driven by risks to ground or surface waters, but such risks are considered elsewhere.

The potential for land contamination (metals, PAHs and possibly dioxins *etc.*) to arise as a result of unintentional fires associated with the storage of combustible wastes at various parts of the ISWMS has not been considered. The risk of such fires, together with the proposed mitigation measures, has been considered in Chapter 4 of the EIA.

8.4.1 Area 1

Area 1 is adjacent to the GTLF and represents the current location of the OSTSA, Arsenic Containment Cell, Equipment Storage Area and OHWSA, which are potential sources of contamination. The potential land quality effects of the proposed development on the relevant receptors (Section 2.2) identified during this assessment are summarised in Table 16 and the significance of these is assessed in Table 17.

Table 16 Potential geoenvironmental effects identified in relation to Area 1. This area is primarily the proposed as the location of the Residual Waste Landfill (RWL), but also the Bottom ash storage and Medical waste facilities.

Activity	Effect	Receptor
Construction Phase		
Disturbance, exposure and spread of existing contamination (including buried wastes) within the Old Scrap and Tyre Stockpile Area	Exposure (and potential spread) of contaminated soils at the site surface and release of runoff, dusts, gases and vapours	• Site staff, construction workers and visitors (human health) • Surrounding land users (human health) e.g. residential, commercial/industrial, schools • (ground and surface water is outside scope of this report and discussed elsewhere)
Disturbance of existing contamination within the Arsenic Containment Cell (current plans involve constructing the RWL over the existing cell and so disturbance should be minimised)	Exposure (and potential spread) of contaminated soils at the site surface and release of runoff, dusts, gases and vapour	• Site staff, construction workers and visitors (human health) • Surrounding land users (human health) e.g. residential, commercial/industrial, schools • (ground and surface water is outside scope)
Disturbance of existing contamination within the Equipment Storage Area, particularly the Oil and Hazardous Waste Storage Area (*NB*: oil contamination has been observed in this area)	Exposure (and potential spread) of contaminated soils at the site surface and release of runoff, dusts, gases and vapour	• Site staff, construction workers and visitors (human health) • Surrounding land users (human health) e.g. residential, commercial/industrial, schools • (ground and surface water is outside scope)
Construction involving composite liner and capping	Impervious footprint has the potential to modify the current gas migration regime, increasing gas migration.	• Surrounding land users (human health) e.g. residential, commercial/industrial, schools
Operational Phase		
Spillage or release of wastes during storage, transport or placement prior to capping	Exposure (and potential spread) of contaminated soils at the site surface and release of runoff, dusts, gases and vapour	• Site staff, construction workers and visitors (human health) • Surrounding land users (human health) e.g. residential, commercial/industrial, schools • (ground and surface water is outside scope)

Activity	Effect	Receptor
Failure of landfill cap (*e.g.* due to flawed engineering, extreme weather events or sea-level rise)	Ingress of rainwater resulting in uncontrolled releases of leachate to the surrounding ground, and the escape of any accumulated gases and vapours	• Site staff, construction workers and visitors (human health) • Surrounding land users (human health) e.g. residential, commercial/industrial, schools • (ground and surface water is outside scope)
Failure of the composite liner (*e.g.* due to flawed engineering, extreme weather events or sea-level rise)	Ingress of groundwater and uncontrolled releases of leachate and contaminants to the surrounding ground	• Site staff, construction workers and visitors (human health) • Surrounding land users (human health) e.g. residential, commercial/industrial, schools • (ground and surface water is outside scope)
Medical waste incinerator is anticipated to be diesel-fired	Leaks and spillages from the diesel storage and distribution system could affect the underlying soils (and ground water)	• Site staff, construction workers and visitors (human health) • ISWMS infrastructure • (ground and surface water is outside scope)
Storage and maturation of ERF Bottom ash	Release of contaminants in leachate and dusts leading to contamination of local soils	• Site staff, construction workers and visitors (human health) • (ground and surface water is outside scope)
Inappropriate disposal of additional wastes during emergency situations (*e.g.* hurricane or earthquake debris)	The composition of such wastes is unknown but may result in unsuitable materials being interred that could result in unforeseen leachate and gas/vapour issues that could affect the surrounding ground	• Site staff, construction workers and visitors (human health) • ISWMS infrastructure • Surrounding land users (human health) e.g. residential, commercial/industrial, schools • (ground and surface water is outside scope)

Notes: 1. No distinction has been made between the construction, operation and decommissioning phases of the RWL, as the construction and operation of a landfill occur concurrently and the landfill is not intended to be decommissioned, although it will be capped, restored and managed in the long-term.

Table 17 Significance assessment of potential geoenvironmental effects in relation to Area 1. All potentially significant effects are highlighted in bold.

Activity	Receptor	Sensitivity	Magnitude	Significance	Rationale
Disturbance, exposure and spread of existing contamination (including buried wastes) within the Old Scrap and Tyre Stockpile Area	**Site staff, construction workers and visitors (human health)**	**Medium**	**Medium**	**Medium**	**Depending on the contaminants encountered the consequences could be substantial (e.g. asbestos or other carcinogens), but this is not likely to occur. However, some risks (particularly to construction workers) may require some degree of mitigation (Section 8.2). Until suitable and sufficient site investigation data is available, this is considered a potential Significant Effect**
	Surrounding land users (human health) e.g. residential, commercial/industrial, schools	High	Negligible	Low	The low contaminant mobility likely to be associated with such weathered wastes, mean it is very unlikely that off-site effects will occur that are greater than those to on-site receptors. Considered not to be significant.
Disturbance of existing contamination within the Arsenic Containment Cell (current plans involve constructing the RWL over the existing cell and so disturbance should be minimised)	Site staff, construction workers and visitors (human health)	Medium	Medium	Medium	Arsenic, and chromium, (which are both potentially carcinogenic) are known to be present but no disturbance of these materials is proposed. Considered not to be significant.
	Surrounding land users (human health) e.g. residential, commercial/industrial, schools	High	Low	Medium	It is very unlikely that off-site effects will occur that are greater than those to on-site receptors. Considered not to be significant.
Disturbance of existing contamination within the Equipment Storage Area, particularly the Oil and Hazardous Waste Storage Area (NB oil contamination has been observed in this area)	**Site staff, construction workers and visitors (human health)**	**Medium**	**Low**	**Medium**	**Oil contamination is known to exist and will need to be addressed. Although serious health effects are considered unlikely, some risks (particularly to construction workers) may require some degree of mitigation (Section 8.2). Until suitable and sufficient site investigation data is available, this is considered a potential Significant Effect**
	Surrounding land users (human health) e.g. residential, commercial/industrial, schools	High	Low	Medium	There have been no reported off-site affects from the currently identified oil contamination. It is unlikely that any off-site effects will occur if all on-site receptors are protected. Considered not to be significant.

Activity	Receptor	Sensitivity	Magnitude	Significance	Rationale
Construction involving composite liner and capping may modify the landfill gas migration	Surrounding land users (human health) e.g. residential, commercial/industrial, schools	High	Low	Medium	The likelihood of landfill gas migration to Area 1 from the GTLF is considered to be minimal. It is considered unlikely that gas risks to surrounding properties would be increased. Considered not to be significant.
Spillage or release of wastes during storage, transport or placement prior to capping	Site staff, construction workers and visitors (human health)	Medium	Medium	Medium	Some minor releases are likely during the 25 year operation. However, the operational standards are likely to ensure that only suitable materials are placed in the landfill and that any exposure of onsite workers is controlled. Considered not to be significant due to these inherent controls
	Surrounding land users (human health) e.g. residential, commercial/industrial, schools	High	Low	Medium	The relatively inert nature of the materials to be landfilled and the existing controls (which should include dust management), should mean that there is no significant risk to the health of off-site receptors.
Failure of landfill cap (*e.g.* due to flawed engineering, extreme weather events or sea-level rise)	Site staff, construction workers and visitors (human health)	Medium	Low	Medium	The relatively inert nature of the materials to be landfilled (solidified APCR etc.) should minimise the risk from leachable or volatile contaminants. The proposed construction standards should ensure that the cap is robust and installed to the required standard, and this EIA will consider potential Climate Change effects. Not considered significant
	Surrounding land users (human health) e.g. residential, commercial/industrial, schools	**High**	**Medium**	**High**	**The spread of landfill wastes could have serious affects over a large area. Although serious health effects are considered unlikely, some risks (particularly to construction workers) may require some degree of mitigation (Section 8.2). Until suitable and sufficient site investigation data is available, this is considered a potential Significant Effect**
Failure of the composite liner (*e.g.* due to flawed engineering, extreme weather events or sea-level rise)	Site staff, construction workers and visitors (human health)	Medium	Low	Medium	The relatively inert nature of the materials to be landfilled (solidified APCR etc.) should minimise the risk from leachable or volatile contaminants. The proposed construction standards should ensure that the cap is robust and installed to the required standard, and this EIA will consider potential Climate Change effects. Not considered significant.
	Surrounding land users (human health) e.g. residential,	High	Low	Medium	Given the nature of the proposed landfill contents, any resulting leachate is unlikely to pose any serious off-site risks. Not considered significant

Activity	Receptor	Sensitivity	Magnitude	Significance	Rationale
	commercial/industrial, schools				
Medical waste incinerator is anticipated to be diesel-fired (leaks)	Site staff, construction workers and visitors (human health)	Low	Low	Low	Release of limited volumes of relatively low toxicity fuels are unlikely to be significant at a waste management facility and there is unlikely to be any critical ISWMS infrastructure in Area 1 that may be affected (e.g. drinking water pipes)
	ISWMS infrastructure	Low	Low	Low	
Storage and maturation of ERF Bottom ash	Site staff, construction workers and visitors (human health)	Low	Low	Low	Significant affects are considered unlikely given the nature of the activities in Area 1
Inappropriate disposal of additional wastes during emergency situations (*e.g.* hurricane or earthquake debris	Site staff, construction workers and visitors (human health)	Medium	Low	Medium	Although such an event is foreseeable during the ISWMS operational period, it is not certain. Substantial affects were not reported following the uncontrolled burial of Hurricane Ivan debris. The landfill construction and existing occupational health controls etc. should prevent or minimise any onsite exposures. Not considered Significant
	Surrounding land users (human health) e.g. residential, commercial/industrial, schools	High	Low	Medium	Although possible, given the landfill construction, it is unlikely that sufficient leachate or gases would be released to substantially affect any of the ISWMS infrastructure on Area 2 and could easily be detected via subsequent monitoring. Not considered significant.

8.4.2 Area 2

The potential land quality effects of the proposed development on the relevant receptors (Section 2.2) identified during this assessment are summarised in Table 18 and the significance of these is assessed in Table 19.

Historically, waste incinerators are known to have been associated with downwind land contamination as a result of atmospheric deposition, including dioxins and heavy metals. However, according to Chapter 4 the design of the ERF is described as *"a state-of-the-art controlled combustion (mass burn) facility"* with "*Advanced air pollution control (APC) and continuous emissions monitoring (CEM) systems will ensure that ERF emissions are able meet current and future standards and not pose an adverse effect to the environment". Consequently, stack emissions from the ERF are been considered to be a potential operational source of land contamination.*

The potential for the handling of APC residues to generate hazardous dusts that could contaminate local soils or of inadequate stabilisation has also not been considered. This risk, together with the proposed mitigation measures, is assessed in Chapter 4.

Table 18 Potential geoenvironmental effects identified in relation to Area 2. There is some evidence that all or parts of this area may have been subject to historical waste disposal but is the proposed location for most other components of the ISWMS, including the Energy Recovery Facility.

Activity	Effect	Receptor
Construction Phase		
Disturbance, exposure and spread of buried wastes and associated contamination	Exposure (and potential spread) of contaminated soils at the site surface and release of runoff, dusts, gases and vapours	• Site staff, construction workers and visitors (human health) • Surrounding land users (human health) e.g. residential, commercial/industrial, schools • (ground and surface water is outside scope)
Releases and spillages of polluting materials and wastes during construction	Contamination of the underlying clean soils	• Site staff, construction workers and visitors (human health) • Surrounding land users (human health) e.g. residential, commercial/industrial, schools • (ground and surface water is outside scope)
Foundation and piling activities	Creation of migration pathways, including for ground gas and vapour migration	• Site staff, construction workers and visitors (human health) • ISWMS infrastructure • (ground and surface water is outside scope)
Construction of building and hardstanding	Impervious footprint has the potential to modify the current gas migration regime, increasing offsite migration.	• Surrounding land users (human health) e.g. residential, commercial/industrial, schools

Activity	Effect	Receptor
Operational Phase		
Storage and treatment of wastes contaminated with hazardous materials (*e.g.* Energy Recovery Facility, Green Waste Facility, Construction and Demolition Waste Facility, End of Life Vehicle Facility, Materials Recycling Facility and Household Waste Recycling Centre)	Contamination of underlying soils by non-aqueous phase liquids (*e.g.* oils), soluble contaminates in leachate/runoff or accumulation of contaminated dusts	• Site staff, construction workers and visitors (human health) • ISWMS infrastructure • (ground and surface water is outside scope)
	Inadequate management of contaminated surface water runoff leading to contamination of nearby soils	• Site staff, construction workers and visitors (human health) • ISWMS infrastructure • Surrounding land users (human health) e.g. residential, commercial/industrial, schools • (ground and surface water is outside scope)
Storage and treatment of construction and demolition wastes contaminated with hazardous materials including asbestos-containing materials	Accumulation of contamination /asbestos fibres in underlying soils and potentially released and spread during treatment and onward during reuse as aggregate.	• Site staff, construction workers and visitors (human health) • ISWMS infrastructure • (ground and surface water is outside scope)
Vehicle and plant fuel storage It is anticipated that oil-based fuels will be stored on-site.	Leaks and spillages from fuel storage and distribution system could affect the underlying soils (and ground water)	• Site staff, construction workers and visitors (human health) • ISWMS infrastructure • (ground and surface water is outside scope)
Leachate and runoff from the windrows at the Green Waste facility	Leading to contamination (including pesticides) of the underlying and surrounding soils	• Site staff, construction workers and visitors (human health) • ISWMS infrastructure • (ground and surface water is outside scope)
Potential return of geothermal cooling water (non-contact)	Reinjection of contaminated cooling water leading to contamination of the soils surrounding the injection point/soakaway	• Site staff, construction workers and visitors (human health) • ISWMS infrastructure • (ground and surface water is outside scope)
Vehicle operation and on-site maintenance	Spillages and leaks of fuels, hydraulic fluids, coolants and waste oils *etc.* affecting underlying soils, particularly at maintenance and waste storage areas	• Site staff, construction workers and visitors (human health) • ISWMS infrastructure (ground and surface water is outside scope)
Flooding or inundation due to extreme weather events or sea-level rise	Spread of wastes and contamination in floodwater/runoff leading to affects on soils beneath Area 2 and surrounding land	• Site staff, construction workers and visitors (human health) • ISWMS infrastructure • Surrounding land users (human health) e.g. residential, commercial/industrial, schools • (ground and surface water is outside scope)

Activity	Effect	Receptor
Decommissioning Phase		
Uncontrolled decommissioning and disposal of plant and equipment containing hazardous materials	Release of hazardous materials (including dusts gases and vapours) into the underlying ground	• Site staff, construction workers and visitors (human health) • Surrounding land users (human health) e.g. residential, commercial/industrial, schools • (ground and surface water is outside scope)

Table 19 Significance assessment of potential geoenvironmental effects in relation to Area 2. All potentially significant effects are highlighted in bold.

Activity	Effect	Receptor	Sensitivity	Magnitude	Significance	Rationale
Construction Phase						
Disturbance, exposure and spread of existing contamination (particularly buried wastes) in the underlying soils	Exposure (and potential spread) of contaminated soils at the site surface and release of runoff, dusts, gases and vapours	**Site staff, construction workers and visitors (human health)**	**Medium**	**Medium**	**Medium**	**Depending on the contaminants encountered the consequences could be substantial (e.g. asbestos or other carcinogens), but this is not likely to occur. However, some risks (particularly to construction workers) may require some degree of mitigation (Section 8.2). Until suitable and sufficient site investigation data is available, this is considered a potential Significant Effect**
		Surrounding land users (human health) e.g. residential, commercial/industrial, schools	High	Low	Medium	The poor contaminant mobility likely to be associated with such weathered wastes, mean it is very unlikely that off-site effects will occur that are greater than those to on-site receptors. Considered not to be significant
Releases and spillages of polluting materials and wastes during construction	Contamination of the underlying soils	Site staff, construction workers and visitors (human health)	Medium	Low	Medium	Some releases are likely but are unlikely to be sufficient in scale to be significant. Considered not to be significant
		Surrounding land users (human health) e.g. residential, commercial/industrial, schools	High	Low	Medium	It is less likely for there to be any effects for off-site receptors. Not considered significant

Activity	Effect	Receptor	Sensitivity	Magnitude	Significance	Rationale
Foundation and piling activities	Creation of migration pathways, including for ground gas (e.g. from underlying alluvium and/or migration from GTLF) and vapour migration	Site staff, construction workers and visitors (human health)	Medium	Medium	Medium	While there is some uncertainty about the potential gas risk, it is likely that any migration from the GTLF will negligible and the gas generation potential of the underlying soils will be low. Based on the nature of the development, the gas risk is thus considered to be low and so is not considered a potentially Significant effect
		ISWMS infrastructure	Medium	Medium	Medium	While there is some uncertainty about the potential gas risk, it is likely that any migration from the GTLF will negligible and the gas generation potential of the underlying soils will be low. Based on the nature of the development, the gas risk is thus considered to be low and so is not considered a potentially Significant effect
Construction of building and hardstanding	Impervious footprint has the potential to modify the current gas migration regime, increasing offsite migration.	Surrounding land users (human health) e.g. residential, commercial/industrial, schools	High	Low	Medium	In the absence of adequate Site investigation data and gas risk assessment, it is possible that off-site gas migration from the GTLF could occur. However, due to the landfill gas extraction system, this is considered unlikely and so is not considered a potentially Significant effect
Operational Phase						
Storage and treatment of wastes contaminated with hazardous materials (*e.g.* Energy Recovery Facility, Green Waste Facility, Construction and Demolition Waste Facility, End of Life Vehicle Facility, Materials Recycling Facility and	Contamination of underlying soils by non-aqueous phase liquids (*e.g.* oils), soluble contaminates in leachate/runoff or accumulation of contaminated dusts	Site staff, construction workers and visitors (human health)	Medium	Medium	Medium	Although some hazardous materials may be stored and treated, these should be identified and managed using appropriate occupational controls etc. Not considered significant
		ISWMS infrastructure	Medium	Low	Medium	Although possible, any affects are unlikely to have serious affects on the function or safety of infrastructure. Not considered significant
	Inadequate management of contaminated	Site staff, construction workers and visitors (human health)	Medium	Low	Medium	Given existing occupational H&S controls, exposure via surface water runoff is unlikely to be of concern. Not considered significant

Activity	Effect	Receptor	Sensitivity	Magnitude	Significance	Rationale
Household Waste Recycling Centre)	surface water runoff leading to contamination of nearby soils	ISWMS infrastructure	Medium	Low	Medium	Likely runoff concentrations are unlikely to have serious affects on the function or safety of infrastructure. Not considered significant
		Surrounding land users (human health) e.g. residential, commercial/industrial, schools	High	Low	Medium	If not sufficiently mitigated, contaminated runoff could affect more sensitive off-site receptors. In the absence of detailed drainage and runoff treatment plans, this is not considered a potential Significant Effect
Storage and treatment of construction and demolition wastes contaminated with hazardous materials including asbestos-containing materials	Accumulation of asbestos fibres in underlying soils and potentially released and spread during treatment and onward during reuse as aggregate.	**Site staff, construction workers and visitors (human health)**	**Medium**	**Low**	**Medium**	**Some C&D materials will contain asbestos and it is becoming apparent that they may also be tainted by other sorbed contaminants. Adequate control measures will be required (*e.g.* periodic testing and occupational hygiene monitoring). Considered a potential Significant Effect**
		ISWMS infrastructure	Medium	Negligible	Low	Compared to site staff, effects of infrastructure are likely to be negligible. Not considered significant
Vehicle and plant fuel storage	Leaks and spillages from fuel storage and distribution system could affect the underlying soils (and ground water)	Site staff, construction workers and visitors (human health)	Medium	Low	Medium	The volume of fuel stored is likely to be minimal and the health risks for diesel are not substantial. Not considered significant
		ISWMS infrastructure	Medium	Negligible	Low	Not considered significant
Leachate and runoff from irrigation of the windrows at the Green Waste facility	Leading to contamination (including pesticides) of the underlying and surrounding soils	Site staff, construction workers and visitors (human health)	Medium	Low	Medium	The leachate is unlikely to have substantial toxicity but due to the long-term operation, adequate consideration of leachate management is required. However, this is not considered a significant effect
		ISWMS infrastructure	Medium	Low	Medium	No substantial affects on infrastructure are anticipated. Not considered significant

Activity	Effect	Receptor	Sensitivity	Magnitude	Significance	Rationale
Potential return of geothermal cooling water (non-contact)	Reinjection of contaminated cooling water leading to contamination of the soils surrounding the injection point/soakaway	Site staff, construction workers and visitors (human health)	Medium	Negligible	Low	“No contact” design minimises any risks. Not significant
		ISWMS infrastructure	Medium	Low	Medium	“No contact” design minimises any risks. Not significant
Vehicle operation and on-site maintenance	Spillages and leaks of fuels, hydraulic fluids, coolants and waste oils *etc.* affecting underlying soils, particularly at maintenance and waste storage areas	Site staff, construction workers and visitors (human health)	Medium	Low	Medium	Even if vehicle maintenance does occur on site, spillages should be minimal and volumes limited. Not significant
		ISWMS infrastructure	Medium	Low	Medium	No substantial affects on infrastructure are anticipated. Not considered significant
Flooding or inundation due to extreme weather events or sea-level rise	Spread of wastes and contamination in floodwater/runoff leading to affects on soils beneath Area 2 and surrounding land	Site staff, construction workers and visitors (human health)	Medium	Low	Medium	The likely affects are unlikely to substantially raise the existing risks from the working environment. Not considered significant
		ISWMS infrastructure	Medium	Low	Medium	Th contamination risks to infrastructure unlikely to affect function or safety. Not significant
		Surrounding land users (human health) e.g. residential, commercial/industrial, schools	**High**	**Medium**	**High**	**The spread of landfill wastes could have serious affects over a large area. Although serious health effects are considered unlikely, some risks (particularly to construction workers) may require some degree of mitigation (Section 8.2). Until suitable and sufficient site investigation data is available, this is considered a potential Significant Effect**

Activity	Effect	Receptor	Sensitivity	Magnitude	Significance	Rationale
Decommissioning Phase						
Uncontrolled decommissioning and disposal of plant and equipment containing hazardous materials	Release of hazardous materials (including dusts gases and vapours) into the underlying ground	Site staff, construction workers and visitors (human health)	Medium	Medium	Medium	The incorporation of hazardous materials into the fabric or the accumulation of hazardous waste residues, could pose a risk to those undertaking demolition. However, such risks apply to all demolition and are not unusual. Not considered significant.
		Surrounding land users (human health) e.g. residential, commercial/industrial, schools	High	Low	Medium	If on-site hazards are managed, off-site risks should be minimal. Not considered significant

8.4.3 Area 3

The current information suggests that land contamination is unlikely to affect Area 3 as it has apparently not been used for waste disposal operations and is isolated from gas migrating from the GTLF. Thus, the potential land quality effects of the proposed development on the relevant receptors (Section 2.2) are limited to those summarised in Table 20 and the significance of these is assessed in Table 21.

Table 20 Potential geoenvironmental effects identified in relation to Area 3 (CUC substation). No underlying contamination or landfill gas migration is anticipated in this area.

Activity	Effect	Receptor
Construction Phase		
Releases and spillages of polluting materials and wastes during construction	Introducing new contamination, which may become mobile, resulting in contaminated soils being present at the site surface and release of runoff, dusts, gases and vapours.	• Site staff, construction workers and visitors (human health) • Surrounding land users (human health) e.g. residential, commercial/industrial, schools • (ground and surface water is outside scope)
Operational Phase		
None identified	None identified	None identified
Decommissioning Phase		
Uncontrolled decommissioning and disposal of plant and equipment containing hazardous materials	Release of hazardous materials (including dusts gases and vapours) into the underlying ground	• Site staff, construction workers and visitors (human health) • Surrounding land users (human health) e.g. residential, commercial/industrial, schools • (ground and surface water is outside scope)

Table 21 Significance assessment of potential geoenvironmental effects in relation to Area 3 (CUC substation). All potentially significant effects are highlighted in bold.

Activity	Effect	Receptor	Sensitivity	Magnitude	Significance	Rationale
Construction Phase						
Releases and spillages of polluting materials and wastes during construction	Contamination of the underlying clean soils	Site staff, construction workers and visitors (human health)	Medium	Low	Medium	Some releases are likely but are unlikely to be sufficient in scale to be significant. Considered not to be significant
		Surrounding land users (human health) e.g. residential, commercial/industrial, schools	High	Low	Medium	It is less likely that any effects will affect off-site receptors. Not considered significant
Decommissioning Phase						
Uncontrolled decommissioning and disposal of plant and equipment containing hazardous materials	Release of hazardous materials (including dusts gases and vapours) into the underlying ground	Site staff, construction workers and visitors (human health)	Medium	Medium	Medium	The incorporation of hazardous materials into the fabric or the accumulation of hazardous waste residues, could pose a risk to those undertaking demolition. However, such risks apply to all demolition and are not unusual. Not considered significant.
		Surrounding land users (human health) e.g. residential, commercial/industrial, schools	High	Low	Medium	If on-site hazards are managed, off-site risks should be minimal. Not considered significant.

8.4.4 Area 4

The Landfill Gas Facility is to be located on the 'Old Landfill' but there is considerable uncertainty regarding both the contamination levels associated with any buried wastes and the degree of landfill gas generation in this vicinity. The potential land quality effects of the proposed development on the relevant receptors (Section 2.2) identified during this assessment are summarised in Table 22 and the significance of these is assessed in Table 23.

Table 22 Potential geoenvironmental effects identified in relation to Area 4 (Landfill Gas Facility). This area is located on or near the 'Old landfill'.

Activity	Effect	Receptor
Construction Phase		
Disturbance, exposure and spread of existing contamination (particularly buried wastes) in the underlying soils	Exposure (and potential spread) of contaminated soils at the site surface and release of runoff, dusts, gases and vapours	• Site staff, construction workers and visitors (human health) • Surrounding land users (human health) e.g. residential, commercial/industrial, schools • (ground and surface water is outside scope)
Releases and spillages of polluting materials and wastes during construction	Contamination of the underlying clean soils	• Site staff, construction workers and visitors (human health) • Surrounding land users (human health) e.g. residential, commercial/industrial, schools • (ground and surface water is outside scope)
Foundation and piling activities	Creation of migration pathways, including for ground gas and vapour migration	• Site staff, construction workers and visitors (human health) • ISWMS infrastructure • (ground and surface water is outside scope)
Construction of building and hardstanding	Impervious footprint has the potential to modify the current gas migration regime, increasing offsite migration.	• Surrounding land users (human health) e.g. residential, commercial/industrial, schools
Operational Phase		
None identified	None identified	None identified
Decommissioning Phase		
Uncontrolled decommissioning and disposal of plant and equipment containing hazardous materials	Release of hazardous materials (including dusts gases and vapours) into the underlying ground	• Site staff, construction workers and visitors (human health) • Surrounding land users (human health) e.g. residential, commercial/industrial, schools • (ground and surface water is outside scope)

Table 23 Assessment of potential geoenvironmental effects in relation to Area 4 (Landfill Gas Facility). All potentially significant effects are highlighted in bold.

Activity	Effect	Receptor	Sensitivity	Magnitude	Significance	Rationale
Construction Phase						
Disturbance, exposure and spread of existing contamination (particularly buried wastes) in the underlying soils	Exposure (and potential spread) of contaminated soils at the site surface and release of runoff, dusts, gases and vapours	**Site staff, construction workers and visitors (human health)**	**Medium**	**Medium**	**Medium**	**Depending on the contaminants encountered the consequences could be substantial (e.g. asbestos or other carcinogens), but this is not likely to occur. However, some risks (particularly to construction workers) may require some degree of mitigation (Section 8.2). Until suitable and sufficient site investigation data is available, this is considered a potential Significant Effect**
		Surrounding land users (human health) e.g. residential, commercial/industrial, schools	High	Low	Medium	The poor contaminant mobility likely to be associated with such weathered wastes, means it is very unlikely that off-site effects will occur that are greater than those to on-site receptors. Considered not to be significant
Releases and spillages of polluting materials and wastes during construction	Contamination of the underlying soils	Site staff, construction workers and visitors (human health)	Medium	Low	Medium	Some releases are likely but are unlikely to be sufficient in scale to be significant. Considered not to be significant
		Surrounding land users (human health) e.g. residential, commercial/industrial, schools	High	Low	Medium	It is less likely that any effects will affect off-site receptors. Not considered significant
Foundation and piling activities	Creation of migration pathways, including for ground gas (e.g. from underlying alluvium and/or migration from GTLF) and vapour migration	Site staff, construction workers and visitors (human health)	Medium	Medium	Medium	While there is some uncertainty about the potential gas risk, it is likely that any migration from the GTLF will negligible and the gas generation potential of the underlying soils will be low. Based on the nature of the development, the gas risk is thus considered to be low and so is not considered a potentially Significant effect
		ISWMS infrastructure	Medium	Medium	Medium	While there is some uncertainty about the potential gas risk, it is likely that any migration from the GTLF will negligible

Activity	Effect	Receptor	Sensitivity	Magnitude	Significance	Rationale
						and the gas generation potential of the underlying soils will be low. Based on the nature of the development, the gas risk is thus considered to be low and so is not considered a potentially Significant effect
Construction of building and hardstanding	Impervious footprint has the potential to modify the current gas migration regime, increasing offsite migration.	**Surrounding land users (human health) e.g. residential, commercial/industrial, schools**	**High**	**Low**	**Medium**	The gas generation potential of buried wastes in Area 4 is expected to be low. Not considered significant
Decommissioning Phase						
Uncontrolled decommissioning and disposal of plant and equipment containing hazardous materials	Release of hazardous materials (including dusts gases and vapours) into the underlying ground	Site staff, construction workers and visitors (human health)	Medium	Medium	Medium	The incorporation of hazardous materials into the fabric or the accumulation of hazardous waste residues, could pose a risk to those undertaking demolition. However, such risks apply to all demolition and are not unusual. Not considered significant.
		Surrounding land users (human health) e.g. residential, commercial/industrial, schools	High	Low	Medium	If on-site hazards are managed, off-site risks should be minimal. Not considered significant

8.5 Summary of findings

An assessment of the significance of each of the potential geoenvironmental effects identified with respect to Area 1 is presented in Table 17. In the absence of adequate site investigation data, this identified the following potentially significant effects:

1. Contamination (particularly buried wastes) associated with the OSTSA affecting the health of Site staff, construction workers and visitors;
2. Contamination (particularly buried wastes) associated with the Equipment Storage Area, particularly the OHWSA, affecting the health of Site staff, construction workers and visitors;
3. Failure of the RWL cap (*e.g.* due to flawed engineering, extreme weather events or sea-level rise) leading to the spread of landfill contents over a wide area affecting the health of surrounding land users (e.g. residential, commercial/industrial, schools).

An assessment of the significance of each of the potential geoenvironmental effects identified with respect to Area 2 is presented in Table 20. In the absence of adequate site investigation data, this identified the following potentially significant effects:

1. Contamination (particularly buried wastes) exposed during site development affecting the health of Site staff, construction workers and visitors;
2. Storage and treatment of construction and demolition wastes contaminated with hazardous materials (including asbestos-containing materials) affecting the health of Site staff, construction workers and visitors;
3. Flooding or inundation due to extreme weather events or sea-level rise resulting in the spread of wastes/contamination across a wide area affecting the health of surrounding land users (e.g. residential, commercial/industrial, schools).

An assessment of the significance of each of the potential geoenvironmental effects identified with respect to Area 3 (CUC substation) is presented in Table 21. No potentially significant effects were identified.

An assessment of the significance of each of the potential geoenvironmental effects identified with respect to Area 4 (Landfill Gas Facility) is presented in Table 23. In the absence of adequate site investigation data, this identified the following potentially significant effects:

1. Contamination (particularly buried wastes) exposed during site development affecting the health of Site staff, construction workers and visitors;

9. Mitigation measures:

9.1 Geotechnical

9.1.1 Geotechnical features of the exiting Formations

The poor bearing capacity of the man-made surficial layer and/or of peaty deposits renders it unsuitable support for the proposed development without mitigation. Development loads must therefore be transferred down to the more competent Ironshore or bedrock of the Bluff Formation. Even if these Formations may be considered suitable to support building foundations, they both present some features that may affect their geotechnical competence as mentioned in the following paragraphs.

9.1.1.1 Ironshore Formation

According to APEC (2021), the Ironshore Formation (*Marl*) is cemented by calcite and can be described as a weak limestone rock in which interbedded layers of cemented and non-cemented material can be found.

The Standard Penetration Test (SPT) performed in this Formation provides generally low blow counts (N values) which does not adequately describe the physical properties of the ‘marl’. These low values are often associated with the breaking of the cementation of the ‘marl’ during the SPT sampling, giving the impression of loose soil.

It is worth noting that the cemented nature of the ‘marl’ sustains small voids within the Ironshore Formation, in particular at the interface zone with the underlying Bluff Formation. The dimensions of these voids are not mentioned in the available documents. The presence of such voids may affect the stability of shallow footings founded into this Formation.

9.1.1.2 Bluff Formation

Numerous cavities were found in this Formation mainly in the Cayman and Brac Formations. The eventual presence of such cavities at shallow depth beneath the tip of deep foundations (piles) may cause a loss of bearing capacity in case of cavity collapse.

9.1.2 Supplemental geophysical investigation

In order to mitigate the risk that a foundation system (either shallow or deep) interfere with any eventual cavity, supplemental geophysical investigations are recommended. Among the usable techniques, Electrical Resistivity Tomography (ERT), Hydro-Tisar and Refraction seismic Tomography seem the most relevant. They may all allow for the cavity mapping down to a reasonable depth. Using the resulting maps to better define proposed structures limits may help mitigating the risk that a cavity impacts the foundations stability.

These investigation techniques may not be readily available in Cayman and involve mobilization from overseas. The required technical staff and equipment to perform a geophysical investigation is relatively limited (two persons and medium size truck for the equipment).

9.1.3 General geotechnical recommendations

As previously mentioned, both of the existing Ironshore and Bluff Formations may serve as a bearing stratum for the proposed development. Depending on the surficial inappropriate man made deposit thickness in the proposed development footprint, and eventually on the geophysical cavity mapping (see 9.1.2), the use of both shallow and deep foundation systems could be considered. Note that the foundation type to be considered should be designed to resist the seismic forces discussed in Section 3.4 in accordance with applicable building codes.

9.1.3.1 Shallow foundations (column and strip footings)

9.1.3.1.1 Areas with limited man-made deposit thickness

In the areas where the surficial man-made deposit is limited, the man made deposit should first be entirely removed in the whole building footprint down to the Ironshore Formation.

The exposed Ironshore Formation surface should then be carefully inspected, and any cavity/void/crack should be filled using either compacted granular material of concrete.

A geotextile should be spread on the exposed Ironshore Formation (to prevent any loss of the soil particles)

An engineering fill should then be constructed above the geotextile up to the proposed structure foundations and slab levels. The use of geogrids may also be required depending on the subgrade conditions.

9.1.3.1.2 Areas with higher man-made deposit thickness

In the areas where the Bluff Formation is deeper, ground improvement techniques should be considered to allow for the use of shallow foundation systems. These techniques require generally specific equipment that are not available in the Islands. Among these methods, vibro-compaction, controlled modulus columns (CMCs) and Geopiers seem to be applicable techniques for the proposed development. The choice of the most suitable technique and its design should be done by an experienced ground improvement contractor.

9.1.3.2 Deep foundations (piles)

It is understood that the use of cast-in-place piles is quite common on the island. It should be noted that loss of concrete installed through the vuggy Ironshore Formation and honeycombed Bluff Limestone could be quite significant. Steel casings set in the bedrock can be used to mitigate the loss of concrete but will not mitigate the risk that a cavity be present at shallow depth beneath the pile tip. Geophysical mapping of the cavities may help in mitigating this risk.

In any case, if the use of deep foundations system is considered, the floor slab should imperatively be structural, i.e. supported by foundation elements transferring the loads to the Bluff Formation (by means of piles, micro piles, grade beams etc.).

9.2 Geoenvironmental

9.2.1 Area 1

A number of potentially Significant Effects have been identified with respect to Area 1. In order to mitigate these potential effects, appropriate site investigation activities across Area 1 are needed, which could be combined with any required geotechnical investigation/remediation, to:

– Identify if any waste materials are present and, if so, to determine their characteristics and extent (both lateral and depth);
– Identify any additional sources of contamination; and
– Confirm the concentration of relevant contaminants, particularly in Made Ground, and their extents.

To ensure that any unacceptable risks are adequately managed, including within the Oil and Hazardous Waste Storage Area, where contaminant concentrations exceed the relevant CCTLs the affected materials will be excavated for stockpiling and subsequent removal to the RWL once the RWL is constructed. Materials below the CCTLs do not pose an unacceptable risk and so no mitigation or remediation of such materials is required.

It is essential that the cap used to seal completed sections of the RWL remains intact into the future; this needs to include consideration of foreseeable changes to the local climate and sea level due to climate change. The RWL is intended to be constructed in a phased manner and capping of the first phase is not anticipated until parts of the landfill have reached final tipping levels. Prior to any capping, checks should be made to ensure that the current design is adequate in light of the latest climate data and modelling and procedures put in place to ensure that the ultimate construction is in line with the agreed design.

9.2.2 Area 2

Further potentially Significant Effects have also been identified with respect to Area 2. Mitigation of a number of these also requires additional appropriate site investigation activities across Area 2, which could be combined with any required geotechnical investigation and/or earthworks verification testing, to:

– Identify if any waste materials are present and, if so, to determine their characteristics and extent (both lateral and depth);
– Identify any additional sources of contamination; and

– Confirm the concentration of relevant contaminants, particularly in Made Ground, and their extents.

To ensure that any unacceptable risks are adequately managed, where contaminant concentrations exceed the relevant CCTLs the affected materials will be excavated for stockpiling and subsequent removal to the RWL once the RWL is constructed. Materials below the CCTLs do not pose an unacceptable risk and so no mitigation or remediation of such materials is required.

If not already available, a detailed surface runoff management plan should be prepared, which details all areas from which runoff can arise and all locations where surface water contamination may arise. The plan should then propose appropriate and adequate runoff collection and treatment options for the identified runoff. It is recommended that, wherever possible, the principles of Sustainable Urban Drainage Systems (Woods Ballard et al., 2015) should be applied.

9.2.3 Area 3

No potentially Significant Effects were identified with respect to Area 3.

9.2.4 Area 4

A number of potentially Significant Effects have been identified with respect to Area 4. In order to mitigate these potential effects, appropriate site investigation activities across Area 4 are needed, which could be combined with any required geotechnical investigation, to:

– Identify if any waste materials are present and, if so, to determine their characteristics and extent (both lateral and depth);
– Identify any additional sources of contamination; and
– Confirm the concentration of relevant contaminants, particularly in Made Ground, and their extents.

To ensure that any unacceptable risks are adequately managed, where contaminant concentrations exceed the relevant CCTLs the affected materials will be excavated for stockpiling and subsequent removal to the RWL once the RWL is constructed. Materials below the CCTLs do not pose an unacceptable risk and so no mitigation or remediation of such materials is required.

10. Conclusions

10.1 Geotechnical

A review of the Site geology and geotechnical conditions show that the relatively flat Site is located in a high seismic zone and is covered with historical landfill waste material mixed with marl underlain by cemented coral deposits known as Ironshore Formation. These two stratigraphic units are underlain by the Bluff Formation limestone available at a depth of 4 to 6 m below the existing grades. The groundwater table is at approximately 0 m AMSL.

The surficial man-made deposit is considered unsuitable for support foundation loads without mitigation. The use of shallow foundation and conventional slab on grade will require the complete removal of the surficial man-made deposit and the construction of an engineered fill from the Ironshore Formation up the grades. Depending on the exposed Ironshore deposit surface deposit and the information provided by geophysical investigation (if available), geotextile and geogrid may be required to prevent loss of soil particles (geotextiles) and increase the fill rigidity (geogrids).

The Bluff Formation limestone although relatively strong is karstic and is characterized by a honeycombed surface, frequent cavities, and voids. Cast-in-place concrete piles is a preferred foundation option on the island. These can be used for the proposed development. To prevent a loss of concrete in the karstic features, steel casings may be used.

In order to mitigate the risk that proposed structure foundations interfere with the cavities noted in both the Ironshore and Bluff Formations, a geophysical mapping of these cavities recommended. Using these maps to better define the limits of the proposed structure will help limiting the risk that a foundation footing of a pile tip be affected by a cavity.

The development must be designed for the seismic forces in accordance with the applicable building codes.

10.2 Geoenvironmental

Construction and operation of the ISWMS is expected to result in net environmental benefits in the long-term compared to the unsustainable design and impacts to soil (and groundwater) quality of the current GTLF.

The footprint of the ISWMS can be considered as four areas with differing development histories and future land use profiles:

– Area 1 is within the current GTLF boundary and has a known history of waste treatment and disposal activities, including stockpiling of scrap metal and tires and the storage of waste oils and hazardous wastes. This area has also been subject to the extraction of underlying marl, but the extent of this extraction is unknown.
– Area 2 is outside the boundary of the GTLF. Although it has no recorded development history, limited site investigation activities have indicated the presence of buried wastes of some or all of this Area.
– Area 3 is within the current GTLF boundary but beyond the North Canal and no historical waste activities are believed to have affected this area.
– Area 4 is within the current GTLF boundary and is located in the vicinity of the original 'Old Landfill' or South Mound. The composition of the wastes in this landfill and their gas generation potential are not well characterised.

A thorough review of all the available information did not identify any significant site investigation data (for example buried waste locations, contaminant concentrations or ground gas monitoring) that would form the basis for establishing current baseline conditions (geoenvironmental) and allow a quantitative assessment of any land quality risks. Such site investigation data is needed prior to construction of the Project.

However, the available information did allow a qualitative assessment of the potential land quantity risks. Based on the current proposed design (Chapter 4), a variety of potential environmental affects associated with the construction, operation and decommissioning of the ISWMS has been identified. A number of these affects have been assessed as potentially Significant Impacts

Appropriate mitigation measures for these potentially Significant Impacts have been recommended, many of which are predicated on the collection of suitable and sufficient site investigation data to allow the current levels and extent of any contamination to be ascertained and the ground gas regime characterised, or the pre-emptive excavation of materials that exceed the relevant CCTLs to the RWL. Given the nature of the ISWMS development, it is likely that any pre-existing wastes present will not result in unacceptable levels of contamination. Finally, procedures should be established to ensure that imported fill materials do not contain sufficient hazardous materials, which pose risk to construction workers.

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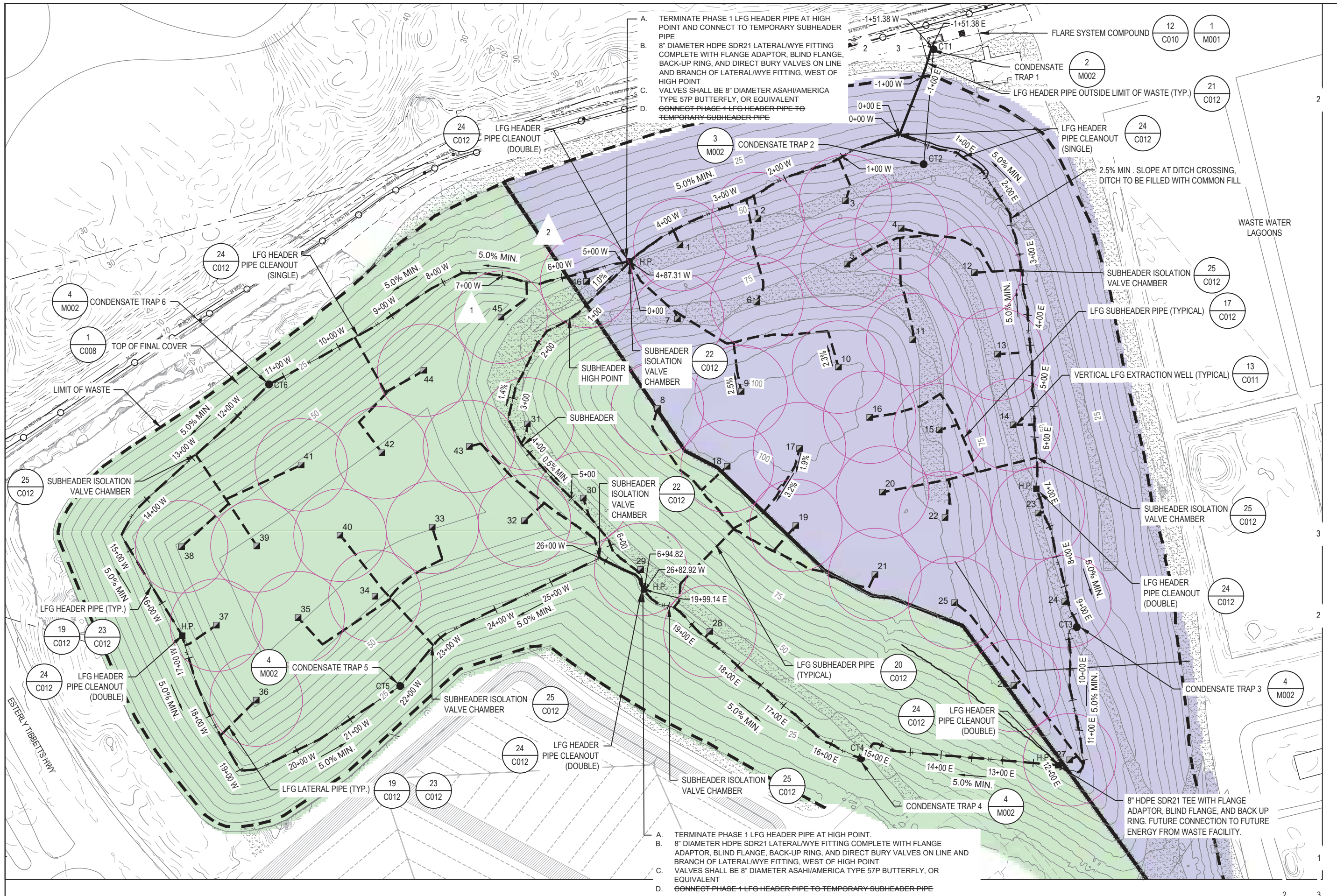
Appendices

Appendix A

Landfill Gas Collection System Plan



VERTICAL GAS EXTRACTION WELL INSTALLATION SCHEDULE				
PHASE	I.D.	NORTHING	EASTING	DEPTH OF BOREHOLE FROM TOP OF TOP SOIL
1	1	7005245.851	1510970.033	50.3
1	2	7005288.138	1511096.511	50.1
1	3	7005317.174	1511238.507	46.0
1	4	7005272.389	1511328.709	60.0
1	5	7005214.640	1511241.108	60.0
1	6	7005152.885	1511094.703	60.0
1	7	7005125.613	1510966.086	60.0
1	8	7004980.186	1510933.691	60.0
1	9	7005008.001	1511069.480	60.0
1	10	7005047.452	1511227.096	60.0
1	11	7005092.007	1511347.586	60.0
1	12	7005200.644	1511447.640	57.7
1	13	7005068.539	1511485.023	57.6
1	14	7004953.727	1511510.338	57.4
1	15	7004945.505	1511390.716	60.0
1	16	7004966.120	1511277.725	60.0
1	17	7004915.384	1511163.979	60.0
1	18	7004886.741	1511046.763	60.0
1	19	7004790.599	1511157.905	60.0
1	20	7004844.765	1511298.600	60.0
1	21	7004711.050	1511286.226	60.0
1	22	7004803.494	1511399.910	60.0
1	23	7004810.740	1511550.774	53.3
1	24	7004667.146	1511594.053	44.9
1	25	7004665.619	1511415.485	60.0
1	26	7004531.247	1511511.632	60.0
1	27	7004410.679	1511602.004	58.0
2	28	7004618.888	1511018.639	40.0
2	29	7004719.200	1510906.421	44.0
2	30	7004835.169	1510813.226	47.6
2	31	7004955.277	1510722.751	48.6
1	CT1	7005562.870	1511381.327	8.92*
1	CT2	7005376.564	1511365.220	18.2
1	CT3	7004625.747	1511613.503	18.2
1	CT4	7004412.908	1511263.851	16.5
2	32	7004798.282	1510718.008	60.0
2	33	7004787.861	1510568.371	60.0
2	34	7004675.878	1510475.693	60.0
2	35	7004641.217	1510350.979	60.0
2	36	7004507.490	1510283.030	60.0
2	37	7004629.118	1510218.474	60.0
2	38	7004756.147	1510162.127	60.0
2	39	7004757.530	1510284.065	60.0
2	40	7004774.943	1510418.929	60.0
2	41	7004888.789	1510355.887	60.0
2	42	7004908.670	1510486.879	60.0
2	43	7004918.780	1510628.675	60.0
2	44	7005042.397	1510554.828	60.0
2	45	7005128.517	1510679.951	53.0
1	46	7005186.517	1510818.695	49.3
2	CT5	7004530.314	1510516.552	16.5
2	CT6	7005018.518	1510304.490	16.5

* MEASURED FROM TOP OF CONCRETE

N

PLAN

SCALE: 1"=100' 0 100' 200'

LEGEND:

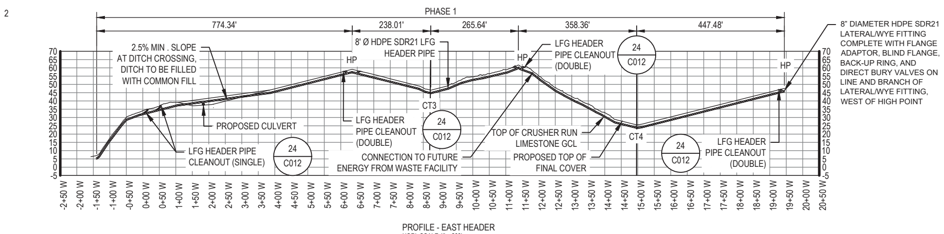
- EXISTING MAJOR CONTOUR (10' INTERVAL)
- EXISTING MINOR CONTOUR (2' INTERVAL)
- PROPOSED MAJOR CONTOUR (25' INTERVAL)
- PROPOSED MINOR CONTOUR (5' INTERVAL)
- EXISTING 24 INCH SEWER LINE
- EXISTING 10 INCH SEWER LINE
- EXISTING FENCE LINE
- PROPERTY BOUNDARY
- LIMIT OF WASTE
- UTILITY POLE
- LANDFILL GAS HEADER
- LANDFILL GAS SUBHEADER/LATERAL
- ACCESS ROAD
- LANDFILL GAS EXTRACTION WELL WITH 75' RADIUS OF INFLUENCE
- PHASE 1
- PHASE 2

NOTES:

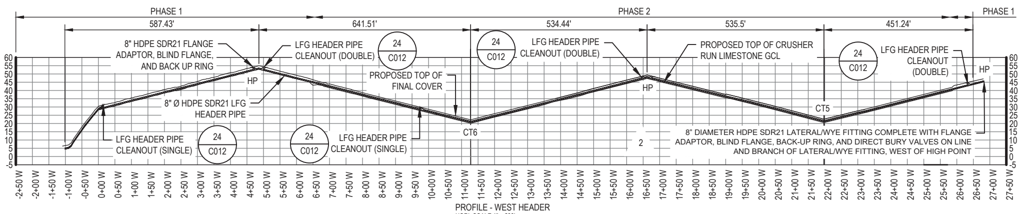
1. ALL HEADER, SUBHEADER AND LATERAL SLOPES MINIMUM 5% UNLESS OTHERWISE NOTED

SOURCE:

1. PHOTOGRAMMETRY SURVEY BY DECCO CONSORTIUM (DC) DATED JULY 16 2021.
2. LIMIT OF WASTE FROM FILE 36082-WOOD-ZZ-O-DR-WM-0011-S3-P01.1 COMPLETED BY WOOD, DATED MAY 2021.
3. AS-BUILT LOCATION OF GAS EXTRACTION WELLS 1- 27, 46 AND CONDENSATE TRAPS 2,3 AND 4 PER SURVEY FILE "GTLF SURVEYED GAS WELLS" PROVIDED BY DART MARCH 4, 2022.



PROFILE - EAST HEADER
HORI. SCALE 1" = 200'
VERT. SCALE 1" = 40'



PROFILE - WEST HEADER
HORI. SCALE 1" = 200'
VERT. SCALE 1" = 40'

No.	Issue	Drawn	Approved	Date
3	REVISED PHASING	KD	DBB	06/16/22
2	INCLUDED EW AS-BUILT; REV. HEADERS/SUBHEADERS/LATERALS/PROFILES	KD	DBB	03/31/22
1	REVISED AS NOTED	KD	DBB	01/26/22
0	ISSUED FOR CONSTRUCTION	KD	DBB	09/21/21

Bar is one inch on original size sheet 0 1"

GHD Consulting Services Inc.
5904 Hampton Oaks Parkway, Suite F
Tampa FL 33610 USA
T 1 813 971 3882 W www.ghd.com

Drawn	K. DHALIWAL	Designer	D. BARTON
Drafting Check	D. BARTON	Design Check	R. SNYDER
Project Manager	S. WILSEY	Date	September 17, 2021
This document shall not be used for construction unless signed and sealed for construction.		Scale	AS SHOWN

Client WASTE SOLUTIONS CAYMAN LTD
Project GEORGE TOWN LANDFILL CLOSURE
Title LFG COLLECTION SYSTEM PLAN

Project No. 11213176
Original Size ANSI D
Sheet No. 11213176-C009
Sheet 10 of 24

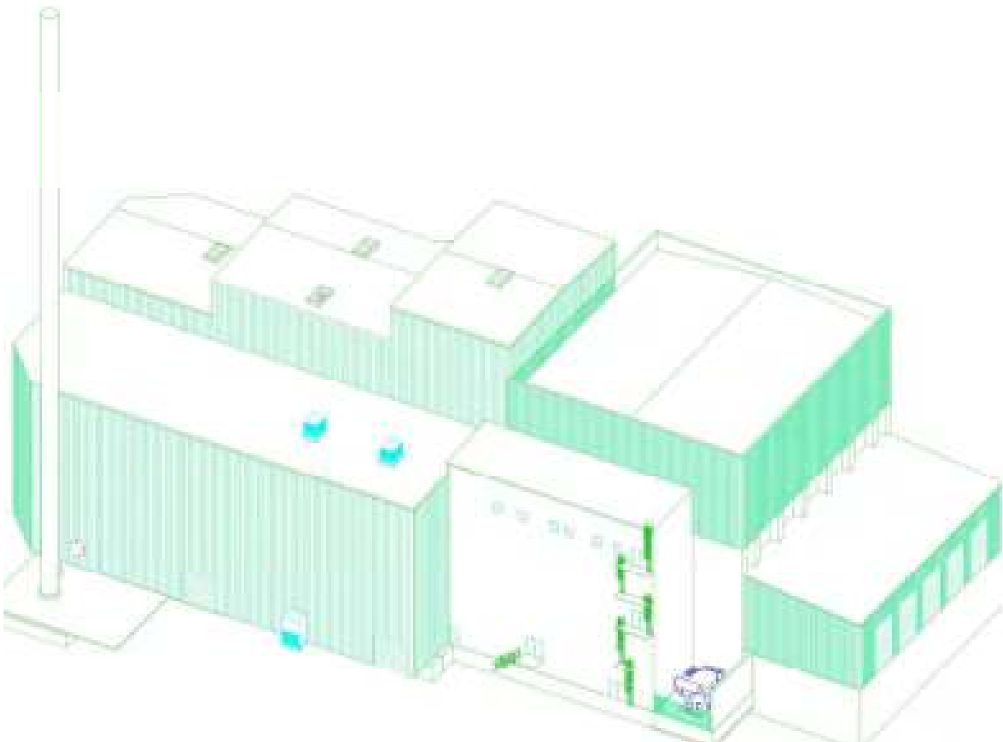
Plot Date: 17 June 2022 - 4:00 PM Plotted By: Kaljinder Dhaliwal Filename: N:\US\Niagara Falls\Projects\564\11213176\Digital_Design\ACAD 2017\Cayman LF Closure\Sheets\CIVIL\11213176-C010.dwg

Appendix B

Grand Cayman Proposed Integrated Waste Management System, ReGen, Geotechnical Investigation and Report. AEC, July 2023

GRAND CAYMAN PROPOSED INTEGRATED SOLID WASTE MANAGEMENT SYSTEM REGEN

GEOTECHNICAL INVESTIGATION AND REPORT



JULY 2023

Final Report

GRAND CAYMAN PROPOSED INTEGRATED SOLID WASTE MANAGEMENT SYSTEM GEOTECHNICAL INVESTIGATION AND REPORT

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GRAND CAYMAN PROPOSED INTEGRATED SOLID WASTE MANAGEMENT SYSTEM GEOTECHNICAL INVESTIGATION AND REPORT

1.0 INTRODUCTION

APEC Consulting Engineers Ltd (APEC) carried out a geotechnical investigation at the site of the proposed Grand Cayman integrated solid waste management system (ISWMS) on parcel 13D431. The site is located in the George Town industrial park area.

The site is bounded to the north and east by the George Town Landfill (GTLF) and to the south by industrial land uses. To the west, the site is bounded by undeveloped land and the Esterley Tibbetts highway (ETH) further west. The site grade elevation varies from approximately 2 to 12 feet above mean sea level (MSL).

The site location and proposed ISWMS facility are shown in **Figures 1** and **2**. The conceptual design for the proposed ERF building is shown in **Figure 3**. As the ERF is considered a power-generating station and public utility facility, it is understood that the ERF building will be assigned as a Risk Category III facility (IBC 2009 and ASCE 7). The geotechnical investigation fieldwork was carried between November and December, 2020.

The report will be required as part of the submission documents for the Cayman Islands Planning Department's Special Inspector program.

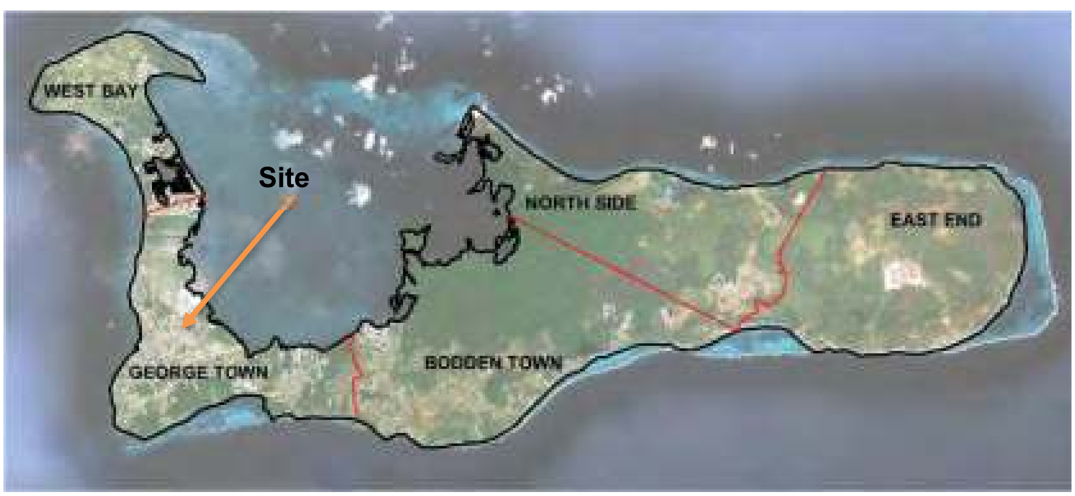

Figure 1 - Site location plan

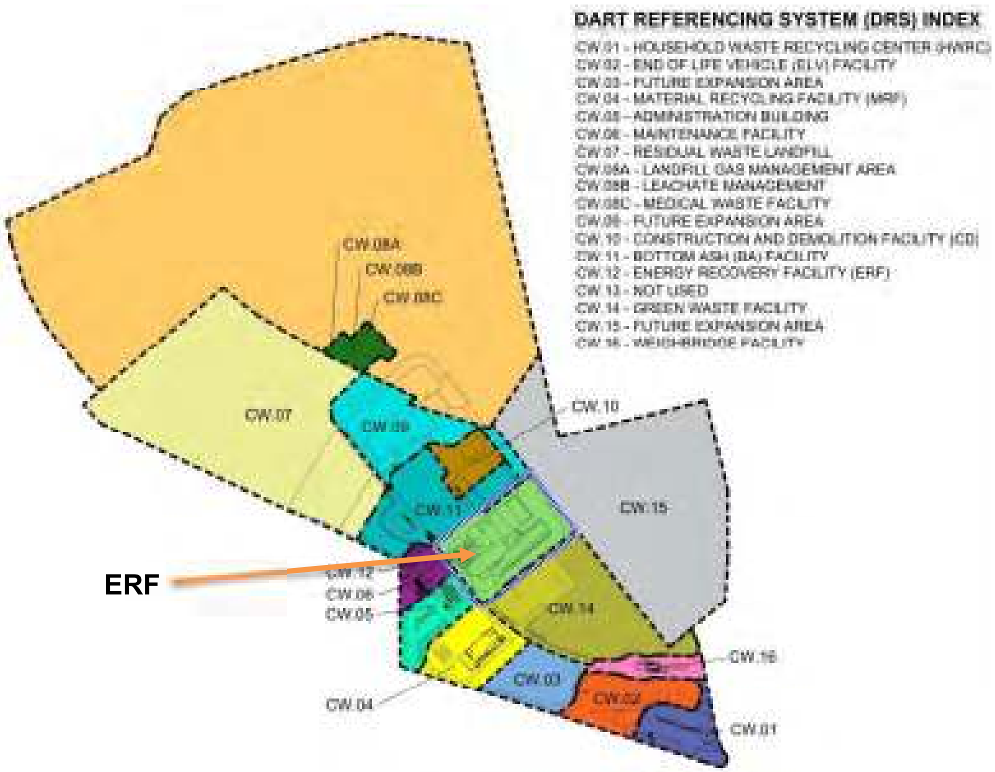

Figure 2 - Proposed ISWMS Facility Layout

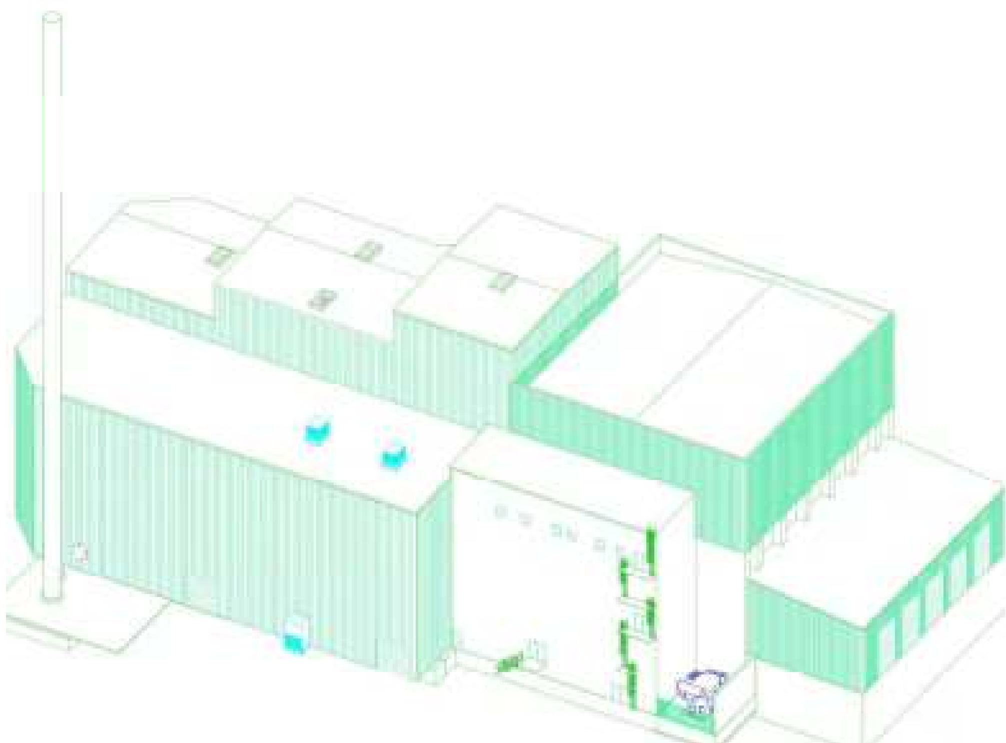

Figure 3 - Proposed Energy Recovery Facility

2.0 SCOPE & LIMITATIONS OF REPORT

This report comprises a description of the field investigation carried out under APEC's supervision; a geotechnical engineering appraisal of the sub-surface soil conditions and recommendations for suitable foundation system(s) and corresponding foundation design parameters. The recommendations and conclusions contained in this report are based on the results of subsoil investigations made at specific locations. These results are extrapolated to give an overall impression of the prevailing soils condition. Local deviation from the conditions predicted in this report may occur. The nature or extent of variations throughout the subsurface profile may not become evident until the time of construction. If variations become evident, it may be necessary to re-evaluate the recommendations provided in this report.

This report is intended for use by the client or his agents for the foundation design of proposed structure(s) as herein described on the site mentioned in this report. This report may not be relied upon by a third party for any purpose without the written consent of this practice. No liability is assumed to any third party using this report for whatever reason.

This report has been prepared in accordance with generally accepted local geotechnical engineering practices; no other warranty is expressed or implied.

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3.0 CAYMAN GEOLOGICAL SETTING

The Cayman Islands are located on the Cayman Ridge. This ridge forms the southern boundary of the North American plate and the northern boundary of the Cayman Islands Trough. Their position near the Oriente Transformation Fault and the Mid-Cayman Rise means that they are located in a tectonically active area. Carbonate rocks exposed on the islands record successive deposition - erosion cycles that have occurred over the last 30 million years. Sea level was the critical factor that controlled deposition because highstands led to deposition whereas lowstands led to the weathering of the previously deposited carbonates.

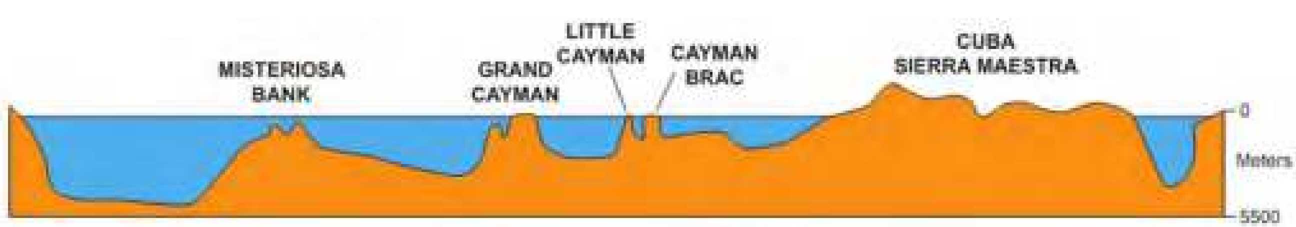

Figure 4 - Cross section along Cayman Ridge (Jones, 2012)

The three Cayman Islands are the tops of pinnacles reaching up from the depths of the ocean as shown in **Figure 4**. Each island appears to be based on a granodiorite foundation succeeded by a cap of basalt and then tertiary carbonates (limestones, dolomites, dolomitic limestones). The thickness of the carbonate cap exceeds 1,300 feet. The actual thickness is not known.

Dr Brian Jones and others have developed a nomenclature for the Cayman Islands stratigraphy. The central part of each island is formed of massive tertiary carbonates called the Bluff Limestone. This Bluff Formation grouping includes the Brac, Cayman and Pedro Castle Formations. The Bluff Formation is a series of medium to fine grained chalky limestone which has re-crystallized in many areas to form a hard white limestones and dolostones. The stratigraphy described is shown diagrammatically in **Figure 5**.

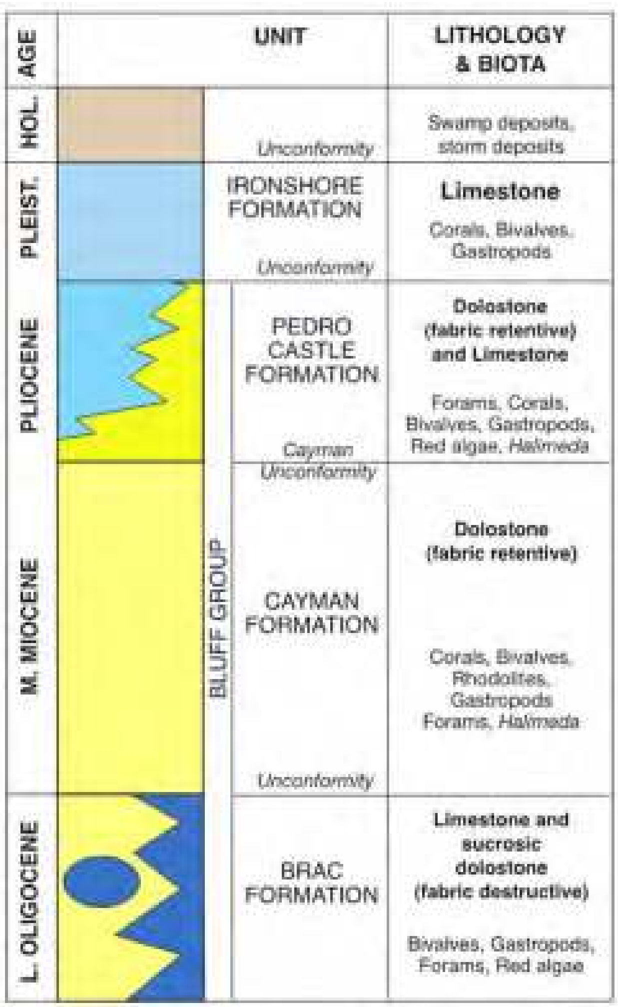

Figure 5 - Stratigraphy of the Cayman Islands (Jones 2012)

The surface of the Bluff Formation is typically jagged because of the development of an extensive karst system. Honeycombed rock pinnacles, fissures and sinkholes are common surface landforms, whereas caves occur in the subsurface. Cavities and caves are filled or partly filled with calcite cement, terra rossa, terrestrial oncoids and freshwater limestone. The Bluff Formation is surrounded and partly onlapped by the Late Pleistocene Ironshore Formation. This Ironshore Formation consists of unconsolidated coralline limestone which is often degraded and decomposed to form a soil type known locally as 'marl'.

The name of the Ironshore Formation was derived from the local Caymanian term for the low, case-hardened rocks that commonly occur around the shorelines of the Islands. The term 'Ironshore' refers to the hard calcrete crust that is typically formed on the weathered surface of the rocks in this formation. The Ironshore Formation is typically formed of friable, poorly consolidated reef limestones, calcarenites and oolitic limestone that are cemented by calcite.

The Ironshore Formation ranges from subtidal lagoonal facies at its base, through lower shoreface facies, to upper shoreface, to foreshore-backshore facies. Most limestones in the Ironshore Formation were deposited in a large lagoon. The Bluff and Ironshore Formations are separated from each other by disconformities. These represent weathering surfaces that developed during the periods of subaerial exposure that followed each phase of deposition. The carbonate rocks of the Cayman Islands contain numerous vugs and moulds caused by the dissolution of the coral fauna skeletons. Tree roots commonly penetrate through the rock to the water table. The roots have formed pathways which have filled with organic debris over time.

The Cayman and Pedro Castle Formations are extensively jointed due to repeated periods of karst development over the last 30 million years. The joints are generally vertical in orientation and run parallel to adjacent shorelines. The joints are often solution widened. At many localities the joints are filled or partly filled with a variety of rock types.

As can be seen in **Figure 6**, the Ironshore Formation is typically present as the uppermost strata in the western part of the island where the proposed ISWMF site is located.

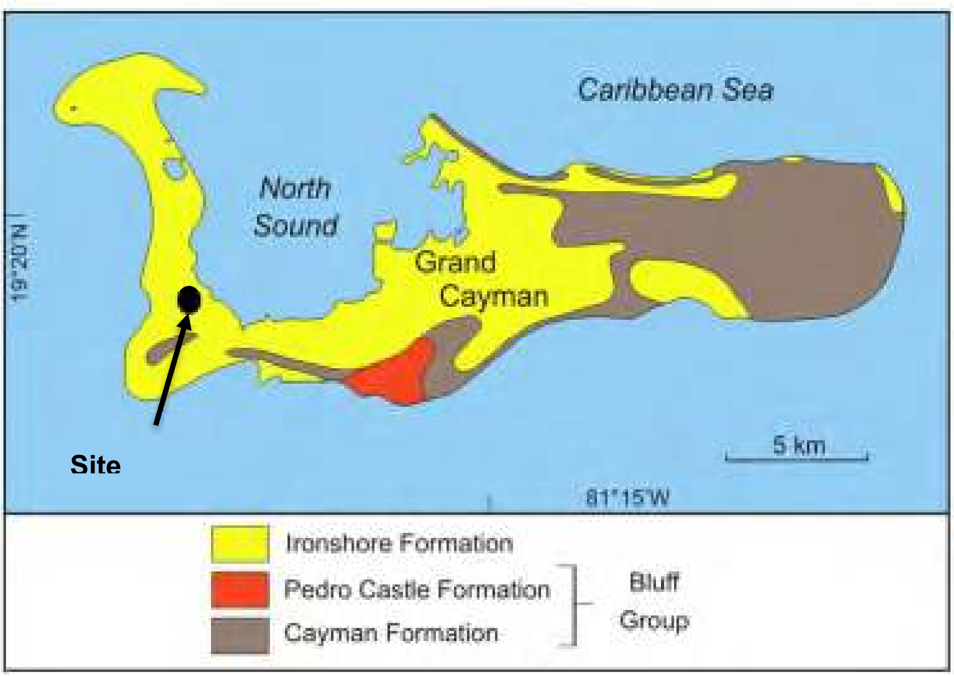

Figure 6 - Geological map of Grand Cayman (Jones 2012)

The Ironshore Formation is overlain by peat deposits which have been laid down over the last 2,000 years. The peat is subjected to seasonal flooding and is waterlogged for much of the year.

4.0 REVIEW OF AVAILABLE SEISMICITY INFORMATION

4.1 TECTONIC SETTING & SEISMICITY

Grand Cayman is in a tectonically active area. Dr. Jones (2012) describes in detail the tectonic setting and seismicity of Grand Cayman in relation to the fault lines which run to the south of the island (**Figure 7**).

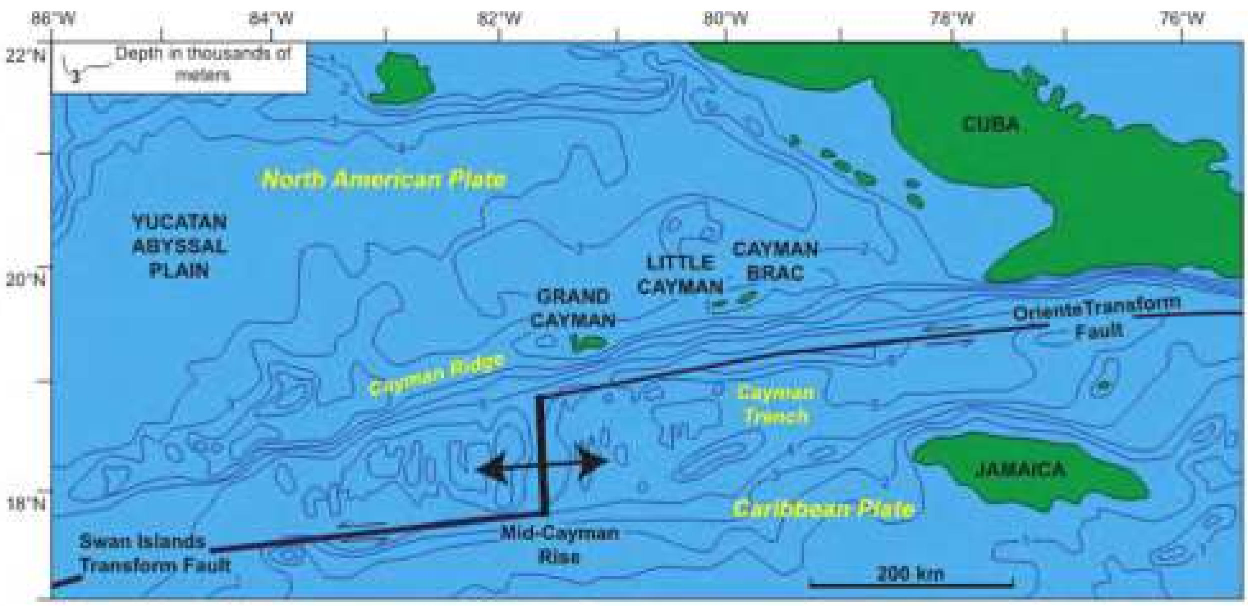

Figure 7 - Caymans Islands fault locations (Jones 2012)

There are few detailed records of the earthquakes that have affected Grand Cayman prior to 1990. Since 1990, there have been six earthquakes with a magnitude greater than 5.5 with the highest being 6.8 on December 14, 2004, and the latest on January 28, 2020 (6.1) as highlighted in **Figure 8**.

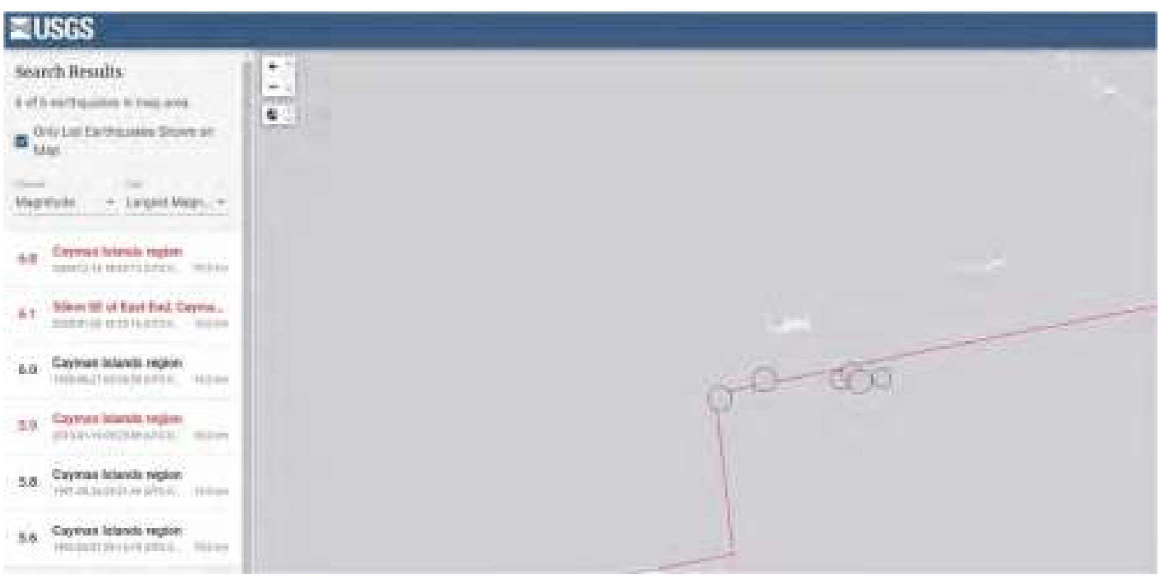

Figure 8 - Cayman Islands Fault Locations (United States Geological Survey)

4.2 Seismic Ground Motion Values

The seismic design for structures in the Cayman Islands is in accordance with the 2009 International Building Code (IBC) as modified by the Cayman Islands Building Control Unit (BCU) through the Cayman Islands Building Code. The IBC references the American Society of Civil Engineers (ASCE) standard ASCE 7: "Minimum Design Loads for Buildings and Other Structures" as an acceptable design standard. Site specific seismic studies, as defined in ASCE 7-05, carried out for Camana Bay, George Town, Grand Cayman (immediately north of the subject site) provided the following design parameters.

S_S	0.659g
S_1	0.300g

where:

MCE = Maximum Considered Earthquake,

2475 year return period (2% chance of exceedance in 50 years) on Class C site

S_S = MCE, 5 percent damped, spectral response acceleration parameter at short periods

S_1 = MCE, 5 percent damped, spectral response acceleration parameter at a period of one second

The ERF structures and components must be designed in accordance with these parameters, refer to **Section 9.0** for further geotechnical discussion and design parameters.

5.0 HURRICANE IMPACT CONSIDERATIONS

Grand Cayman is located in the tropics and is prone to tropical cyclone activity. The predominant features of a tropical storm/hurricane event are rainfall, wind, wind-borne debris, wave action and seawater flooding due to storm surge and wave run-up. The facility design parameters in relation to such events will include design as well as operational measures to mitigate the impacts of such events. The design parameters associated with environmental conditions due to potential flooding and wave impact of the site are summarised below.

5.1 SEAWATER FLOODING AND WAVE IMPACTS

Based on data gained during Hurricane Ivan, a 1 in 100-year return period still water elevation at the site of 8ft MSL or higher was determined. The Cayman Island Lands and Survey flood mapping at the site for Hurricane Ivan is reproduced in **Figure 9** for conversational information purposes only**.**

Using US Federal Emergency Management Agency (FEMA) guidance, a base flood elevation (BFE) of 9ft MSL is recommended for all buildings and structures on this site. A design flood elevation (DFE) of 11ft MSL is recommended for all ISWMF buildings assigned as Risk Category III or IV (essential facilities) per ASCE 7 – this includes the ERF building. Refer to the *Design Flood Elevation Review* prepared by this office in August 2020, included in **Appendix A**.

BFE	**9ft MSL**
ERF (Critical) DFE	**11ft MSL**

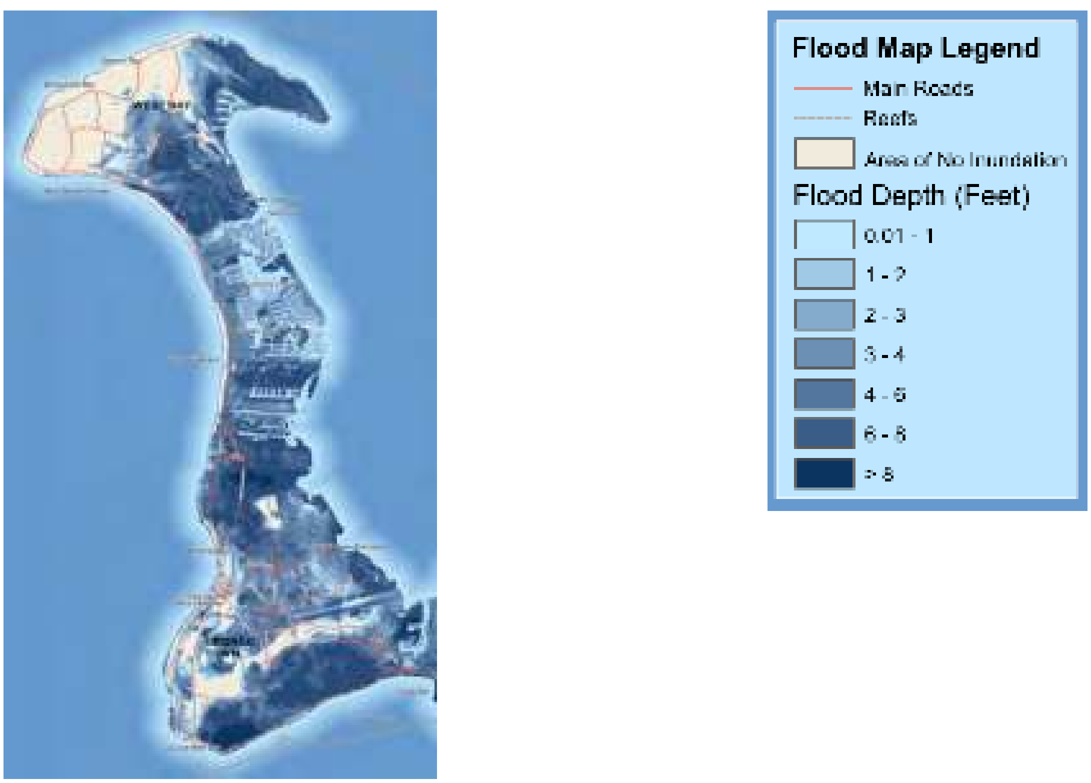

Figure 9 – Hurricane Ivan Flood Map for West Bay Peninsula (Lands & Survey Department)

The Cayman Islands Planning Department requires that the lowest (non-protected basement) habitable floor level for this area of Grand Cayman should be at least FIVE feet (5ft) above MSL, i.e. two feet (2ft) above the Vidal Bench Mark. It is important to note that the Department does NOT require the habitable floor levels to be placed at the higher elevations recommended in this report.

The United States Federal Emergency Management Agency (FEMA) Coastal Construction Manual was used to estimate the base flood elevation (BFE) during a coastal flooding event. The BFE represents the lowest possible floor elevation (subject to upward adjustment by other design criteria) but can also be used to estimate the requirements for other protection structures.

The site for the proposed ERF building is classified as within FEMA's Coastal A-Zone (**Figure 10**). Structures within the Coastal A-Zone are at risk of surge and waterborne debris impact, scour and erosion in the event of major storms. The majority of Grand Cayman falls within either category V or A due to the typically low ground elevations. The BFE is the sum of the 100-year still water elevation plus wave effects.

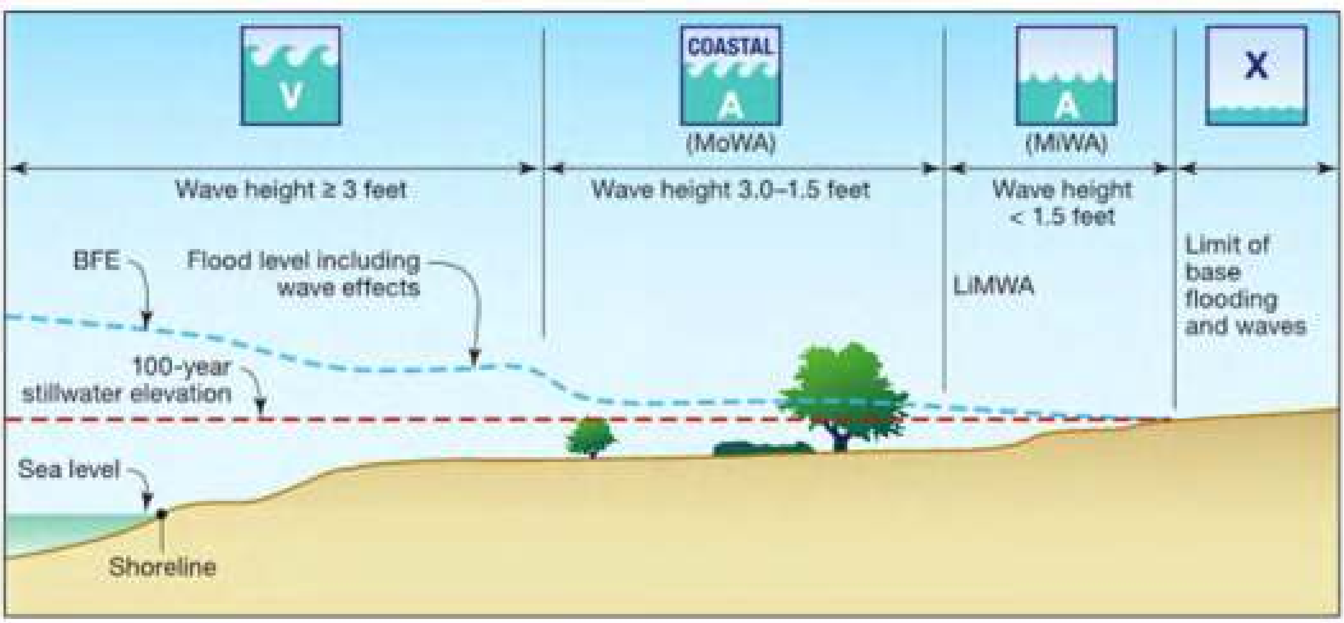

Figure 10 – Typical Shoreline and Associated Flood Zones (FEMA)

The incorporation of flood barriers in the building design should be considered to provide enhanced resistance to flooding. It is also recommended that buildings be designed to resist the buoyancy forces associated with flooding up to the BFE should the lower floors be dry proofed (protected against flood water ingress to the building interior).

The seawater flooding elevations discussed in this section do not account for any potential sea level rise predictions (see **Section 6.3**).

6.0 CLIMATE CHANGE IMPACTS

The following is taken from a study carried out by APEC for the ETH Cayman Parkway, in June 2016. Climate change[1] incorporates changes in temperature, rainfall, tropical cyclones, earthquakes and sea levels. The impact of climate change predictions may have an effect, not only on the physical components and operation of the proposed facility, but also on the ecological and socio-economic environments in the vicinity of the site.

Several publications on the predicted impacts of climate change were previously reviewed. The publications cover a mix of geographical areas from specific Caribbean wide research to the global effects of climate change.

The following sections itemize the predictions contained in the publications on the possible effect of climate change on rainfall, tropical cyclones / hurricanes, and sea level rise. Most of the publications reviewed refer to 2100 as the design horizon year.

6.1 RAINFALL

A summary of the predictions taken from the publications on the effect of climate change on rainfall levels is provided in **Table 1**.

Publication Author	Horizon Year	Commentary
Cayman Islands National Climate Change Committee	2100	• Changes in rainfall patterns expected with generally heavier rainfall events • Significantly less rainfall region wide • Conditions predicted to become more El Niño-like, i.e. drier Caribbean region
Intergovernmental Panel on Climate Change (IPCC)	Not Given	• Significant future increase in heavy rainfall events • Mean rainfall is projected to decrease • Increases in the frequency and severity of floods and droughts are projected to adversely affect sustainable development • In coastal areas, sea level rise will exacerbate water resource constraints due to increased salinization of groundwater supplies
US National Research Council	Not Given	• A higher fraction of rainfall is expected to fall in the form of heavy precipitation events as temperatures increase
US Global Change Research Program	Not Given	• Projections of future changes in precipitation show overall increases in the global average, but with substantial shifts in where and how precipitation falls • The widespread trend toward more heavy downpours is expected to continue, with precipitation becoming less frequent but more intense

Table 1: Summary of Reviewed Publications into Future Rainfall Predictions

[1] Climate Change is defined as a statistically significant variation in the mean state of the climate or its variability, persisting for an extended period (typically decades or longer). Climate change may be caused by natural internal processes or external forcings or by persistent anthropogenic changes in the composition of the atmosphere or land use.

Although there is no quantitative estimate of the effect of climate change on rainfall / precipitation, all publications agree that there will be an overall decrease in rainfall but with shifts in the rainfall intensity and rainfall pattern.

6.2 Tropical Cyclones / Hurricanes

A summary of the predictions taken from the publications into the effect of climate change on tropical cyclones / hurricanes is provided in **Table 2**.

Publication Author	Horizon Year	Commentary
Cayman Islands National Climate Change Committee	Not Given	• Stronger hurricanes expected • Substantially more rainfall during the storm and peak winds intensity
Intergovernmental Panel on Climate Change (IPCC)	Not Given	• Future hurricanes will become more intense • Larger peak wind speeds and more heavy precipitation
US Global Change Research Program	Not Given	• Ocean temperatures lead to stronger storms with higher wind speeds and more rainfall • Changes in wind speed and direction with height are also projected to increase in some regions, and this tends to work against storm formation and growth
US National Research Council	Not Given	• Growing certainty that climate change could lead to increases in the strength of hurricanes

Table 2: Summary of Reviewed Publications into Future Hurricane Predictions

There is a mixture of predictions in the publications with some publications predicting stronger, more intense hurricanes and other publications saying that there is still uncertainty on the effect of climate change on tropical cyclones / hurricanes.

6.3 Sea Level Rise

Most of the reviewed publications on sea level change utilize models to estimate the rise in sea levels over the rest of this century, with the majority of the publications using 2100 as the horizon year. A summary of the predictions taken from the publications has been provided in **Table 3**.

As all the publications state, estimating sea level rise (SLR) due to changing climatic conditions is based on several assumptions and models and the accuracy of results cannot be guaranteed. An estimate has been made of the predicted sea level rise due to climate change. For the purposes of this review, we have simply taken the mean value of all predictions relating to the Caribbean and South East Florida for the 2100 horizon year only (shaded rows). The mean value for predicted sea level rise for the year 2100 is 2.0 ft (this is supported by Dr S. Douglass, South Coast Engineers).

A recent review of engineering studies suggests a lower value for SLR of 1.2 feet with an upper value of 3 feet by 2100, with a mean of 2.0 feet.

Publication Author	Horizon Year	Max / Min / Mean	Predicted Sea Level Rise (feet)
Cayman Islands National Weather Service assisted by Caribbean Community Climate Change Centre and the Cuban Institute of Meteorology (2011)	2100	Min Max	0.40 2.60
Cayman Islands National Climate Assessment (Appendix 2) (2011)	2100	Min Max	0.40 2.60
Environment & Coastal Zone Management Special Issue Committee (2002)	2100	Mean	1.00
Intergovernmental Panel on Climate Change (IPCC) (2007)	2100	Max	1.90
Mainstreaming Adaptation to Climate Change (2005)	2080	Mean	1.20
Pew Center on Global Climate Change (2009)	2100	Min Max	6.50 9.80
Southeast Florida Regional Climate Change Compact (Table 4) (2011)	2100	Min Mean Max	1.96 3.34 4.71
Southeast Florida Regional Climate Change Compact (Table 5) (2011)	2100	Mean	2.50
Southeast Florida Regional Climate Change Compact (Table 5) (2011)	2110	Mean	2.83
The Center for Science and Public Policy	2100	Mean	1.25
US Army Corps of Engineers (2009)	2070 2060	Min Max	1.00 2.00
US Army Corps of Engineers (2009)	2110	Min Max	1.92 5.58
US Global Change Research Program	2100	Min Max	0.67 2.00
US National Research Council	2100	Min Max	1.80 6.60
NOAA Technical Report NOS CO-OPS 083	2060	Mean	2.00

Table 3: Summary of Reviewed Publications into Sea Level Rise

6.4 Summary of Reviewed Publications on Climate Change Impacts

The reviewed publications predict the potential impact of climate change on rainfall, tropical cyclones / hurricanes and sea levels. The prediction of climate changes is not an exact science and is based on theoretical models. The preceding sections have itemized these predictions from the internationally based research. Where applicable, an arithmetic mean has been taken of these predictions in order to quantify the potential impact. **Table 4** provides a summary of these values.

Climatic Condition	Prediction (Calculated Mean)	Horizon Year
Rainfall	• Heavier rainfall events • Significantly less rainfall	Not Given
Hurricanes	• Stronger, more intense hurricanes expected	Not Given
Sea Levels	• 2.0 feet increase	2100

Table 4: Summary of Predicted Climate Change Impacts Review

7.0 SUMMARY OF FIELD INVESTIGATIONS AT THE PROPOSED SITE

Fieldwork for the geotechnical investigation was carried out in two stages between November and December 2020.

A total of twenty-six (26) trial pits were undertaken on the subject site, three (3) of which were within the footprint of the proposed ERF building. The pits were advanced by mechanical excavator as part of the first stage of works (see **Figure 11**).

As part of the second stage, a local drilling contractor was retained to undertake the drilling of the boreholes, which were advanced using a truck-mounted rotary drill employing rotary air flush drilling techniques with diamond plug bits. Fifteern (15) boreholes were advanced to a maximum depth of 24.5 feet below ground level (BGL) (see **Figure 11**), Six (6) of which were advanced within the ERF footprint. Standard penetration tests (SPTs) were carried out in each borehole. The work was undertaken under the field supervision of an APEC engineer.

Ten-foot cores were advanced and retrieved from the rock encountered in all boreholes. The rock cores were delivered to APEC's office in George Town, where they will be stored for a period of three months and will then be discarded.

The trial pit & borehole logs and location plan are included in **Appendix B.**

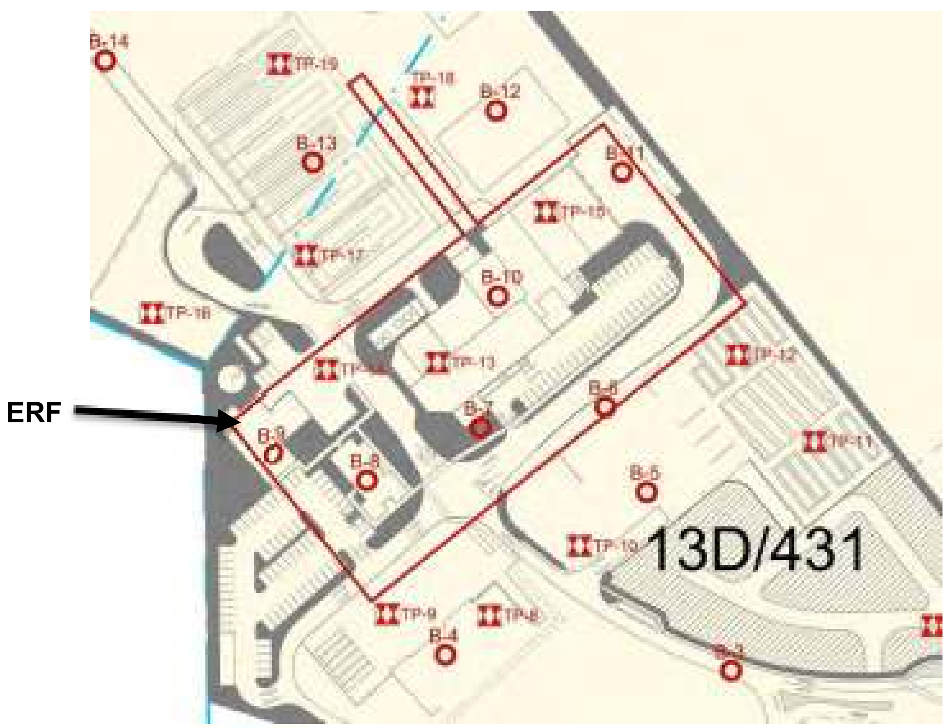

Figure 11 – Approximate Locations of Trial Pits & Boreholes

8.0 SOIL CONDITIONS

8.1 GEOLOGY

There are distinct subsurface conditions present on the site. Due to the historic use of this site, there is municipal waste material present in the vast majority of trial pits. This waste was found to be mixed with 'marl' and topsoil, possibly due to the addition of daily cover during waste landfilling works. **Table 5** provides a summary of the near surface soil profiles generally encountered.

Strata	Approx. thickness/ elevation
Topsoil 'Marl' fill and municipal waste mix	Surface elevation varies from 4 to 12ft MSL Thickness 6 to 16ft
Highly compressible organic material ('peat')	Thickness 0 to 2ft
'Marl' (Ironshore Formation)	Thickness 6 to 12ft
Dolostone rock (Pedro Castle Formation)	Top of rock varies from 15 to 24.5 ft BGL
Ground water	Ground water level varies average of 2ft MSL*

*average levels measured within monitoring wells, variation tidally influenced

Table 5 – Typical soil profile summary

The following describes the material referenced in **Table 5**.

Topsoil 'Marl' fill and municipal waste mix

The mix of topsoil, marl and municipal waste is believed to have been deposited over thirty years ago. Aerial imagery indicates the area was used as a landfill sometime between the 1970s and 1980s. The 1994 aerial photography shows the site as being covered. This is consistent with an environmental assessment report prepared in 1991 by Post, Buckley, Schuh and Jernigan Inc. (PBSJ) which refers to landfilled waste on an adjacent property not owned by CI Government. At the time it was proposed that CIG purchase the property and expand the new landfill over the old landfill.

Organic Peat

One out of three trial pits and one out of six boreholes within the ERF contained a 2 ft to 5 ft thick layer of highly compressible organic material (peat) at depths of between -2 ft and +2 ft MSL. Deeper pockets ('moleholes') of peat may be present on the site which may not be detected, if at all, until construction commences.

Ironshore Formation - 'marl'

Native limestone 'marl' (Ironshore Formation) was encountered in all test locations. Based on the SPT blow counts, the 'marl' would generally be characterized as loose to compact. In our opinion the general use of the SPT blow counts to correlate the engineering properties of the 'marl' does not generally provide a true characterization of the material. 'Marl' typically exhibits greater engineering characteristics than blow counts would ordinarily indicate. See **Section 9.0** for discussion of the properties of the 'marl'.

As identified and classified by Dr Jones, patch reefs occur within the Ironshore Formation in the West Bay peninsula. The patch reefs occur at the bottom of the formation with lagoonal and oolitic limestones in the upper horizons. These reefs were created and aerially exposed more than 125,000 years ago and subsequently covered by the deposition of lagoonal limestones as sea level rose. Patch reefs are surrounded by lagoonal sands and muds. These former reefs contain hard cemented layers and rubble from the coral reefs, including boulders and cobble sized material. As an indication of the density of the cemented reefs, driven steel piles have achieved an acceptable 'set' when the shaft is obstructed by a patch reef. Cavities will be encountered in the patch reef zone given the manner in which these reefs are created.

Cavities are also typically found in the epikarst[2] zone which is common throughout the island at or near the interface between the limestone 'marl' (Ironshore Formation) and rock (Pedro Castle and Cayman Formations).

Limestone/Dolostone rock

The upper horizon of limestone rock (Pedro Castle Formation) was encountered between 15.0 and 24.5 feet BGL. Core samples of the rock were taken in all boreholes. Core recovery was variable across the boreholes sampled from 50% in BH-6 to 96% in BH-7 with Rock Quality Designation (RQD) ranging from 27% to 79%.

Laboratory testing was not possible due to the laboratory refusing to test material containing municipal waste.

8.2 Ground Water

The stabilized ground water elevation on the site during Mean High Water Spring (MHWS) tide is estimated to be approximately 2.0 ft above MSL. This correlates with the typical ground water elevations of between 1.5 and 2.5 ft above MSL experienced on Grand Cayman that depend on site location, rainfall and atmospheric conditions, tides etc. The Highest Astronomic Tide (HAT) reported to 2018 for Grand Cayman is 2.62 ft MSL. These elevations do not account for tropical cyclone induced ground water level fluctuations.

The groundwater ingress into the trial pits was noted as being slow.

[2] The zone of weathering found at the upper surface of the 'limestone bedrock'. Weathering, stress release and dissolution of the limestone surface results in an irregular surface and limestone pinnacles and boulders are common within the zone.

9.0 GEOTECHNICAL DISCUSSION

9.1 THE IRONSHORE FORMATION

The Ironshore Formation (commonly known as 'marl') is cemented by calcite and can be described as a weak limestone rock. Interbedded layers of cemented and non-cemented material can be found.

Island constraints limit the range of available geotechnical investigation techniques. The commonly used Standard Penetration Test (SPT) does not adequately describe the physical properties of the 'marl'. Where they occur, low blow counts (N values) are often associated with the breaking of the cementation of the 'marl' during the SPT sampling, giving the impression of loose soil. This conclusion has been validated by the performance of as-built structures bearing on the native 'marl' as well as by in-situ seismic downhole, crosshole and resistivity testing and laboratory testing carried out for previous projects on Grand Cayman. The cemented nature of the 'marl' sustains small voids within the layer. These investigation techniques are not readily available in Cayman and involve mobilization of special equipment and crew from overseas.

More recently, another form of seismic exploration known as Multichannel Analysis of Surface Waves (MASW) has been used in Grand Cayman to verify the physical properties of the marl material. MASW evaluates ground stiffness by measuring shear-wave velocity (Vs) of subsurface in 1-D, 2-D, and 3-D in the most common depth range of 0 - 100 feet. The results from the MASW testing gave similar velocities to those determined from seismic testing using boreholes on previous projects in the vicinity of this site.

9.2 THE EPIKARST ZONE

Evidence of the epikarst zone (or the "inconformity" as defined by Dr Jones) was detected while advancing all of the boreholes. The epikarst zone can be found throughout the island. As previously described, the joints in this zone are typically filled with calcite cement, terra rossa, reef rock terrestrial oncoids and freshwater limestone. The epikarst zone typically occurs at the interface of the 'marl' and carbonate rock layers. This stratum also contained several cavities as indicated by the low core recovery in some of the boreholes and noted during the SPTs.

9.3 SITE COEFFICIENTS AND MODIFIED SPECTRAL ACCELERATION PARAMETERS

The site is classified as Class C (soft rock) under ASCE 7-05. The corresponding site coefficients are as follows.

F_a = short-period site coefficient = 1.136 ....(ASCE 7 Table 11.4-1)
F_v = long-term site coefficient = 1.5 ....(ASCE 7 Table 11.4-2)
$S_{MS} = F_aS_s = 1.136 \times 0.659 = 0.749$ g...(ASCE equation 11.4-1)
$S_{M1} = F_vS_1 = 1.5 \times 0.300 = 0.450$g ....(ASCE equation 11.4-2)
where
S_{MS} = the MCE, 5 percent damped, spectral response acceleration at short periods adjusted for site class effects
S_{M1}= the MCE, 5 percent damped, spectral response acceleration at a period of one second adjusted for site class effects

9.4 Design Spectral Acceleration Parameters

The design spectral acceleration parameters for this site are as follows.

S_{DS} = 2/3 S_{MS} = 0.499g (ASCE equation 11.4-3)
S_{D1} = 2/3 S_{M1} = 0.3g (ASCE equation 11.4-4)
where
S_{DS} = design, 5 percent damped, spectral response acceleration parameter at short periods
S_{D1} = design, 5 percent damped, spectral response acceleration parameter at a period of one second

Based on the risk category and soil classification, it is understood that the ERF building will need to be designed as a Seismic Design Category (SDC) D structure. Other buildings within the ISWMS facility are likely to be designated SDC C structures.

9.5 Geologic Site Hazards Review

9.5.1 Liquefaction and Differential Settlement

There is no potential for liquefaction at most of the site due to the competent nature of the underlying marl and bedrock and their relative shallow elevation.

9.5.2 Slope Failure

There is no potential for slope failure within the soil and rock strata at the ISWMS site.

9.5.3 Surface Fault Rupture

Surface fault rupture and surface displacements are not anticipated. See **Section 4.0**.

10.0 FOUNDATION DISCUSSION

Two options for a suitable foundation system under the Energy Recovery Facility (ERF) building are considered as follows. We have limited our review and recommendations to solutions that have been successfully employed in Grand Cayman. The range of feasible ground improvement and deep foundation systems for projects in Cayman is limited by available equipment on island and the challenges of transporting specialist plant, equipment and specialist personnel.

Option 1: Ground improvement for a reinforced concrete shallow foundation system.

Option 2: The installation of reinforced concrete continuous flight auger (CFA) piles supporting reinforced concrete substructure & grade beams.

10.1 Option 1: Ground Improvement Techniques for Shallow Foundations

Vibro compaction techniques are suggested as part of a ground improvement works strategy for this project to create an acceptable ground bearing formation for the building foundations and to meet the industry established settlement limits for acceptable building foundation performance.

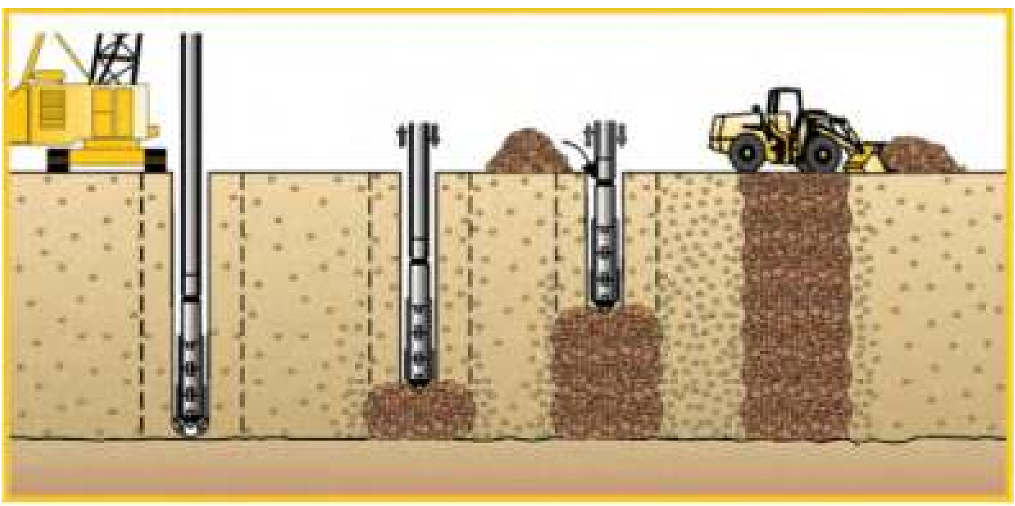

Figure 12 – Vibro Compaction

To create an adequate formation for shallow foundations, the following steps need to be taken.

Step 1: Remove all existing waste material and highly compressible organic material from under the entire foundation footprint and an appropriate distance beyond its perimeter. Make due allowance for the removal of deeper pockets of unsuitable material.

Step 2: Backfill the footprint with new imported, selected ‘shot rock’ material to required elevations. Conduct vibro densification of the rockfill and the underlying Ironshore / ‘marl’ to achieve refusal of the vibrating ‘poker’ at the rock interface (using screened granular material as required by this process). Verify densification degree achieved by in-situ testing, in conjunction with the vibro specialist’s analysis.

Step 3: Excavate the vibro-compacted fill under the future building footprint to achieve the elevations required for the building substructure.

Step 4: Proof roll the formation using 10-ton vibrating roller (40 passes min). The compacted layer is to be proof roll tested using a fully laden 22 cubic yard capacity twin axle dump truck.

The described ground improvement works predict the following parameters for foundation design (subject to trial, post-trial analysis and confirmation by vibro-compaction specialist).

- Allowable bearing capacity of up to 6,000 psf with a short term overstress of 25%.
- 1 - 1.5 inch total settlement and L/500 differential settlement limits.
- A subgrade modulus of 150 – 250 pounds per cubic inch (pci). This value may be varied depending on the results of recommended vibro-compaction trial. We recommend a sensitivity analysis be conducted by the structural engineer responsible for foundation analysis and design.

10.2 Option 2: Reinforced Concrete Continuous Flight Auger (CFA) Piles Supporting Reinforced Concrete Pile Caps

The second appropriate foundation system for the proposed structures would be the construction of an arrangement of reinforced concrete augercast piles supporting reinforced concrete pile caps and grade beams.

As part of these works, the existing waste material would need to be removed and replaced with selected granular material with no boulder sizes in excess of 9” such that the auger rig is not obstructed.

Sixteen (16) and twenty-four (24) inch diameter augercast piles bearing in the ‘limestone rock’ nominally at approximately 13ft below MSL are estimated to have an allowable compression load of 65 and 130 tons respectively, subject to confirmation by pile load testing. Piles in tension with a shaft length of a minimum of 20 ft minimum through competent Ironshore Formation ‘marl’ and compacted ‘shotrock’ have an uplift capacity of 25 tons for sixteen (16) inch diameter and 40 tons for a twenty-four (24) inch pile. The lateral load capacity is 10 tons and 17 tons respectively, based on fixed head condition. The above capacities are assuming a pile spacing of three (3) times the pile diameter. Care should be taken to ensure that the piles bear in the rock and not on a localized layer of dense 'marl’. Settlement of the piles is not expected to exceed 0.5 inch under design loads.

The auger rig shall drill into the rock until a refusal criterion of 2 inches per 30 minutes drilling at maximum torque. It is estimated that the pile embedment into the rock will be in the order of 6-8ft based on our experience to date.

Based on the preliminary building design with ground floor elevation at +11ft MSL and assuming a pile cap thickness of 4ft, the pile head would be at +7ft MSL. It can be expected that the pile embedment into the rock could be 6-8ft. Based on a typical rock elevation of -13ft MSL, the pile shaft length may be up to 30ft long.

Spring stiffness for the 24” diameter CFA piles can be taken as 600 kips/inch (300 tons/inch) from the load test results carried out for the ETH underpass and more recent projects.

It should be noted that significant grout loss is likely as the piles will be installed through the Ironshore Formation ‘marl’ and epikarst zones, and may encounter cavities at the rockhead. Redrilling and regrouting of piles may be needed in some instances. A useful advantage of the augercast pile is the system’s facility to easily cater for the variable pile penetration lengths likely to be encountered on the site. Equipment with sufficient torque will be required to provide the required embedment in the rockhead.

Medium strength (5,000 pounds per square inch) grout should be tremied to fill the pile shaft under pressure. The concrete should be supplied from the bottom of the shaft and allowed to rise to expel ground water.

10.3 FOUNDATIONS FOR LIGHTWEIGHT STRUCTURES

Municipal solid waste (MSW) is known to generally act in a homogenous nature in terms of response to imposed loading. It provides an allowable load bearing capacity that can be incorporated into the foundation design for lightweight buildings and ancillary structures with shallow foundations.

The general approach is to ‘proof roll’ the existing surface in compacted 9 inch lifts using a 10-ton vibrating roller (40 passes min) and later truck tested. Any soft areas identified during the truck test is to be demucked and backfilled under the direction of the Engineer. A minimum of 24 inches of well graded rockfill is to be placed in 9 inch lifts compacted to a minimum of 95% dry density.

Plate load compaction testing has indicated an allowable bearing capacity of at least 2,000psf can be achieved using the approach outlined above. Refer to **Addendums 1 & 2** for details on the testing completed on-site

10.4 PROTECTION OF FOUNDATION STRUCTURES

A minimum of 5,000 pounds per square inch (psi) concrete and a maximum water/cement ratio of 0.4 is recommended for all reinforced concrete in contact with ground water. This is to ensure resistance to sulphate attack. Laboratory testing of the groundwater sample indicates that the sulphate level is consistent with seawater and can be characterized as ‘moderate’ per ACI 318.

10.5 RETAINING WALLS

The angle of internal friction of typical engineering fill available in Grand Cayman is 30 – 35 degrees. Refer to **Appendix C** for Dynamic Lateral Earth Pressure Coefficient design information for retaining walls.

11.0 CONCLUSIONS AND RECOMMENDATIONS

11.1 General

The proposed development comprises an Energy Recovery Facility (ERF) on the site of a proposed Integrated Solid Waste Management System (ISWMS) Facility. The site is part of a historic municipal landfill with existing ground elevations ranging from approximately 2 ft to 12 ft MSL. Twenty-six trial pits and fifteen boreholes were advanced on the site between November and December, 2020 under APEC's supervision.

The subsoil conditions encountered during the investigation were generally consistent across the site. The subsoils encountered included up to 16 feet of topsoil/ 'marl' / municipal waste mix. This mixed fill material is superjacent to native Ironshore Formation 'marl' at approximately 0 - 2 ft below MSL. Highly compressible organic material was encountered in some trial pits and boreholes typically between -2 ft and +2 ft MSL. 'Limestone bedrock' was encountered at between 15 and 24.5 ft BGL (10 and 13.5 ft below MSL) in the boreholes. A number of cavities were encountered within the Ironshore Formation, the epikarst zone and the limestone rock stratum.

The stabilized ground water elevation on the site during Mean High Water Spring (MHWS) tide is estimated to be approximately 2.0 ft above MSL. The groundwater ingress into the trial pits was noted as being slow.

11.2 Recommendations for Suitable Foundation Systems for the Building

Two options are provided for consideration for the foundation systems for the proposed ERF structures.

Option 1 - Demuck/backfill/vibro densification

This option involves the removal of all existing mixed fill and compressible organic material from under the entire foundation footprint of the ERF building and to an appropriate distance beyond its perimeter. The depth of excavation should extend to a minimum of 16 ft below existing ground levels and extend into the Ironshore Formation. Allowance should be made for deep pockets of unsuitable material (waste fill mix and / or highly compressible organics). The footprint would then be backfilled using imported 'shot rock' selected from local quarries and vibro densification of the rockfill carried out by a reputable and experienced groundworks specialist company.

It is predicted - subject to a field trial by the vibro compaction specialist contractor - the vibro compaction technique will provide the following parameters for foundation design:

- Allowable bearing capacity of up to 6,000 psf with a short term overstress of 25%.
- 1 - 1.5 inch total settlement and L/500 differential settlement limits.
- A subgrade modulus of 150 – 250 pounds per cubic inch (pci). This value may be varied depending on the results of recommended vibro compaction trial. We recommend a sensitivity analysis be conducted by the structural engineer responsible for foundation analysis and design.

Option 2 - The installation of reinforced concrete continuous flight auger (CFA) piles supporting reinforced concrete pile caps.

Sixteen (16) and twenty-four (24) inch diameter augercast piles bearing in the ‘limestone rock’ nominally at approximately 13ft below MSL are estimated to have a compression load ranging from 65 to 130 tons respectively, subject to confirmation by pile load testing. Piles in tension with a shaft length of a minimum of 20 ft minimum through competent Ironshore Formation ‘marl’ and compacted ‘shotrock’ have an uplift capacity of 25 tons for sixteen (16) inch diameter and 40 tons for a twenty-four (24) inch pile. The lateral load capacity is 10 tons and 17 tons respectively, based on fixed head condition. The above capacities are assuming a pile spacing of three (3) times the pile diameter. Care should be taken to ensure that the piles bear in the rock and not on a localized layer of dense 'marl’. Settlement of the piles is not expected to exceed 0.5 inch under design loads.

Spring stiffness for the CFA piles can be taken as 600 kips/inch (300 tons/inch) from the load test results carried out for the ETH overpass.

Significant grout loss may be likely as the piles will be installed through the epikarst zone which we noted as extending up to 8 ft above the nominal ‘bedrock’ level. Redrilling and regrouting of piles may be needed in some instances. Equipment with sufficient torque will be needed to provide the required embedment.

It is understood from the Director of Planning and based on the requirements of the Cayman Islands Building Code that Special Structural Inspections will be required for the foundation testing and construction of this structure.

11.3 Foundations for Lightweight Structures

Shallow foundations are recommended for lightweight buildings and ancillary structures at the ISWMS site. The existing MSW & soil should be ‘proof rolled’ in compacted 9 inch lifts using a 10-ton vibrating roller (40 passes min) and later truck tested. Any soft areas identified during the truck test is to be demucked and backfilled under the direction of the Engineer. A minimum of 24 inches of well graded rockfill is to be placed in 9 inch lifts compacted to a minimum of 95% dry density.

Plate load testing has confirmed an allowable bearing capacity of 2,000psf can be achieved.

11.4 Protection of Foundation Structures

Reinforced concrete in direct contact with the ground water should have a minimum strength of 5,000 psi and a maximum water-cement ratio of 0.4. Reinforcement should have adequate cover.

11.5 Environmental Considerations

Hurricane related sea surge and flooding could occur on the site during the life of the development from either the North Sound to the east or from the Caribbean Sea to the west. Based on the currently available information, the 100-year base flood elevation for the site is 9 feet MSL (refer to **Section 5.0** for details).

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APPENDIX A – DESIGN FLOOD ELEVATION REVIEW

APEC Consulting Engineers Ltd
PO Box 10118, Grand Cayman KY1-1001, Cayman Islands
Ph: (345) 949-5858 Fax: (345) 945-7585 E-mail: apec@apec.com.ky

DESIGN FLOOD ELEVATION REVIEW

Client:	Dart Ltd PO Box 772 Grand Cayman KY1-9006	**Job:**	Integrated Solid Waste Management Facility Block 13D / Parcel 431 George Town, Grand Cayman
Attn:	Finley Joseph & Naomi Law		
		Date:	August 5, 2020

1.0 INTRODUCTION & BACKGROUND

APEC has been asked to review the design flood elevations (DFEs) for a proposed integrated solid waste management system (ISWMS) facility to be located on parcel 13D431. Refer to **Figure 1**.

FIGURE 1: PROPOSED LOCATION FOR SOLID WASTE MANAGEMENT FACILITY

The Cayman Islands does not currently have established Flood Insurance Study (FIS) reports or FEMA flood maps (FIRMS). In the absence of these, APEC has been referencing the documented Hurricane Ivan flood data which equates approximately to the 100 year design flood event. The Cayman Islands Lands & Survey Department Hurricane Ivan flood map reports a stillwater flood elevation in excess of 8ft MSL in this area. This is consistent with readings APEC took in the aftermath of Hurricane Ivan at the neighbouring Camana Bay site. It is noteworthy that the stillwater flood elevations depicted on the flood map for this area of George Town are representative of severe flooding due to a 100 year event which is partly dependant on the storm's track. Ivan's westerly track to the south of Grand Cayman and the anticlockwise motion of its winds forced a large volume of seawater into the shallow North Sound which resulted in the worst flooding on Island to occur in the industrial park area of Cayman.

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2.0 DETERMINATION OF THE NEW SITE DESIGN FLOOD ELEVATIONS

The proposed new facility is approximately 3,000ft inland from the North Sound. It is protected by the George Town Landfill's (GTLF) south mound, which reaches 44ft MSL in height. It is also flanked to the north by the GTLF's North Mound (at over 80ft MSL), and east & south with industrial development. The backshore is not conducive to maintaining significant wave action at this site from either the North Sound or the Caribbean Sea to the west. This would put the site under an **A** zone under the FEMA classification (refer to **Figure 2**), i.e. expected to be subjected to stillwater flooding only during a 100 year flood event. The base flood elevation (BFE) was therefore calculated as follows:

Existing Ground Elevation =	~4ft MSL
100 year flood, d100 =	8.5 – 4 = 4.5 ft (Hurricane Ivan stillwater readings)
Wave Crest, 0.55*d100 =	~0.5
BFE = 8.5+2.5 =	**+9 ft MSL**

ASCE Standard 24 for Flood Resistant Design and Construction gives guidance for determining the DFE based on building occupancy categories.

DFE for Occupancy Categories on 13D431

Occupancy Category I buildings (e.g. agri. buildings, storage sheds) = BFE	**+9ft MSL**
Occupancy Category II buildings (all other buildings.) = BFE + 1ft	**+10ft MSL**
Occupancy Category III & IV (essential facility, public assembly, etc.) = BFE + 2ft	**+11ft MSL**

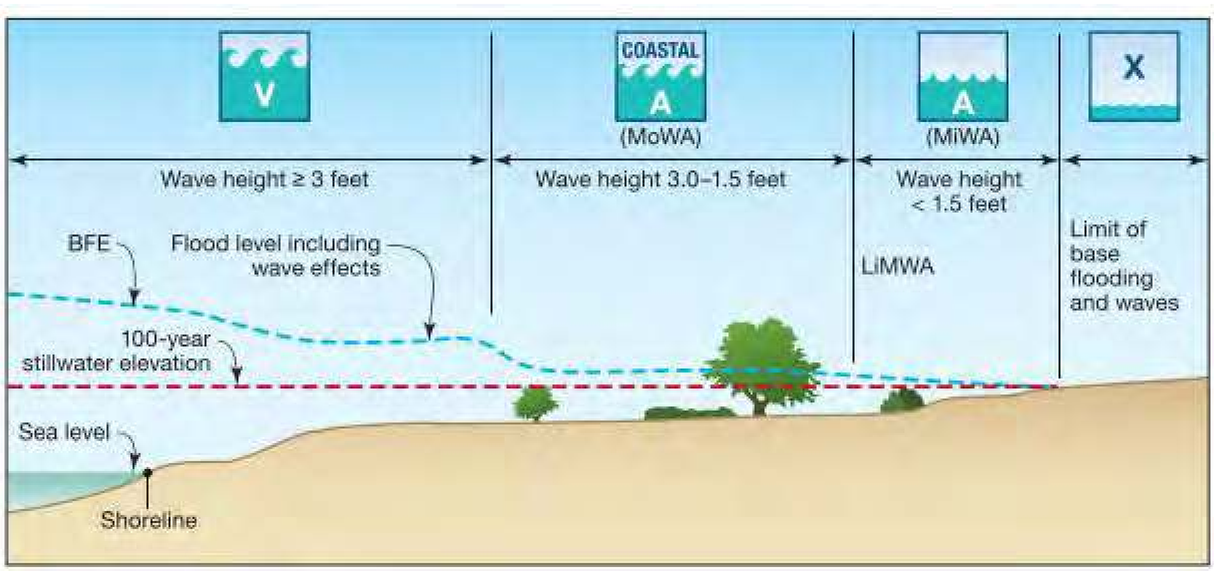

FIGURE 2: FEMA COASTAL ZONES

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3.0 REVIEW OF ISWMF BUILDING FLOOR ELEVATIONS

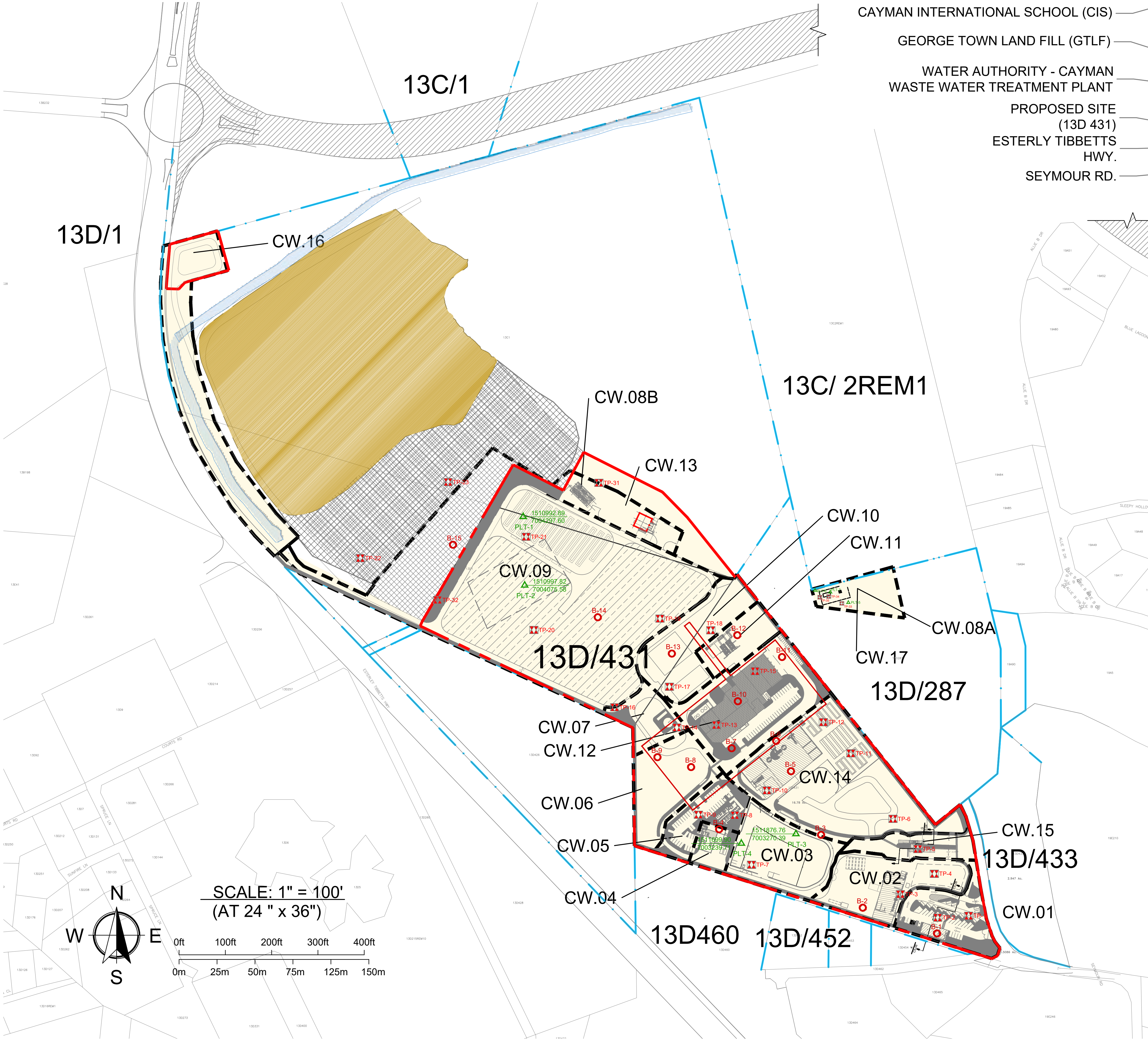
Below is a summary of the various buildings at the proposed ISWMF with their occupancy category in accordance with the 2009 International Building Code (IBC) and associated DFEs.

ISWMF BUILDING	DESCRIPTION	OCCUPANCY CATEGORY	DFE (ft MSL)
WEIGHBRIDGE	OPERATOR'S OFFICE	II	10
HOUSEHOLD WASTE PROCESSING	STAFF FACILITIES & WORKSHOP	II	10
ELV FACILITY	STAFF FACILITIES	II	10
MRF	SHED WITH PROCESSING EQUIPMENT	I	9
ADMINISTRATION	OFFICES, STAFF FACILITITES	II	10
MAINTENANCE FACILITY	STAFF FACILITIES	II	10
BA PROCESSING	SHED WITH PROCESSING EQUIPMENT	I	9
ENERGY RECOVERY FACILITY	POWER GENERATION PLANT	III	11

In some cases the processing buildings do include small staff facilities such as restrooms, break rooms & associated equipment rooms. These rooms can be locally elevated to provide an Occupancy Category II DFE.

It is worth noting that the building DFEs do not require the surrounding hardscape to be elevated to similar levels. Final site elevations will be dictated by the requirements for transporting processing and disposing of the waste and how the buildings interact with the various processes.

APPENDIX B – SITE INVESTIGATION LOCATION PLAN AND LOGS



NOTES:

I hereby certify that all the dimensions shown on this plan are correct.

Decco Ltd

LOCATION MAP

SCALE: 1" = 1000'

(AT 24 " x 36")

1000ft 2000ft 3000ft 4000ft

250m 500m 1000m 1250m 1500m

NO.	Description	Date
6	REV 5 - TRIAL PITS & PLATE TESTS ADDED	2023-04-03
5	REV 4 - TRIAL PIT TP-32 ADDED	2023-04-03
4	REV 3 - SITE PLAN BACKGROUND	2021-06-29
3	REV 2 - GTLF TPS ADDED	2021-06-29
2	REV 1 - LOCATIONS UPDATED	2020-12-22
1	REV 0	2020-11-03

ISSUED:

CONSULTANTS:

LEGEND

- LANDSCAPING
- TP-1 TRIAL PIT
- B-4 BOREHOLE
- PLT-1 PLATE BEARING TEST
- MT-1 'MARL' TEST LOCATION
- EXISTING SITE BOUNDARY

DRAFT VERSION

RESERVED FOR OFFICIAL STAMPS

PROJECT STATUS: PERMITTING PHASE PL

decco

Suite 8203 89 Nexus Way, Camana Bay, PO Box 771, Grand Cayman, KY1-9006, Cayman Islands.
T 345.640.3600
F 345.640.9020

PROJECT & ADDRESS:
INTEGRATED SOLID WASTE MANAGEMENT SYSTEM (ISWMS) PROJECT
BLOCK 13D PARCEL 431

DRS NUMBER(S):

DRS JOB #:

DRSCOST CODE #:

CLIENT:
DECCO CONSORTIUM

DRAWN: DS

CHECKED: FJ/AW

SEAL:

SCALE:

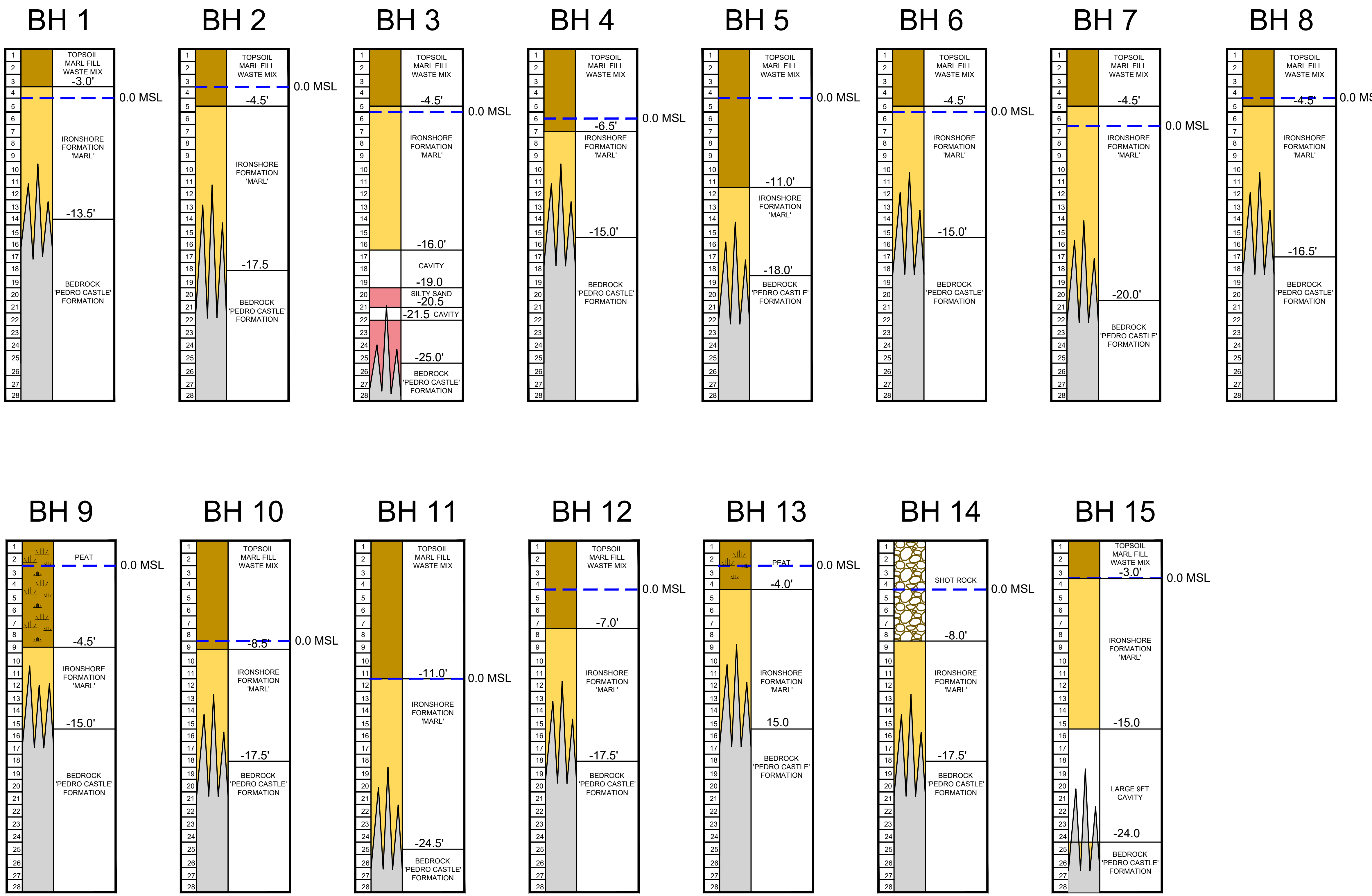
DATE: 03-11-20

SHEET TITLE:
SITE INVESTIGATION PLAN

DRAWING NO: SI-01

REV: 5

FILE LOCATION: G:\ACTIVE\2017\7015 ISWMS\Graphics\Civil\Client modified drawings\SI-01 Site Investigation.dwg. DATE & TIME: Thursday, July 13, 2023 5:07:55 PM



CAMANA BAY

decco

Dart Enterprises Contracting Co.
89 Nexus Way, Camana Bay
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Tel: 345.640.3600

Status
INFORMATION

REV	DATE	REVISION
-	2021-07-06	ISSUED FOR CLIENT INFORMATION

Client
decco

Job
SOLID WASTE MANAGEMENT FACILITY

Dwg. Title
BOREHOLE SUMMARY

Scale AS SHOWN Date DEC 2020
Drawn LV Checked DM

APEC

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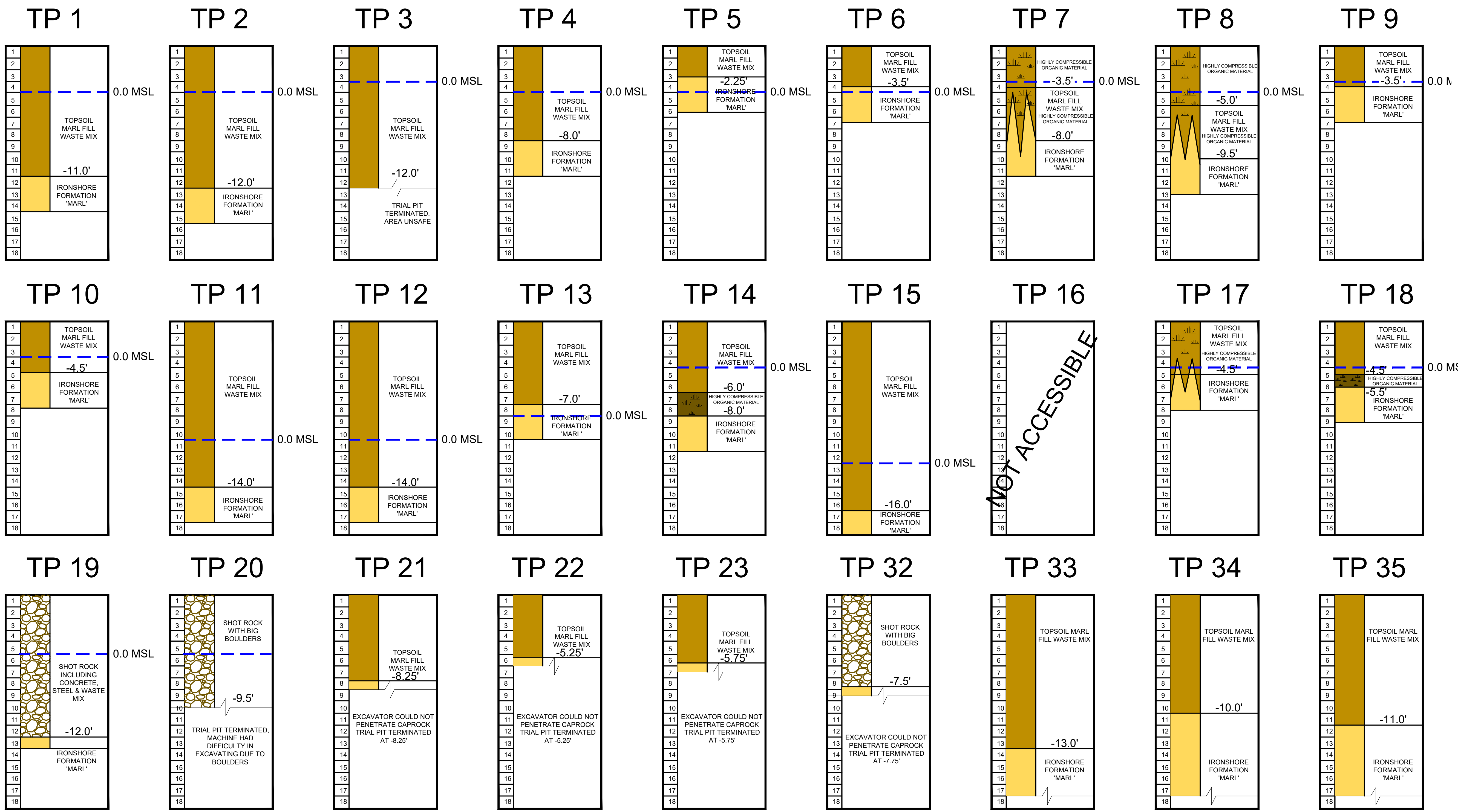
Job No	Dwg No	Rev
17015	SK-16	



CAMANA BAY

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Status
INFORMATION

REV	DATE	REVISION
2	2023-05-31	ISSUED FOR CLIENT INFORMATION
1	2023-03-29	ISSUED FOR CLIENT INFORMATION
-	2021-07-06	ISSUED FOR CLIENT INFORMATION

Client
decco

Job
SOLID WASTE MANAGEMENT FACILITY

Dwg. Title
TRIAL PIT SUMMARY

Scale AS SHOWN Date DEC 2020
Drawn LV Checked DM

APEC

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Job No	Dwg No	Rev
17015	SK-17	2

APPENDIX C – DYNAMIC LATERAL EARTH PRESSURE COEFFICIENT

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Calculation of Dynamic Lateral Earth Pressure Coefficient:

Method – Monobe-Okabe (M-O) as modified by Seed and Whitman.

$P_{AE} = P_A + \Delta P_{AE}$

$K_{AE} = K_A + \Delta K_{AE}$

$\Delta P_{AE} = (1/2)\ \gamma\ H^2\ \Delta K_{AE}$

$\Delta K_{AE} = 0.75\ K_h$

$\Delta P_{AE} = 0.5\ \gamma\ H^2 \times 0.75\ K_h$

Where:

$P_{AE:}$ The total (static + dynamic) lateral thrust

γ is unit weight of backfill soil

H is height of backfill behind the wall

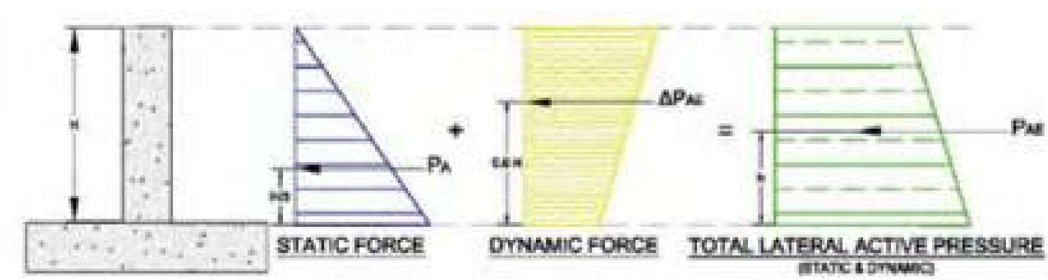
K_{AE} is the static plus dynamic lateral earth pressure coefficient

K_A is the static lateral earth pressure coefficient

ΔK_{AE} is the dynamic lateral earth pressure coefficient

K_h is the horizontal seismic ground acceleration component and can be taken as 0.5 (S_{DS}/2.5) for yielding retaining walls or (S_{DS}/2.5) for a restrained retaining wall

For the distribution of the dynamic thrust, ΔP_{AE}, the resultant dynamic thrust act at 0.6H above the base of the wall (that is, inverted trapezoidal pressure distribution). Assume no hydrostatic pressure for seismic condition.



Lateral Pressure Diagram Example

ADDENDUM – PLATE LOAD TESTING & TRIAL PITS

A.1 Plate load testing

Four Plate Load Tests (PLT) were carried out on February 27, 2023 - two of the PLT's were located within CW.09, the residual waste landfill area, and two were located within CW.03, the end-of-life vehicle (ELV) facility. At each test location one loading point was measured at grade level.

PLT is used to determine load settlement lines which are used to evaluate the deformability and the bearing capacity of the soil. During testing, a circular load plate (300mm in diameter) is repeatedly loaded and relieved by means of a load device consisting of a hydraulic pump and pneumatic cylinder. The load is applied to the plate in 6 to 8 equal loading steps. The settlement of the plate is measured by the tester consisting of a carrier frame with a sensing arm and dial gauge. As a counterbalance, a heavy-weight vehicle is used – during testing the CAT 330 tracked excavator was used for this. **Figure A1** shows the PLT set-up used on site.

The indentation of the load plate into the soil, generated with every load step, is indicated on a dial gauge. The settlement of every load step and the corresponding mean normal stress below the load plate appear as test values. Subsequent to the last load step the relief and a second loading similar to the first loading takes place. For the test evaluation these values are plotted as load settlement lines.

FIGURE A1 – PLT USING CAT330 AXEL AS COUNTERBALANCE

The modulus of deformation, Ev, is determined from the load settlement line of the first load (Ev1) and the second load (Ev2). The degree of settlement attained is determined by comparing the initial deformation from Ev1 and the subsequent deformation of Ev2. Refer to **Appendix D** for test results.

A.2 Trial Pits

APEC completed Trial Pits 21 to 24 on February 2nd within CW.09, the future expansion area. These trial pits formed part of the original geotechnical investigation plan however could not be complete at the time as the areas were inaccessible. Refer to drawing S1-01 Rev 4 for the trial pit locations and SK17 Rev 1 for the trial pit logs. **Table A1** below summarizes the results of the Trial Pits 21, 22 and 23. Trial Pit 24 contained 7.5 feet of rock fill superjacent to the Ironshore Formation ‘marl’. Trial pitting was carried out using a CAT 330L tracked excavator which could not penetrate the caprock of the Ironshore Formation ‘marl’ encountered underlying the fill material in all trial pits.

Strata	Approx. thickness/ elevation
Topsoil ‘Marl’ fill and municipal waste mix	Surface elevation varies from 3 to 6.25ft MSL Thickness 5 to 8.5ft
'Marl' (Ironshore Formation) Caprock	Excavator could not penetrate
Ground water	Ground water level varies average of 2ft MSL*

*average levels measured within trial pits, variation tidally influenced

TABLE A1 – SOIL PROFILE SUMMARY

A.3 ALLOWABLE BEARING CAPACITY

The bearing capacities from the PLT results are considered high with values of greater than 10,000 PSF noted in three of the four test areas. The values obtained have been rationalized by assuming that the maximum test value obtained within the engineered rock fill in CW.02, the ELV facility, is 4,000 psf and all test results then calculated relative to this figure to provide allowable bearing capacities (ABC). Using this conservative approach, we get ABC’s of approximately 4,000 psf in test areas 2, 3 and 4. Test area 1 returns an ABC of 1,280 psf, the soil profile in the vicinity of this test area is approximately 6 feet of topsoil ‘marl’ fill and municipal waste mix over the Ironshore Formation.

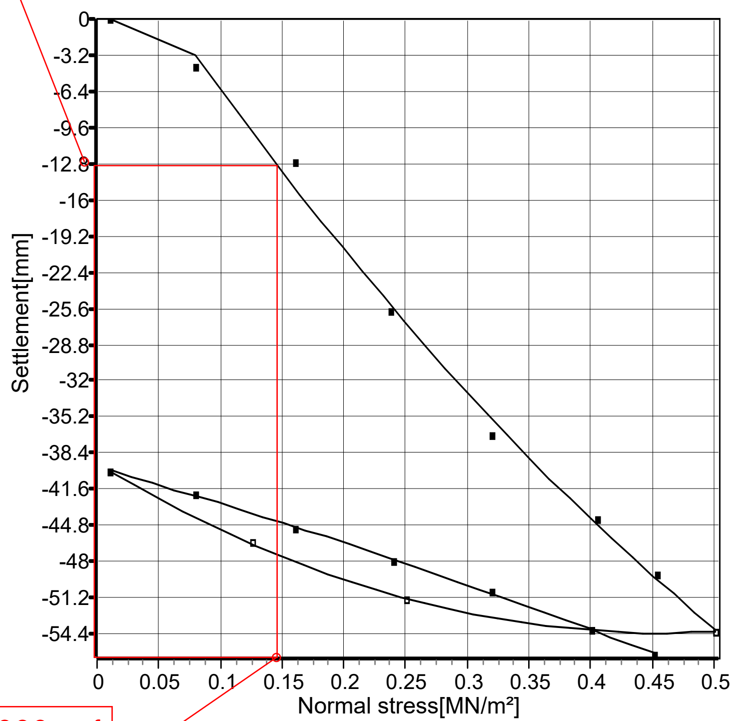
Measuring series:	data-012 edited
Tested by:	
Date/Time:	27.02.2023 / 10:58 - 11:12
Temperature/Weather:	/
Weather yesterday:	

Static Plate Load Test to DIN 18 134

Project:		Diameter loadplate:	300 mm
Type of ground:		settlement measuring dev.:	indirect
Measuring point:		Measuring arm factor:	2:1
Underlaying mat.:		Device number:	00973
Excavation:		GPS position:	19°18'32.16" 175°234'-28.-62"

Max allowable deflection of 1/2"

Value No.	Standard tension (MN/m²)	Settlement [mm]
First load		
1.	0.0100	0.00
2.	0.0802	4.20
3.	0.1601	12.72
4.	0.2379	25.84
5.	0.3201	36.80
6.	0.4055	44.32
7.	0.4539	49.20
8.	0.5013	54.16
Unloaded		
9.	0.2506	51.36
10.	0.1259	46.32
11.	0.0100	40.00
Second load		
12.	0.0799	42.00
13.	0.1601	45.04
14.	0.2400	48.00
15.	0.3205	50.64
16.	0.4013	54.00
17.	0.4511	56.24



Approx 3,000 psf

Load number :	1	2	3
sig0 max.[MN/m²]	0.5013	0.5013	
a0 [mm]	-9.502	39.630	
a1 [mm /(MN/m²)]	164.380	31.108	
a2 [mm /(MN/m²)²]	-75.220	12.179	
Ev [MN/m²]	1.8	6.0	

Ev1 = 1.8 MN/m²

Ev2 = 6.0 MN/m²

Ev2 / Ev1 = 3.40

Remarks

,16/03/2023

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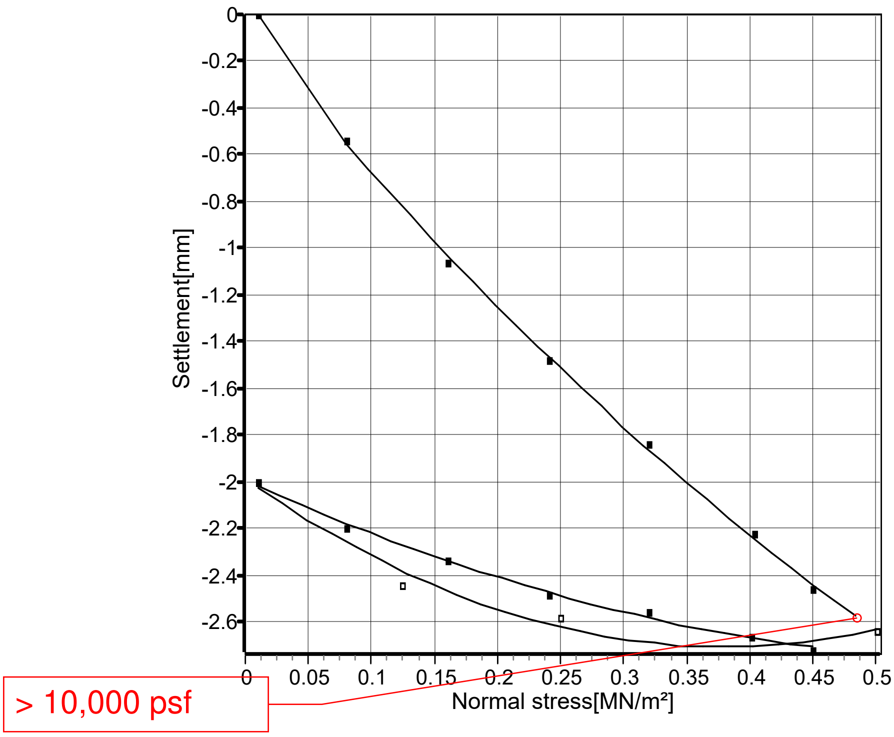
Measuring series:	data-013 (Test #2)
Tested by:	
Date/Time:	27.02.2023 / 11:46 - 11:56
Temperature/Weather:	/
Weather yesterday:	

Static Plate Load Test to DIN 18 134

Project:		Diameter loadplate:	300 mm
Type of ground:		settlement measuring dev.:	indirect
Measuring point:		Measuring arm factor:	2:1
Underlaying mat.:		Device number:	00973
Excavation:		GPS position:	19°18'30.02" 175°234'-28.-85"

Value No.	Standard tension (MN/m²)	Settlement [mm]
First load		
1.	0.0100	0.00
2.	0.0802	0.54
3.	0.1605	1.06
4.	0.2407	1.48
5.	0.3202	1.84
6.	0.4037	2.22
7.	0.4498	2.46
8.	0.5008	2.64
Unloaded		
9.	0.2499	2.58
10.	0.1243	2.44
11.	0.0099	2.00
Second load		
12.	0.0804	2.20
13.	0.1602	2.34
14.	0.2407	2.48
15.	0.3204	2.56
16.	0.4017	2.66
17.	0.4498	2.72



Load number :	1	2	3	
sig0 max.[MN/m²]	0.5008	0.5008		Ev1 = 43.6 MN/m²
a0 [mm]	0.053	1.992		Ev2 = 151.3 MN/m²
a1 [mm /(MN/m²)]	6.530	2.471		
a2 [mm /(MN/m²)²]	-2.730	-1.966		Ev2 / Ev1 = 3.47
Ev [MN/m²]	43.6	151.3		

Remarks

,15/03/2023 ....

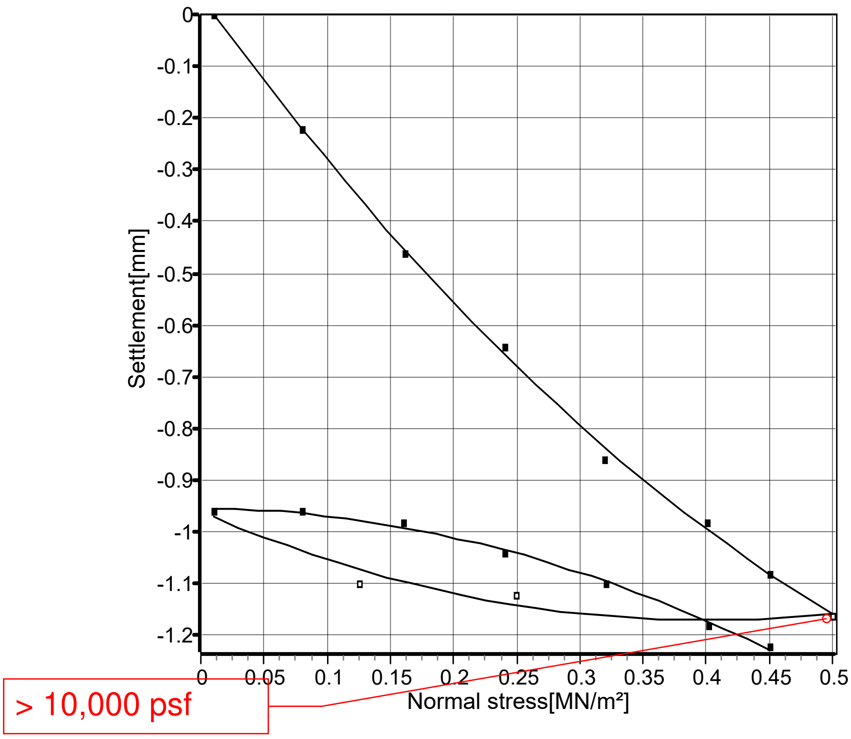
Software ProPlatt HMP Magdeburger Prüfgerätebau GmbH 2003-2019

Measuring series:	data-014 (Test #3)
Tested by:	
Date/Time:	27.02.2023 / 12:43 - 12:55
Temperature/Weather:	/
Weather yesterday:	

Static Plate Load Test to DIN 18 134

Project:		Diameter loadplate:	300 mm
Type of ground:		settlement measuring dev.:	indirect
Measuring point:		Measuring arm factor:	2:1
Underlaying mat.:		Device number:	00973
Excavation:		GPS position:	19°18'22.16" 175°234'-19.-63"

Value No.	Standard tension (MN/m²)	Settlement [mm]
First load		
1.	0.0101	0.00
2.	0.0800	0.22
3.	0.1617	0.46
4.	0.2405	0.64
5.	0.3194	0.86
6.	0.4002	0.98
7.	0.4497	1.08
8.	0.4999	1.16
Unloaded		
9.	0.2491	1.12
10.	0.1252	1.10
11.	0.0099	0.96
Second load		
12.	0.0799	0.96
13.	0.1605	0.98
14.	0.2405	1.04
15.	0.3201	1.10
16.	0.4013	1.18
17.	0.4498	1.22



Load number :	1	2	3	
sig0 max.[MN/m²]	0.4999	0.4999		Ev1 = 94.5 MN/m²
a0 [mm]	-0.033	0.954		Ev2 = 333.3 MN/m²
a1 [mm /(MN/m²)]	3.325	0.024		
a2 [mm /(MN/m²)²]	-1.888	1.302		Ev2 / Ev1 = 3.53
Ev [MN/m²]	94.5	333.3		

Remarks

,15/03/2023

....

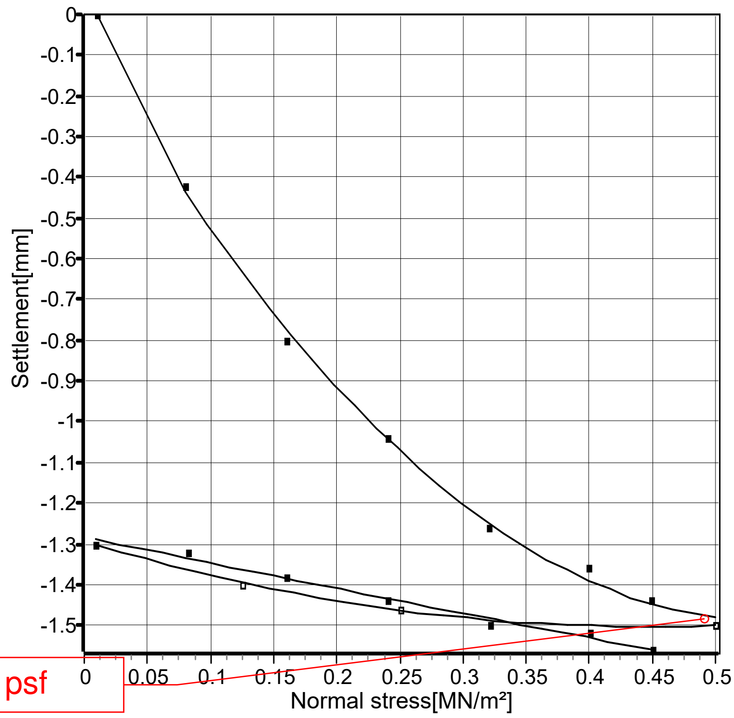
Dart

Measuring series:	data-015 (Test #4)
Tested by:	APEC
Date/Time:	27.02.2023 / 13:12 - 13:22
Temperature/Weather:	/
Weather yesterday:	

Static Plate Load Test to DIN 18 134

Project:	GRAND CAYMAN PROPOSED INTEGRATED	Diameter loadplate:	300 mm
Type of ground:	Topsoil 'Marl' fill and municipal waste mix	settlement measuring dev.:	indirect
Measuring point:	PLT Test #1	Measuring arm factor:	2:1
Underlaying mat.:	Ironshore Formation	Device number:	00973
Excavation:		GPS position:	19°18'21.76" 175°234'-21.-58"

Value No.	Standard tension (MN/m²)	Settlement [mm]
First load		
1.	0.0100	0.00
2.	0.0800	0.42
3.	0.1600	0.80
4.	0.2402	1.04
5.	0.3200	1.26
6.	0.4000	1.36
7.	0.4495	1.44
8.	0.5000	1.50
Unloaded		
9.	0.2502	1.46
10.	0.1252	1.40
11.	0.0094	1.30
Second load		
12.	0.0824	1.32
13.	0.1604	1.38
14.	0.2402	1.44
15.	0.3212	1.50
16.	0.4003	1.52
17.	0.4500	1.56



Load number :	1	2	3
sig0 max.[MN/m²]	0.5000	0.5000	
a0 [mm]	0.040	1.283	
a1 [mm /(MN/m²)]	5.372	0.655	
a2 [mm /(MN/m²)²]	-4.982	-0.088	
Ev [MN/m²]	78.1	368.1	

Ev1 = 78.1 MN/m²

Ev2 = 368.1 MN/m²

Ev2 / Ev1 = 4.71

Remarks

,2023-02-27

....

ADDENDUM 2 – GAS FLARE COMPOUND

B.1 INTODUCTION

The proposed gas flare compound is located along the northern boundary of the GT Landfill's south mound. See **Figure 1**. It is located in an area which was mined of limestone 'marl' and backfilled with municipal solid wate (MSW) sometime in the 1980s. We understand the south mound has been left inert with a soil cap for over 30 years.

The preliminary design for the compound indicates a gas flare stack on shallow reinforced concrete foundations on a minimum of 2 feet engineered rockfill. The total depth of rockfill varies, as the compound will be levelled to a minimum elevation of 12ft MSL.

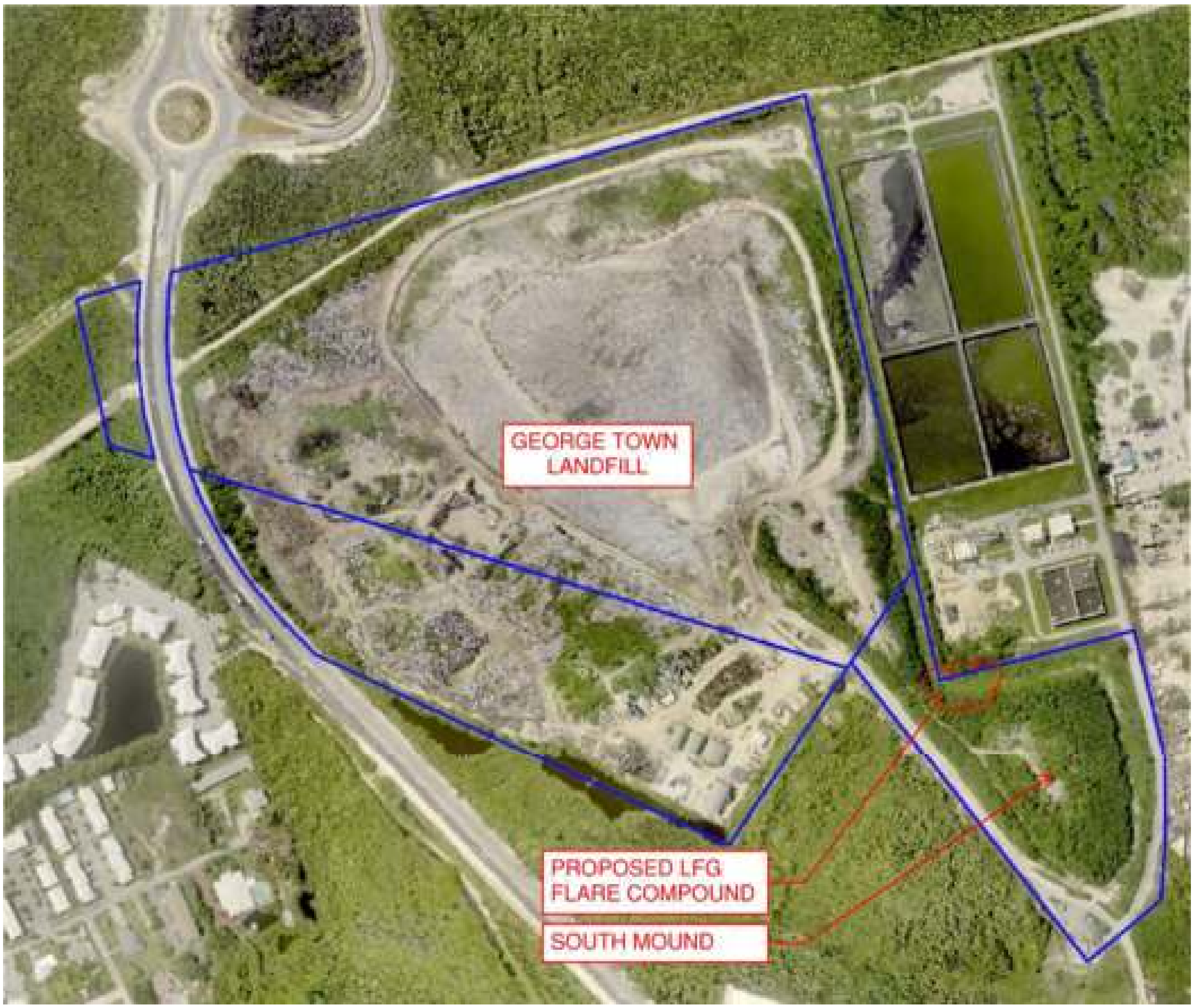


FIGURE 1: GEORGE TOWN LANDFILL AND PROPOSED GAS FLARE IDENTIFIED (2018 LANDS AND SURVEY AERIAL)

B.2 Trial Pits

APEC completed Trial Pits 33 to 35 on 12th April 2023 within CW.17, the landfill gas treatment area. These trial pits formed part of the original geotechnical investigation plan however could not be completed at the time as the areas were inaccessible. Refer to drawing SI-01 Rev 6 for the trial pit locations and SK-17 for the trial pit logs. **Table 1** below summarizes the results of Trial Pits 33 to 35. Trial pitting was carried out using a Hitachi 350 tracked excavator which could not penetrate the caprock of the Ironshore Formation 'marl' encountered underlying the fill material in all trial pits.

Strata	Approx. thickness/ elevation
Topsoil 'Marl' fill and municipal waste mix	Surface elevation varies from 7.5 to 15.75ft MSL Thickness 10 to 13ft
'Marl' (Ironshore Formation) Caprock	Excavator could not penetrate
Ground water	Ground water level varies average of 2ft MSL*

*average levels measured within trial pits, variation tidally influenced

Table 1 – Soil profile summary

Figure 2: Trial pit TP-33

B.3 Plate load testing

Three Plate Load Tests (PLT) were carried out on May 4th 2023 - all of the PLTs were located within CW.17. A fourth PLT was completed in the industrial estate in an area with no MSW present on May 24th 2023. This was used as a control test for comparative purposes. At each test location one loading point was measured at grade level.

PLT is used to determine load settlement lines which are used to evaluate the deformability and the bearing capacity of the soil. During testing, a circular load plate (300mm in diameter) is repeatedly loaded and relieved by means of a load device consisting of a hydraulic pump and pneumatic cylinder. The load is applied to the plate in 6 to 8 equal loading steps. The settlement of the plate is measured by the tester consisting of a carrier frame with a sensing arm and dial gauge. As a counterbalance, a heavy-weight vehicle is used – during testing a tracked excavator was used for this purpose. **Figure 3** shows the PLT set-up used on site.

The indentation of the load plate into the soil, generated with every load step, is indicated on a dial gauge. The settlement of every load step and the corresponding mean normal stress below the load plate appear as test values. Subsequent to the last load step the load relief and a second loading similar to the first loading takes place. For the test evaluation these values are plotted as load settlement lines.

The modulus of deformation, Ev, is determined from the load settlement line of the first load (Ev1) and the second load (Ev2). The degree of settlement attained is determined by comparing the initial deformation from Ev1 and the subsequent deformation of Ev2. Refer to the end of this addendum for test results.

Figure 3: Plate load test

B.4 Allowable Bearing Capacity

The allowable bearing capacities (ABC) from the PLT results are considered as medium capacities for soil with values of greater than 5,000 PSF noted in two of the three test areas. The values obtained have been rationalized by assuming that the maximum test value obtained from the ‘control’ test in the industrial estate on limestone ‘marl’, is 4,000 psf and all test results then calculated relative to this figure. Using this conservative approach, we get ABC’s of approximately 2,000 psf in test areas 6 and 7. Test area 5 officially failed, with an ABC of approximately 1,000psf.

We recommend an ABC of 2,000 psf is taken for the proposed foundations within the gas flare compound. Any areas of obvious soft spots (e.g. test area 5) should be removed and backfilled with well graded engineered rockfill compacted in lifts not exceeding 12 inches. It is worth noting however that test areas 6 and 7 were proximate to the proposed gas flare stack and equipment pads.

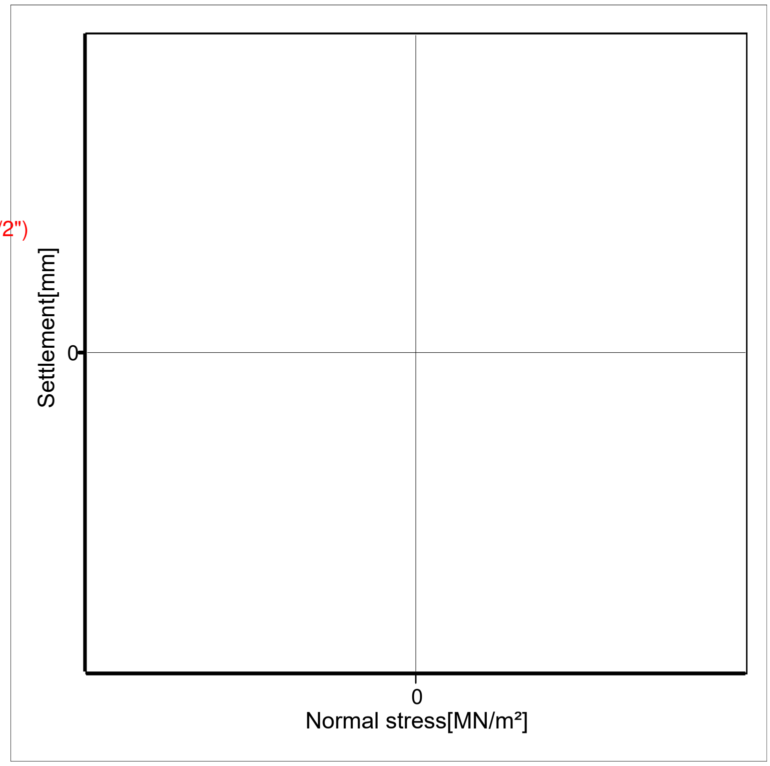
Measuring series:	data-016
Tested by:	
Date/Time:	04.05.2023 / 09:15 - 09:25
Temperature/Weather:	/
Weather yesterday:	

Static Plate Load Test to DIN 18 134

Project:		Diameter loadplate:	300 mm
Type of ground:		settlement measuring dev.:	indirect
Measuring point:		Measuring arm factor:	2:1
Underlaying mat.:		Device number:	00973
Excavation:		GPS position:	19°18'29.45" 175°234'-17.-94"

Value No.	Standard tension (MN/m²)	Settlement [mm]
First load		
1.	0.0100	0.00
2.	0.0816	8.50
3.	0.1600	16.36
4.	0.2420	23.64
5.	0.3316	28.52
6.	0.4014	35.05
7.	0.4418	42.00
Unloaded		
8.	0.4040	28.54
9.	0.1899	28.54
10.	0.0643	28.54
11.	0.0643	28.54
12.	0.0625	28.54
13.	0.0625	28.54
14.	0.0625	28.54
15.	0.0625	28.54
16.	0.0625	28.54
17.	0.0604	28.54

(Approx 2,500PSF) 12.43mm (approx 1/2")



Load number :	1	2	3	
sig0 max.[MN/m²]	0.0000	0.0000		Ev1 = 0.0 MN/m²
a0 [mm]	0.000	0.000		Ev2 = 0.0 MN/m²
a1 [mm /(MN/m²)]	0.000	0.000		
a2 [mm /(MN/m²)²]	0.000	0.000		Ev2 / Ev1 =
Ev [MN/m²]	0.0	0.0		

Remarks

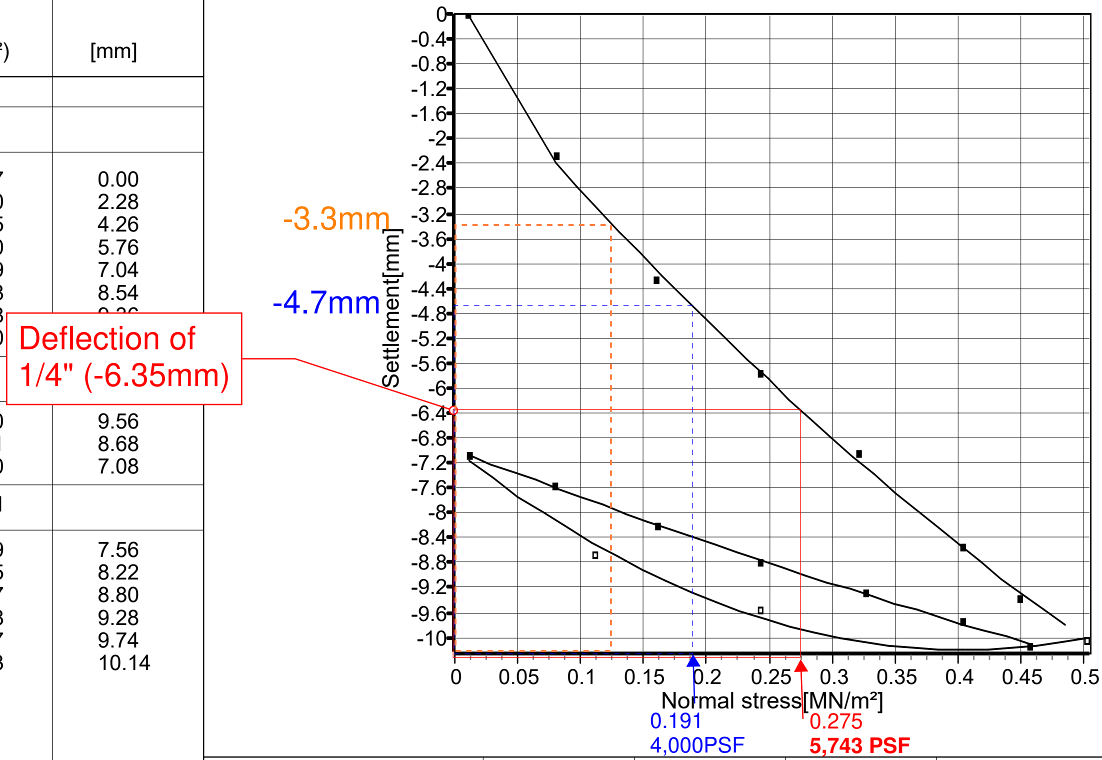
,31/05/2023 ....

Measuring series:	data-017
Tested by:	
Date/Time:	04.05.2023 / 09:40 - 09:48
Temperature/Weather:	/
Weather yesterday:	

Static Plate Load Test to DIN 18 134

Project:		Diameter loadplate:	300 mm
Type of ground:		settlement measuring dev.:	indirect
Measuring point:		Measuring arm factor:	2:1
Underlaying mat.:		Device number:	00973
Excavation:	Flare Test #6	GPS position:	19°18'29.88" 175°234'-19.-10"

Value No.	Standard tension (MN/m²)	Settlement [mm]
First load		
1.	0.0097	0.00
2.	0.0800	2.28
3.	0.1595	4.26
4.	0.2430	5.76
5.	0.3209	7.04
6.	0.4038	8.54
7.	0.4488	[illegible]
8.	0.5020	[illegible]
Unloaded		
9.	0.2430	9.56
10.	0.1111	8.68
11.	0.0110	7.08
Second load		
12.	0.0789	7.56
13.	0.1605	8.22
14.	0.2427	8.80
15.	0.3258	9.28
16.	0.4037	9.74
17.	0.4563	10.14



Load number :	1	2	3
sig0 max.[MN/m²]	0.5020	0.5020	
a0 [mm]	0.532	6.987	
a1 [mm /(MN/m²)]	23.809	7.884	
a2 [mm /(MN/m²)²]	-9.655	-2.328	
Ev [MN/m²]	11.9	33.5	

Ev1 = 11.9 MN/m²

Ev2 = 33.5 MN/m²

Ev2 / Ev1 = 2.82

Remarks

,29/05/2023 ....

Measuring series:	data-018
Tested by:	
Date/Time:	04.05.2023 / 10:06 - 10:12
Temperature/Weather:	/
Weather yesterday:	

Static Plate Load Test to DIN 18 134

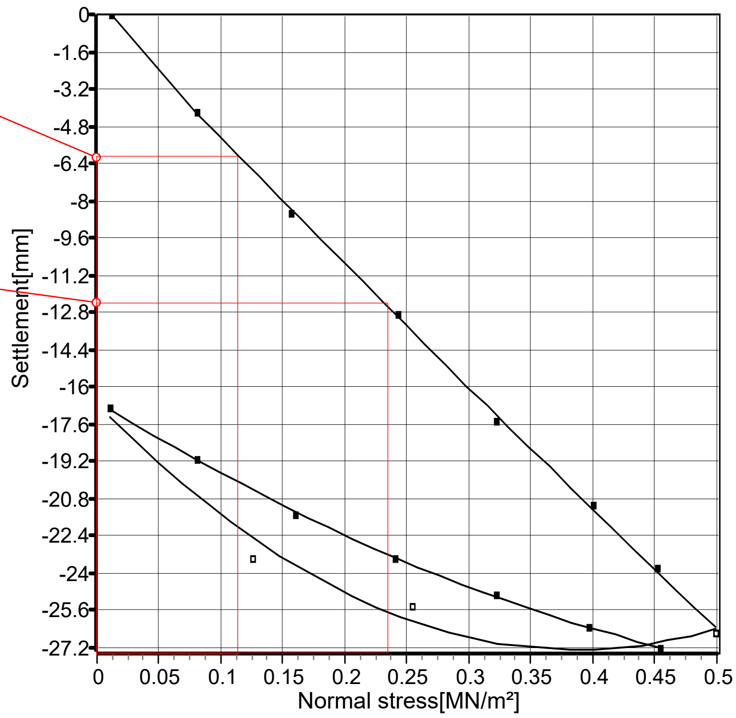
Project:		Diameter loadplate:	300 mm
Type of ground:		settlement measuring dev.:	indirect
Measuring point:		Measuring arm factor:	2:1
Underlaying mat.:		Device number:	00973
Excavation:		GPS position:	19°18'29.71" 175°234'-18.-57"

Flare Test #7

Value No.	Standard tension (MN/m²)	Settlement
First load		
1.	0.0118	0.00
2.	0.0806	4.16
3.	[illegible]	[illegible]
4.	[illegible]	[illegible]
5.	[illegible]	[illegible]
6.	[illegible]	[illegible]
7.	[illegible]	[illegible]
8.	0.4993	26.52
Unloaded		
9.	0.2542	25.38
10.	0.1249	23.38
11.	0.0104	16.92
Second load		
12.	0.0804	19.08
13.	0.1595	21.48
14.	0.2405	23.32
15.	0.3217	24.92
16.	0.3966	26.32
17.	0.4541	27.22

Deflection of 1/4" (-6.35mm)

Max allowable deflection of 1/2" (-12.7mm)



2,394PSF 4,960PSF

Load number :	1	2	3
sig0 max.[MN/m²]	0.4993	0.4993	
a0 [mm]	-0.189	16.593	
a1 [mm /(MN/m²)]	55.494	33.280	
a2 [mm /(MN/m²)²]	-4.718	-21.987	
Ev [MN/m²]	4.2	10.1	

Ev1 = 4.2 MN/m²

Ev2 = 10.1 MN/m²

Ev2 / Ev1 = 2.38

Remarks

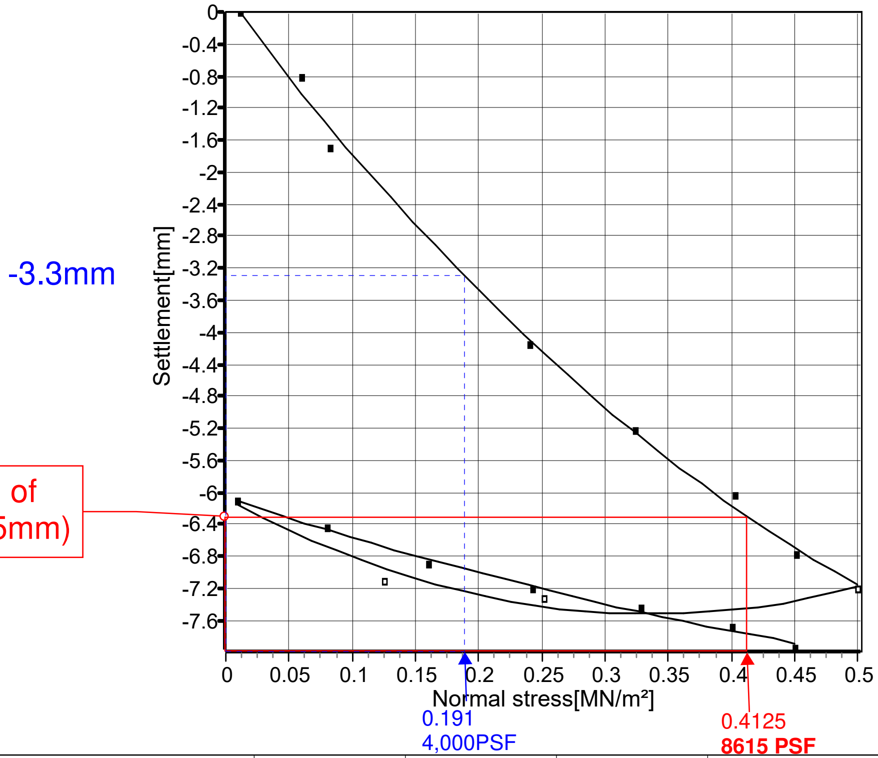
,29/05/2023 ....

Measuring series:	data-020
Tested by:	
Date/Time:	24.05.2023 / 10:51 - 11:00
Temperature/Weather:	/
Weather yesterday:	

Static Plate Load Test to DIN 18 134

Project:		Diameter loadplate:	300 mm
Type of ground:		settlement measuring dev.:	indirect
Measuring point:		Measuring arm factor:	2:1
Underlaying mat.:		Device number:	00973
Excavation:	Control	GPS position:	19°18'39.84" 175°234'-4.-51"

Value No.	Standard tension (MN/m²)	Settlement [mm]
First load		
1.	0.0114	0.00
2.	0.0600	0.80
3.	0.0821	1.70
4.	0.2406	4.16
5.	0.3232	5.22
6.	0.4020	6.04
7.	0.4515	6.76
8.	0.4995	7.20
Unloaded		
9.	0.2513	7.32
10.	0.1247	7.10
11.	0.0094	6.10
Second load		
12.	0.0799	[illegible]
13.	0.1604	6.90
14.	0.2429	7.20
15.	0.3280	7.44
16.	0.4007	7.68
17.	0.4504	7.94



Load number :	1	2	3
sig0 max.[MN/m²]	0.4995	0.4995	
a0 [mm]	-0.153	6.061	
a1 [mm /(MN/m²)]	20.505	5.259	
a2 [mm /(MN/m²)²]	-11.764	-2.705	
Ev [MN/m²]	15.4	57.6	

Ev1 = 15.4 MN/m²

Ev2 = 57.6 MN/m²

Ev2 / Ev1 = 3.74

Remarks

,29/05/2023 ....

Appendix 10.A

Seascape and Landscape Visual Considerations Report

Contents

Table Index

Figure Index

Photo Index

Terminology

Terminology	Definition
Aesthetics	Relating to the sense of the beautiful or science of aesthetics, i.e., the deduction, from nature and taste, the rules, and principles of beauty.
Impact	The effect of a proposal, which can be adverse or beneficial, when measured against an existing condition.
Landscape	All aspects of a tract of land, including landform, vegetation, buildings, villages, towns, cities, and infrastructure.
Landscape character	The combined quality of built, natural and cultural aspects which make up an area and provide its unique sense of place.
Landscape character zone	An area of landscape with similar properties or strongly defined spatial qualities, distinct from areas immediately nearby.
Magnitude	The measurement of the scale, form and character of a development proposal when compared to the existing condition. In the case of visual assessment this also relates to how far the proposal is from the viewer. Combines with sensitivity, magnitude provides a measurement of impact.
Project	The construction and operation of the Integrated Solid Waste Management Facility (ISWMS) Project
Project area	The area within which all the Project construction and operational elements will be contained within.
Seascape character	An area of land, coastline, and sea whose combined interactions define an area
Seascape character zone	A specific locality compromising defined attributes and characteristics distinct from neighbouring areas.
Sensitivity	The sensitivity of a landscape character zone or view and its capacity to absorb change of the nature of the Project. In the case of visual impact this also relates to the type of viewer and number of viewers. Combined with magnitude, sensitivity provides a measurement of impact. Viewpoint The point from which a view is observed that represents a visual receiver. Viewshed The area within which a project can be seen at eye level above ground. Its extent will usually be defined by a combination of landform, vegetation and built elements
Significant	In the context of Environmental Impact Assessment, after analysing the extent (type, size, scope, intensity, and duration) and nature (predictability, resilience of the environment, reversibility, ability to manage/mitigate, level of public interest) of a proposal, an expected level of impact of a proposal which requires an EIS to be undertaken. The term should be avoided in landscape character and visual impact assessments if the expected level of impacts is below the threshold.
Study area	Consists of land in the vicinity of, and including, the Project site. The study area is a wider area surrounding the Project site as defined in this assessment, including land that has the potential to be indirectly impacted by the Project.
View	The sight or prospect of a landscape or scene.
Viewpoint	The point from which a view is observed that represents a visual receiver.
Viewshed	The area within which a project can be seen at eye level above ground. Its extent will usually be defined by a combination of landform, vegetation and built elements.
Visibility	The state or fact of being visible or seen.
Visual effect	The effect on the views from residences, workplaces, and public place
Visual receiver	A selected location of view representing a visual receiver.
Zone of Theoretical Visibility	A map, usually digitally produced, showing areas of land within which, a development is theoretically visible.

1 Adapted from: *Environmental impact assessment practice note EIA-N04 - Guideline for landscape character and visual impact assessment, Version 2.2*

Abbreviations

Abbreviations	Definition
3D	Three dimensional
DCP	Development Control Plan
GTLF	George Town Land Fill
GHD	GHD Pty Ltd
GIS	Geographic Information System
ISWMS	Integrated Solid Waste Management Facility
km	Kilometre
LCZ	Landscape character zone
LEP	Local Environmental Plan
LGA	Local Government Area
LVIA	Landscape and visual impact assessment
m	Metre
SCZ	Seascape character zone
ToR	ISWMS Terms of Reference
VP	Viewpoint
RWL	Residual Waste Landfill
ZTV	Zone of theoretical visibility

1. Introduction

1.1 Overview

The proposed ISWMS Site is located to the north of central George Town towards the western coast of Grand Cayman, immediately south-west of the existing George Town Landfill (GTLF).

The proposed ISWMS development consists of various new waste management facilities. The various components of the ISWMS subject to assessment in the *Terrestrial Ecology Assessment – Existing Conditions Report* are as follows:

– Energy Recovery Facility
– Non-Energy Recovery Facilities:
  - Green Waste Processing Facility
  - Construction and Demolition Waste Processing Facility
  - Bottom Ash Processing Facility
  - Abandoned and End-of-Life / Scrap Metal Processing Facility
  - Medical Waste Facility
  - Landfill Gas Facility
  - Residual Waste Landfill (RWL)

The design life of the new facilities is 25 years.

1.2 Purpose of this report

The Cayman Islands Government in partnership with DECCO Consortium (the Proponent) is proposing to develop an Integrated Solid Waste Management Facility (ISWMS) in the Cayman Islands, on Grand Cayman ('the Project'). The Seascape and Landscape Visual Considerations Report consist of two related assessments that assess effects of the construction and operation of the proposed ISWMS on the landscape, concentrating upon effects upon the landscape and townscape character, and effects upon the views and visual amenity of people who live, undertake recreational activities, work and/or travel through the area around the proposed ISWMS on the western side of Grand Cayman.

1.3 Report structure

The report is comprised of the following sections:

Section 1 - Introduction: provides background information and an overview of the project and assessment.

Section 2 - Methodology: describes the methodology used for the purpose of this report.

Section 3 - Proposal description: describes the proposed development, with emphasis on identifying the key sources of potential effects relevant to this assessment.

Section 4 - Legislation and policy: provides an overview of relevant legislation and policy.

Section 5 - Existing environment: provides an overview and describes the landscape and visual environment within the study area.

Section 6 - Landscape character assessment: landscape character zones are identified and assessed against the proposed development.

Section 7 - Visual consideration assessment: representative viewpoint locations are identified and assessed against the proposed development.

Section 9 – Mitigation measures: recommendations and mitigation measures are provided in response to identified effects as a result of the construction and operation of the project.

Section 10 Conclusion presents a summary of the Seascape and Landscape Visual Considerations Report.

1.4 Scope and limitations

This report: has been prepared by GHD for ReGen and the Cayman Islands Government and may only be used and relied on by ReGen and the Cayman Islands Government for the purpose agreed between GHD and ReGen and the Cayman Islands Government as set out in this report.

GHD otherwise disclaims responsibility to any person other than ReGen and the Cayman Islands Government arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section(s) 1.5 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by ReGen and the Cayman Islands Government and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

1.5 Assumptions

The methodology includes the following assumptions and limitations:

– There is no national guidance on the assessment of landscape and visual impacts specific to Cayman Islands, however, the industry typically refers to the guidelines as outlined in Section 2.1.
– The assessment aims to be objective and describe any changes factually. While potential changes resulting from the proposal are defined, the significance of these changes requires qualitative (subjective) judgements. This assessment's conclusion therefore combines objective measurement and professional interpretation. While this assessment aims to be objective, it is recognised that visual impact assessment can be subjective, and individuals are likely to associate different visual experiences to the study area.
– The assessment is based on the information provided to GHD at the time of writing.
– This assessment does not include landscape and visual effects from lighting.
– The authors of this report have not carried out the site visit as it was conducted by other within GHD.
– Detailed terrain data was unable to be obtained from the Lands and Survey Department, which is a limitation of the assessment.
– Visualisations were conducted by subconsultants OLA of 1270 Fulton Street #3, Brooklyn, New York. These are Artistic Impressions only and do not meet the LVIA technical photomontage standards as set out in *"The Landscape Institute Advice Note 06/19 Visual Representation of Development Proposals".* These artistic impressions are approximate and produced without appropriately accurate geolocation and topography data and therefore should not be relied upon for a LVIA visual impact assessment.

2. Methodology

2.1 Standards and guidance

This LVIA chapter has been prepared within the spirit and intent of the ISWMS Terms Of Reference (TOR) however the methodology slightly deviates from the GLVIA guidance below, due to the visual impact specialists not attending site and artistic impressions being provided using a non-standard methodology:

– *Guidelines for Landscape and Visual Impact Assessment, 3rd Edition (Landscape Institute and Institute of Environmental Management & Assessment, 2013)* ('GLVIA3')

2.2 Study area

The Seascape and Landscape Visual Considerations Report study area (the 'study area') for the Project extends 3 miles (4.8 kilometres [km]) which was rounded up to five km from the ISWMS site boundary, see Figure 1 Study Area.

This study area has been used for the purposes of data collection and the subsequent assessment and has been defined to ensure that the LVIA concentrates upon receptors that are most likely to be significantly affected by the Project. It is derived from a review of the Final EIA Terms of Reference for a Cruise Birthing Terminal that was proposed for George Town[1]. It is considered that the height of the proposed Project is broadly comparable to the height of cruise ships and that the baseline topography will be comparable given both developments are located in western Grand Cayman. The extent of the study area also reflects the assessors' experience of undertaking LVIAs for similar developments.

The study area accords with best practice, as set out in Sections 5.2 and 6.2 in GLVIA3, as well as the principle of proportionality set out in paragraph 3.16: "The level of detail provided should be that which is reasonably required to assess the likely significant effects. It should be appropriate and proportional to the scale and type of development and the type and significance of the landscape and visual effects likely to occur."

[1] Mott Macdonald for the Government of the Cayman Islands (2013). Final EIA Terms of Reference for Cruise Berthing Terminal for the Cayman Islands.

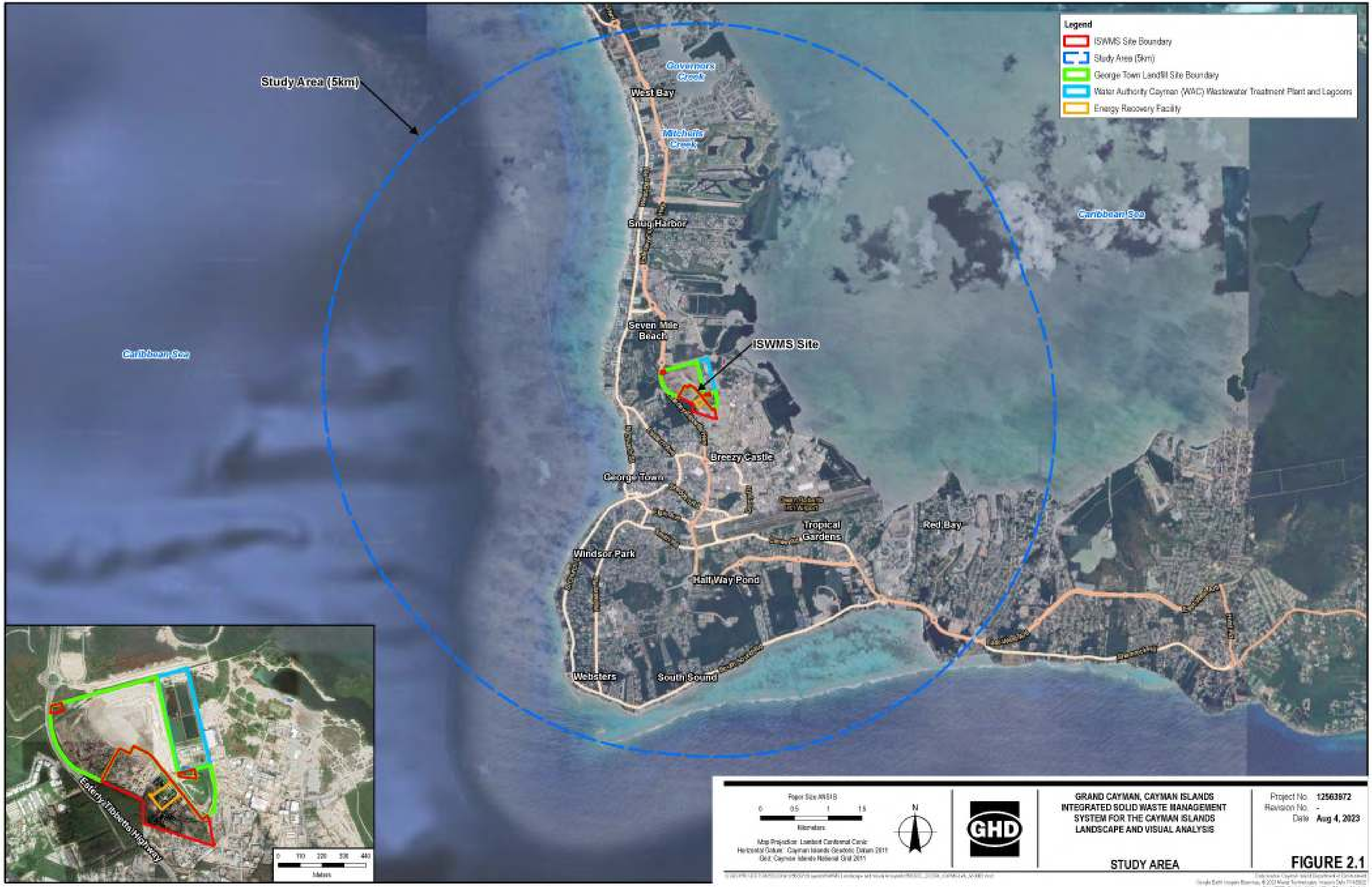


Figure 1 *Study area*

2.3 Existing landscape and visual environment

2.3.1 Review of legislation and policy

A review of key planning designations, policies and guidance was undertaken in relation to landscape and visual amenity within the study area. The emphasis of the review was to identify elements outlined within legislation, policy, and planning documents relevant to landscape and visual character and identity of the study area.

2.3.2 Desktop analysis

Existing data was gathered and reviewed for the Project, including the following landscape and visual resources:

– Project design information and site photographs
– Land use and vegetation maps
– Aerial imagery, Google Earth, and Google Street View

Using this data, a preliminary assessment of the landscape and visual environment was undertaken to inform the site inspection. Due to the data availability constraints, topographical data was unable to be obtained.

2.3.3 Zone of Theoretical Visibility assessment

Zone of theoretical visibility (ZTV) mapping is computer-generated analysis which identifies land from which it is theoretically possible to view the components of the Project.

Separate ZTV maps have not been calculated for the project due to the lack of available terrain data. Based upon desktop studies which emphasise the flat topography of western Grand Cayman, it is highly likely that a ZTV calculated using bare earth digital terrain data would extend across all the land and sea within the study area, due to the low-lying topography and long views.

The proposed ISWMS will potentially be visible as the stack has a height of 48.1 m (158 feet) above ground level (AGL) and will likely be the tallest component in the study area. The ERF has heights of between 37.8 m AGL (124 feet) for the boiler house and 33.4 m AGL (110 feet) for the waste bunker. These are likely to be the tallest and therefore the most visible components within the overall proposed project.

The data gathering methodology has been restricted to a desk study utilising a variety of websites, including:

– Visitcaymanislands.com – identification of principal tourist destinations in western Grand Cayman.
– En.wikipedia.org – general information and details of National Trust properties.
– Academic.emporia.edu – information on geology and topography.
– Brahmsonline.kew.org/cayman – information on geology and vegetation types.
– Camanabay.com – information upon tourist development and associated landscape planting in western Grand Cayman.
– Familyvacationcritic.com – for information on the height and accessibility of the Camana Bay Observation Tower.
– Review of baseline information in Final EIA Terms of Reference for a Cruise Ship Berthing Terminal; and
– Review of aerial photography:
    - Imagery dated 21 November 2018 from Google Earth Pro; and
    - Updated imagery from Bing Maps and Google Maps.

2.3.4 Site inspection

A site inspection was undertaken by GHD staff on 19th of April 2023. The purpose of the inspection was to:

– Inspect the site and appreciate views to / from sensitive visual receivers.

– Inspect publicly accessible locations identified in the desktop study as likely to provide views of the Project.
– Identify sensitive visual receiver locations.
– Assess the landscape character of the study area and identify landscape sensitivities.
– Undertake site photography suitable for viewpoint assessment and artistic impression preparation.

The coordinates of each viewpoint were recorded during the site inspection.

2.3.5 Description of existing seascape, landscape, and visual environment

The description of the existing seascape, landscape and visual environment establishes a baseline against which the project is assessed. An existing conditions assessment was undertaken to determine the existing natural and cultural features within the study area. This includes determination of key seascape, landscape and spatial elements, features, and values. Aspects considered include:

– Land use and built form.
– Landform, topography, and hydrology
– Vegetation
– Views
– Historical features.
– Coastal edge
– Water column depth and qualities
– Seabed geology and form
– Key habitats, features, and species

A visual analysis was also undertaken to establish:

– The key views
– The Projects viewsheds
– Other visual features within the study area

2.4 Assessment

2.4.1 Landscape character zones

Landscape character considers common landscape zones defined by typical features and characteristics identified during the desktop assessment and site inspection. Defining landscape character zones (LCZs) identifies areas sharing the same homogenous environmental or cultural qualities or pattern such as topography, vegetation, hydrology, land use and settlement, built form scale and character, cultural and recreational characteristics.

This approach has been used to establish the existing landscape character within the study area and to provide a framework for measuring the effects of the Project. This assists in:

– Defining landscape elements that contribute to defining character.
– Defining landscape character attributes
– Identifying landscape value.

The assessment of the existing environment also considers factors which have influenced landscape change in the past and those that are likely to do so in the future. The landscape character zones are defined in Section 6.1.

Landscape value

When defining LCZs, the value attached to the landscape also forms the baseline for which the significance of the assessment is measured. Landscape value looks at designated and undesignated landscapes, and holistically at all the elements such as the environmental, cultural, historical, and visual/sensory elements that form the landscape. The value of the landscape from an international, national, local and community level is considered when applying a landscape value. The following factors are taken into consideration (Natural England, Scottish Natural Heritage and Countryside Council, 2011):

– Landscape quality
– Scenic quality
– Rarity
– Representativeness
– Conservation value
– Recreation value
– Perceptual aspects/qualities
– Associations.

Table 1 Landscape value

Landscape value	Definition
High	Seascape character elements in good or above average condition and/or that make a strong positive contribution to landscape character. May include nationally important features.
Medium	Seascape character elements in reasonably good condition and/or that make an average contribution to the local character, which may include locally important landscape features.
Low	Seascape character elements in below average condition and/or that are not particularly distinctive local features.

2.4.1.1 Seascape Character

Seascape character assessment (SCA) has emerged as a method for assessing, characterising, mapping, and describing seascape character. The SCA follows the well-established, process of Landscape Character Assessment (LCA). This is a process of characterising the seascape that currently exists and classifying character areas and types to be used as a baseline for assessment.

Criteria for assessing the value of the landscape and seascape is defined in Section 6.

2.4.2 Landscape character effects

Assessment of landscape effects deal with the effect of change and development on landscape as a resource. The concern is with how the Project would affect the elements that make up the landscape, the aesthetic and perceptual aspects of the landscape and its distinctive character. The consideration of potential effects on landscape character is determined based on the sensitivity of the existing landscape and the magnitude of change that is likely to occur.

The sensitivity and magnitude of landscape effects address the following specific criteria:

– Sensitivity of landscape to proposed change is judged on a combination of the landscape value and the landscape susceptibility to change from the type of development proposed (refer Table 1 and Table 2). A judgement on the level of sensitivity is made and a rating of high, medium, or low applied.
– The magnitude of change to landscape character is based on the size or scale of change, the geographical extent of effects, and the duration and reversibility of effects (refer Table 3). It also depends on the loss, change or addition of any feature to the existing landscape. It is based on the part of the landscape character zone which is likely to be affected to the greatest extent by the Project.

An assessment is made on the overall level of significance in relation to the existing conditions (refer to section 0).

Table 2 Landscape susceptibility to change.

Landscape susceptibility	Definition
High susceptibility to change	The type of development proposed could have a detrimental effect on the landscape character, condition, or value. Mitigation measures are unlikely to reduce the effects of the change.
Medium susceptibility to change	Any change caused by the type of development would be unlikely to have a significant adverse effect on the landscape character, condition or value that could not be mitigated.
Low susceptibility to change	Development of this type is unlikely to have an adverse effect on the landscape character, condition, or value. Mitigation measures would be effective in neutralising adverse effects.

Table 3 Magnitude of change criteria (landscape)

Rating	Criteria
High	A substantial/obvious change to the landscape character due to total loss of, or change to, elements, features, or characteristics of the landscape. Would cause a landscape to be permanently changed and its quality diminished.
Medium	Discernible changes in the landscape character due to partial loss of, or change to elements, features, or characteristics of the landscape, however, has potential to be partly mitigated. The change would be out of scale with the landscape character, and at odds with the local pattern and landform and would leave an adverse effect on the landscape character.
Low	Minor loss or alteration to one or more key landscape character elements, features or characteristics, or the introduction of components that may be new but may not be uncharacteristic within the existing landscape character.
Negligible	Almost imperceptible or no change in the landscape character as there is little or no loss of/or change to the elements, features, or characteristics of the landscape.

2.4.3 Viewpoint selection

Assessment of visual effects deals with the effects of change and development on the views available to people and their visual amenity. It assesses how the surroundings of individuals or groups of people may be specifically affected by changes in the context and character of views as a result of the change or loss of existing elements of the landscape and/or the introduction of new elements.

Visual receivers have been considered in terms of the views they are likely to obtain from within the study area including consideration of any key vantage points, such as lookouts, where there is particular interest in the view. Visual receivers are identified based on:

– Proximity of the receivers to the Project, as the most affected visual receivers are anticipated to be located closest to the Project, unless located at an elevated vantage point.
– Type of receiver, as different viewer types would have different perceptions of the change.

Based on the analysis of the existing landscape and visual environment, viewpoint locations were selected for assessment as representative of sensitive visual receiver locations. To best illustrate the likely visual effects of the Project, where appropriate, viewpoint locations chosen for assessment aim to represent a balance of:

– The most sensitive visual receivers
– A range of visual receiver types
– A range of distances from the Project
– A range of view directions towards the Project within the study area.

2.4.4 Visual assessment

The evaluation of potential effects on visual amenity is based on the sensitivity of the viewpoint (and the visual receiver it represents) to change, and the magnitude of change that is likely to occur. The assessment considers the likely effects of the Project. The level of effects on a view depends on factors such as the extent of visibility, degree of obstruction of existing features, degree of contrast with the existing view, angle of view, duration of view and distance from the Project.

The sensitivity and magnitude of visual effects addresses the following specific criteria:

– The sensitivity of the viewpoint to proposed change considers the importance of the view, its existing scenic qualities, and the presence of other existing man-made elements in the view; type of visual receiver and their likely interest in the view; susceptibility of visual receivers to change, and value attached to views.
– The magnitude of change to views and visual amenity considers the size or scale of change; geographical extent of effects, and duration and reversibility of effects (referTable 5). It also depends on the loss, change or addition of any feature in the field of view of the receiver including an assessment of the level to which the change contrasts with the existing view or expected view of the landscape.

An assessment is made of the overall level of significance in relation to the existing view.

Table 4 Sensitivity criteria (visual)

Rating	Criteria
High	Occupiers of residential properties, at home or going to or from, with long viewing periods, within proximity to the proposed development; Communities that place value upon the landscape and enjoyment of views of their setting.
Medium	Outdoor workers who have a key focus on their work who may also have intermittent views of the study area; Viewers at schools, or similar, when outdoor play and recreation areas are located within proximity but viewing periods are limited; Occupiers of residential properties with long viewing periods, at a distance from or screened from the study area.
Low	Road users in motor vehicles, trains or on transport routes that are passing through or adjacent to the study area and therefore have short term views; Viewers indoor at their place of work, schools or similar.

Table 5 Magnitude of change criteria (visual)

Rating	Criteria
High	A substantial/obvious change to the existing view due to total loss of, or change to, elements, features, or characteristics of the view. Would cause a view to be permanently changed and its quality diminished.
Medium	Discernible changes in the existing view due to partial loss of, or change to elements, features, or characteristics of the view, however, has potential to be partly mitigated. The change would be out of scale with the existing view and would leave an adverse effect on the view.
Low	Minor loss or alteration to one or more key view elements, features or characteristics, or the introduction of components that may be visible but may not be uncharacteristic within the existing view.
Negligible	Almost imperceptible or no change in the view as there is little or no loss of/or change to the elements, features, or characteristics of the view.

2.4.5 Significance of effects

The combination of sensitivity and magnitude determines the significance of the effect on the landscape character or representative viewpoint. Refer to Table 6 for the matrix used to determine the significance of effect.

Table 6 Significance of effect matrix

Sensitivity \ Magnitude of change	High	Medium	Low	Negligible
High	Major (Significant)	Major (Significant)	Moderate (Probably significant)	Minor (Not significant)
Medium	Major (Significant)	Moderate (Probably significant)	Minor (Not significant)	Negligible (Not significant)
Low	Moderate (Probably significant)	Minor (Not significant)	Negligible (Not significant)	Negligible (Not significant)

2.4.6 Panorama and photomontage

Visualisations were conducted by subconsultants OLA of 1270 Fulton Street #3, Brooklyn, New York.

These are Artistic Impressions only and do not meet the LVIA technical photomontage standards as set out in *"The Landscape Institute Advice Note 06/19 Visual Representation of Development Proposals".*

The photographic methodology was non-standard and therefore the visualisations non-compliant with the internationally recognised standard of *LI TGN-06-19 Visual Representation, as specified in the TOR*.

The photo data did not have GPS capability embedded, the focal length was variable, the ground pictures are taken with a Nikon D810 with a Nikon 24-70 Lens. Tripod use is unknown, height above ground is unknown.

The Artistic impressions were conducted using the following methodology from the subcontractor OLA:

"The 3D modelling was carried out using Rhino software. The camera lens length was matched to the model view with the camera view, by matching roads in the model with the road angles in the view. We used Rhino to overlay the photo with the model. However, note that 3D or 2D drawings in Rhino never exactly match what is built or existing."

It should be noted that Rhino is a non-compliant software for producing LVIA technical photomontages.

These artistic impressions are approximate and produced without appropriately accurate geolocation and topography data and therefore should not be relied upon for a LVIA visual impact assessment.

2.5 Mitigation measures

Mitigation measures were developed in response to the effects identified within Section 6 and Section 0. Potential mitigation measures would typically include:

– Adopting alternative designs or revisions to the basic engineering and architectural design to prevent and/or minimise negative effects.
– Remedial measures such as colour and textural treatment of structural features.
– Compensatory measures such as landscape design to compensate for unavoidable negative effects and to attempt to generate long-term positive effects.

3. Project description

The following section provides a summary of the Project and includes the detail relating to the main visual components that have potential to affect the landscape character and visual amenity of the study area.

3.1 The Project site

The Project site covers approximately 30 acres (12.4 hectares (ha)) of land that is partially vacant and undeveloped on the eastern side of the west peninsula of Grand Cayman. The site has been disturbed by previous activities (including landfill) and consequently it contains no naturally occurring features. In common with large parts of Grand Cayman, the Project site has a ground level height that is only a few metres above sea level as a result of the geology of low-lying limestone and dolostone rocks.

3.2 The Project

The Project is located on the northern edge of George Town in an area that is zoned ‘Heavy Industrial’ (HI). It is bounded to the east and south by other HI land-uses comprising a mixture of vacant lots and small-scale industrial businesses such as marine fitters, metal workers and processing of quarried stone. Areas of hardstanding are interspersed with areas of rough grass and patches of scrub vegetation. Immediately north of the site lies George Town Landfill (GTLF). To the west is an area of mangrove and the Esterly Tibbetts Highway, and to the northeast is the Cayman Islands wastewater treatment plant.

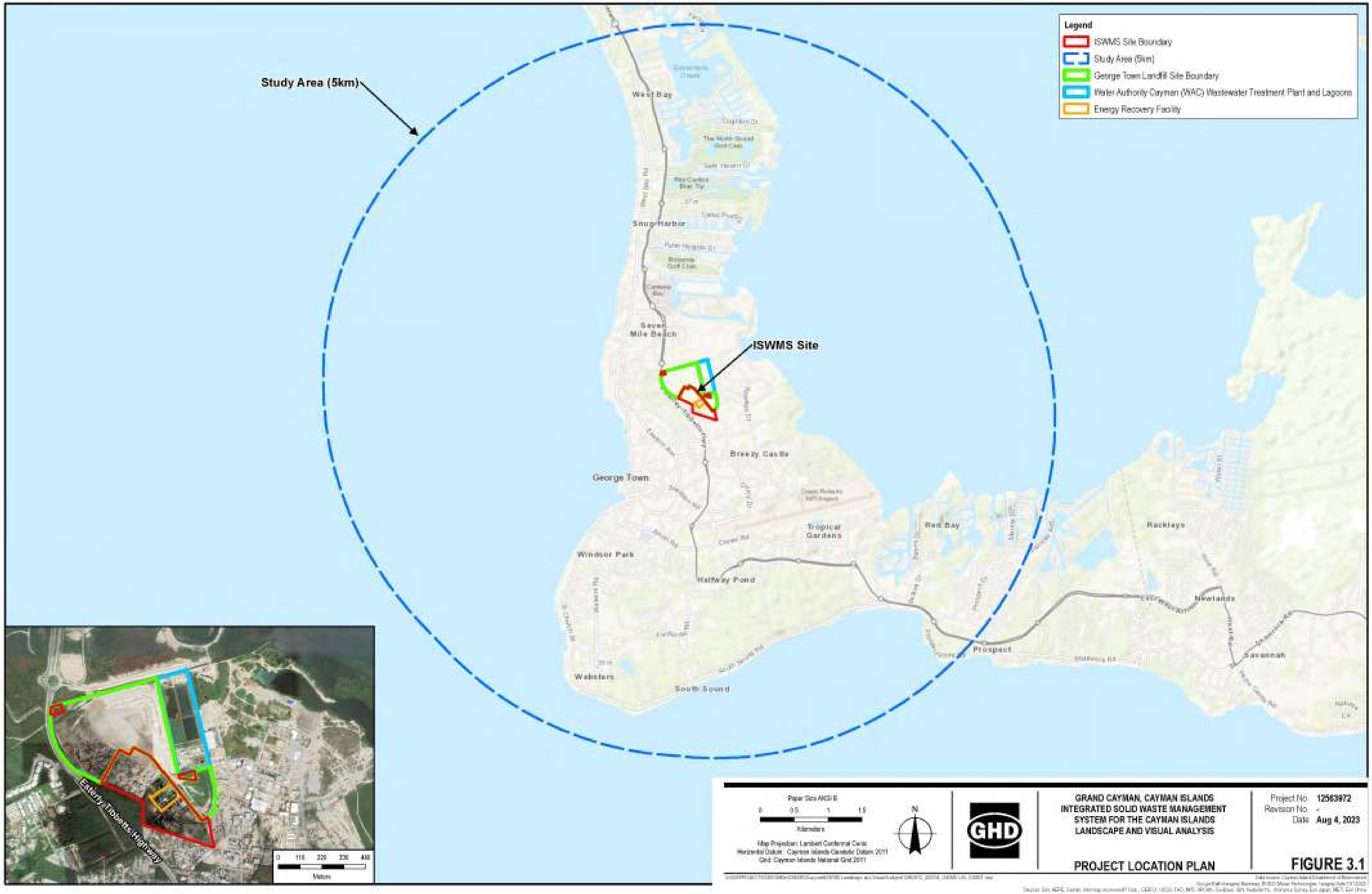


Figure 2 The project site

4. Legislation and policy

The following section provides an overview of relevant legislation and policy objectives relevant to landscape and visual considerations within the study area.

4.1 State legislation and framework

Land use planning, including zoning and development control, is governed primarily by local environmental plans (LEPs). LEPs include lists of local heritage items and local heritage precincts and provide controls on development which may affect those items or be located in those precincts. The study area for the project is within the Local Government Area (LGA) of Grand Cayman. The relevant LEPs for this Council area were reviewed for the purpose of preparing this report.

4.1.1 Cayman Islands Constitution Order, 2009

The Cayman Islands Constitution Order of 2009 was developed in order to establish the powers and activities of the legislative, executive, and judicial branches of government, as well as the rights of all citizens. Section 18 of this Constitution provides the basis for the legal protection of the environment, and states the following:

> *Government shall, in all its decisions, have due regard to the need to foster and protect an environment that is not harmful to the health or well-being of present and future generations, while promoting justifiable economic and social development.*
>
> *To this end government should adopt reasonable legislative and other measures to protect the heritage and wildlife and the land and sea biodiversity of the Cayman Islands that –*
>
> *(a) limit pollution and ecological degradation.*
>
> *(b) promote conservation and biodiversity; and*
>
> *(c) secure ecologically sustainable development and use of natural resources.*

4.1.2 Cultural and Natural Heritage Sites

Cultural and Natural Heritage sites are important resources on Grand Cayman. These heritage site resources include both designated features protected by legislation and features of national or local archaeological, historical, or architectural interest. Based on the type and location of the proposed project the studies for the EIA will focus on terrestrial heritage resources within the project study area.

Heritage site resources are identified and/or protected under the following legislation:

– National Conservation Act (2013) – Under Part 3 - Conservation of Land, the Cabinet may designate any area of Crown Land or Cayman waters as a “protected area”.

– National Trust Act (2010) – National Trust for the Cayman Islands (NTCI) ownership or management of specific sites – Allows the NTCI to protect those sites from offences “for actions which could harm Trust property or otherwise contravene the purposes of the Trust.”[2].

– Heritage Register (2010) – Records the Islands’ “natural, historic and cultural resources which are recognised and designated by the Council of the National Trust as being nationally significant and worthy of preservation.”

[2] Bullings, K., Cayman Islands; National Trust for the Cayman Islands. NATIONAL TRUST LAW (2010 Revision). 2010, October 19

Entries are predominantly historic homes, civic and religious structures. Listing on the Heritage Register does not afford individual sites legal protection.

– Public Lands Act (2020) – Regulates the use of public land in the public interest.

4.2 Local legislation and policy

4.2.1 Planning policy

Planning policy is set out by the Cayman Islands Government Central Planning Authority (CPA) and approved by Parliament. The LVIA will consider planning policy which is relevant to the proposed development as summarised in the Development Plan 1997 (being the plan for zoning and physical development of the Cayman Islands).

Extant policy in the Development Plan 1997 is also presently under review. In November 2018, the CPA published, for consultation, a new draft National Planning Framework. As this new policy emerges, the LVIA will, as appropriate, take cognisance of this evolving, new policy.

Building height restrictions

Height restrictions aren't specified within the Industrial zone; however, it is anticipated that the ERF will exceed the height of the surrounding built form. The Development and Planning Regulations (Development and Planning Act 2021) Regulation 8.2 stipulates *a maximum permitted height of the building shall not exceed:*

- *one hundred and thirty feet* (39.6 m) *or ten storeys, in Hotel/Tourism zone 1:*
- *ninety-one feet* (27.74 m) *or seven storeys, within a General Commercial zone;*
- *sixty-five feet* (19.8 m) *or five storeys or for Hotel/Tourism zone;*
- *forty feet* (12.2 m) *or three storeys in a high-density Residential zone, and the building shall be so designed that no continuous vertical facade or elevation exceeds twenty-five feet or two storeys in height.*

A review of current planning requirements for maximum heights and compliance of the stack of 48.1 m, the ERF boiler house of 37.8 m and ERF waste bunker of 33.4 m will be included in Chapter 4.

Scenic Shoreline

The Development and Planning Regulations (Development and Planning Act 2021) Regulation 20 - Scenic shoreline, stipulates:

– *It is the duty of the Authority to ensure that the open character of scenic shoreline land is preserved, in particular that of the beaches, and also to safeguard the public's right to use the beaches and to gain access to them through public rights of way.*

4.2.2 Waste management policy

Waste management policy for the Cayman Islands is set out in the following key documents:

National Solid Waste Management Policy for the Cayman Islands (August 2015); and

National Solid Waste Management Strategy for Cayman Islands (2016); and the associated Integrated Solid Waste Management System for the Cayman Islands – Outline Business Case (2016).

5. Existing landscape and visual environment

The following section provides a summary of the existing landscape and visual environment of the study area.

5.1.1 Land use and built form

The proposed site is situated within an area of mixed low-density residential neighbourhoods with single-family homes and high-density commercial areas with multi-story buildings. The green spaces within the area are predominantly mangrove forest and woodlands. The immediate surroundings of the proposed site are zoned for industrial or commercial use and feature warehouses, factories, and storage yards.

The landscape of George Town Centre is predominantly characterised by high-density commercial development, including tall buildings, while West Bay Road is the main tourist drive through the tourist district. The ruins of an 18th-century fort and historical architecture, such as the George Town Library and Town Hall, add to the town centre's unique character. Contemporary Caymanian architecture is also present, such as The Harquail Theatre and The Paseo in Camana Bay.

As one moves further away from the city centre, the built form becomes less dense, with lower-rise buildings and more open green spaces. The periphery of the study area is dominated by automotive repair, bodyworks shops and concrete batching plants.

The human programming of the area caters towards tourists and their use of the linear beaches bordering the extent of the study area. Access to recreational green spaces is limited, with small pockets of accessible green areas such as Airport Park and Dart family park. Other facilities within the area include the Truman Bodden Sports Complex, the University of the Cayman Islands, and Grand Cayman's Hospital.

5.1.2 Topography and hydrology

The study area is defined by its unique topography and hydrology. A large bay and beach on the West side punctuates the flat terrain. The Ironshore geological formation primarily characterises the area, and the most significant feature is the North Sound Lagoon, located on the eastern side of the study area. It is a reef-protected lagoon covering approximately 34.75 square miles (90 square km), of which the study area covers about half. The lagoons foreshore is characterised by shallow coral reefs and pockets of established mangrove vegetation.

The topography in the northeast regions of the study area has undergone significant modifications due to the island's evolving landscape and changing land use patterns. Canals and channels have been cut through the island to convert mangrove areas to residential waterfront properties.

5.1.3 Vegetation

The study area's vegetation on the west side is comprises a mix of modified and remnant habitats. The flat topography is scattered with sparse clusters of palm trees amongst the existing mixed species and mangrove vegetation. With single palm trees and other tree species used to line the tourist drive along West Bay Road.

The study area's eastern and southern sides are dominated by remnant low-lying coastal mangroves and sedge vegetation, which serve a dual purpose of tidal and flood mitigation while providing essential habitat for local fauna. Palm trees can be spotted growing amidst the mature mangrove vegetation.

The North Sound lagoon on the zone's eastern side is the island's most significant protected bay. Its fringing mangroves, and seagrass beds serve as critical breeding and nursery habitats for marine fauna. The underwater topography beyond the fringing reef of North Sound Lagoon is characterised by two well-developed spur-and-groove terraces: a shallow terrace reaching a depth of nine meters and a deeper one at fifteen meters. The vegetation and topography of the study area create a unique and valuable ecosystem that needs to be protected and conserved.

5.1.4 Key visual features

Based on the desktop review and site inspection, the key visual features in the study area were identified as:

- Views along the coast from West Bay Road's linear tourist drive are a significant visual feature of the district.
- The observation tower at Camana Bay is a striking visual landmark that attracts many tourists and provides elevated views out across the island and coast.
- The ruins of the 18th-century fort on Harbour Drive and Fort Street add historical interest to the streetscape.
- The mix of historic and contemporary architecture includes the George Town Library, Town Hall, The Harquail Theatre, and The Paseo in Camana Bay.
- Caymanian style of zinc-roofed, pastel-painted, wood-boarded cabins with louvred shutters and fretworked porch.
- The new developments in the northern zone, featuring colonial-style masonry buildings and other residential communities, add to the visual landscape.
- The Truman Bodden Sports Complex, The University of the Cayman Islands, Grand Cayman's Hospital, the Government Administration Building, and the National Art Gallery add modern architectural elements to the landscape.
- The unusual high point of George Town land fill is also a significant visual feature of the local area.

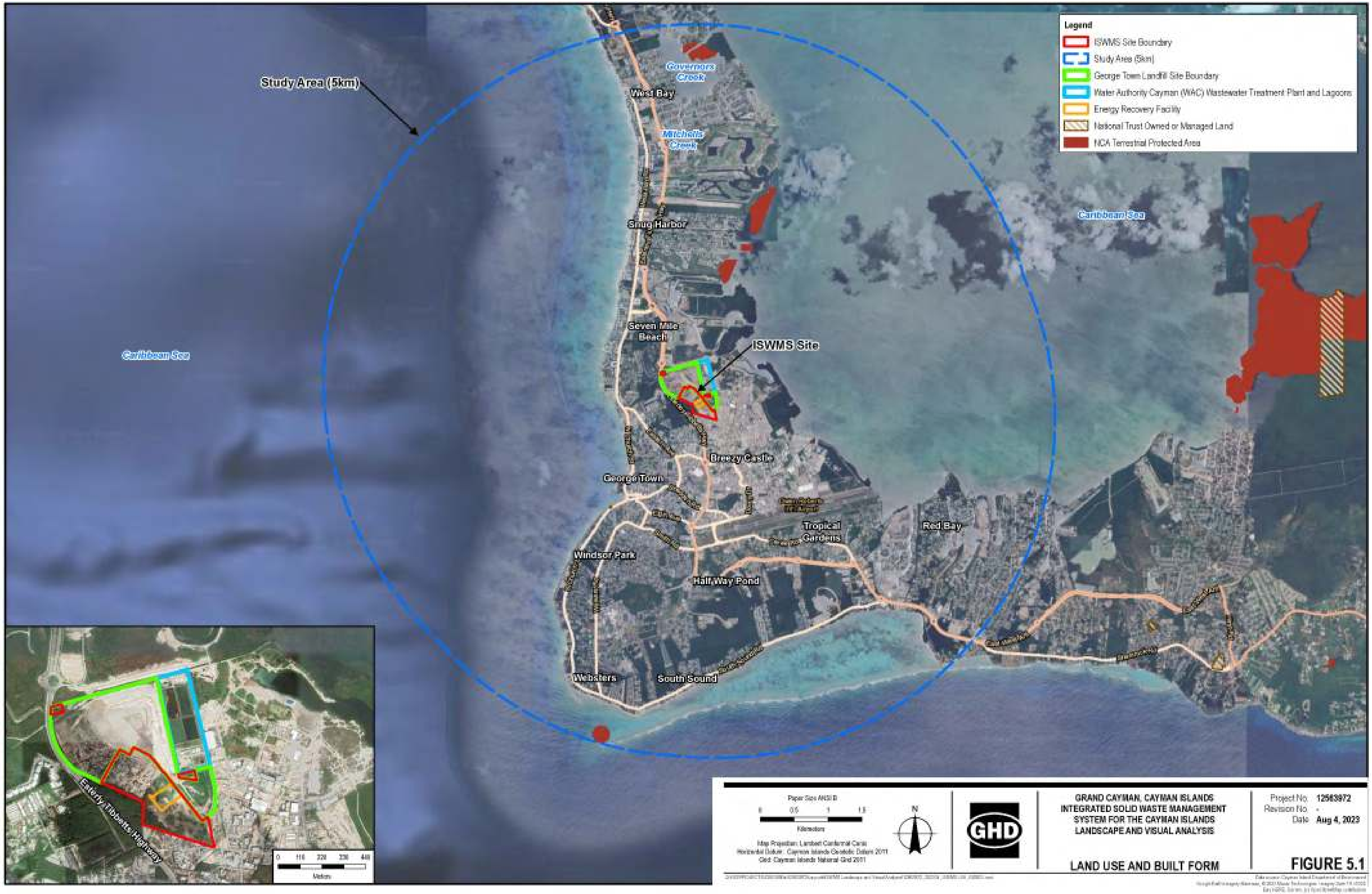


Figure 3 *Existing land use*

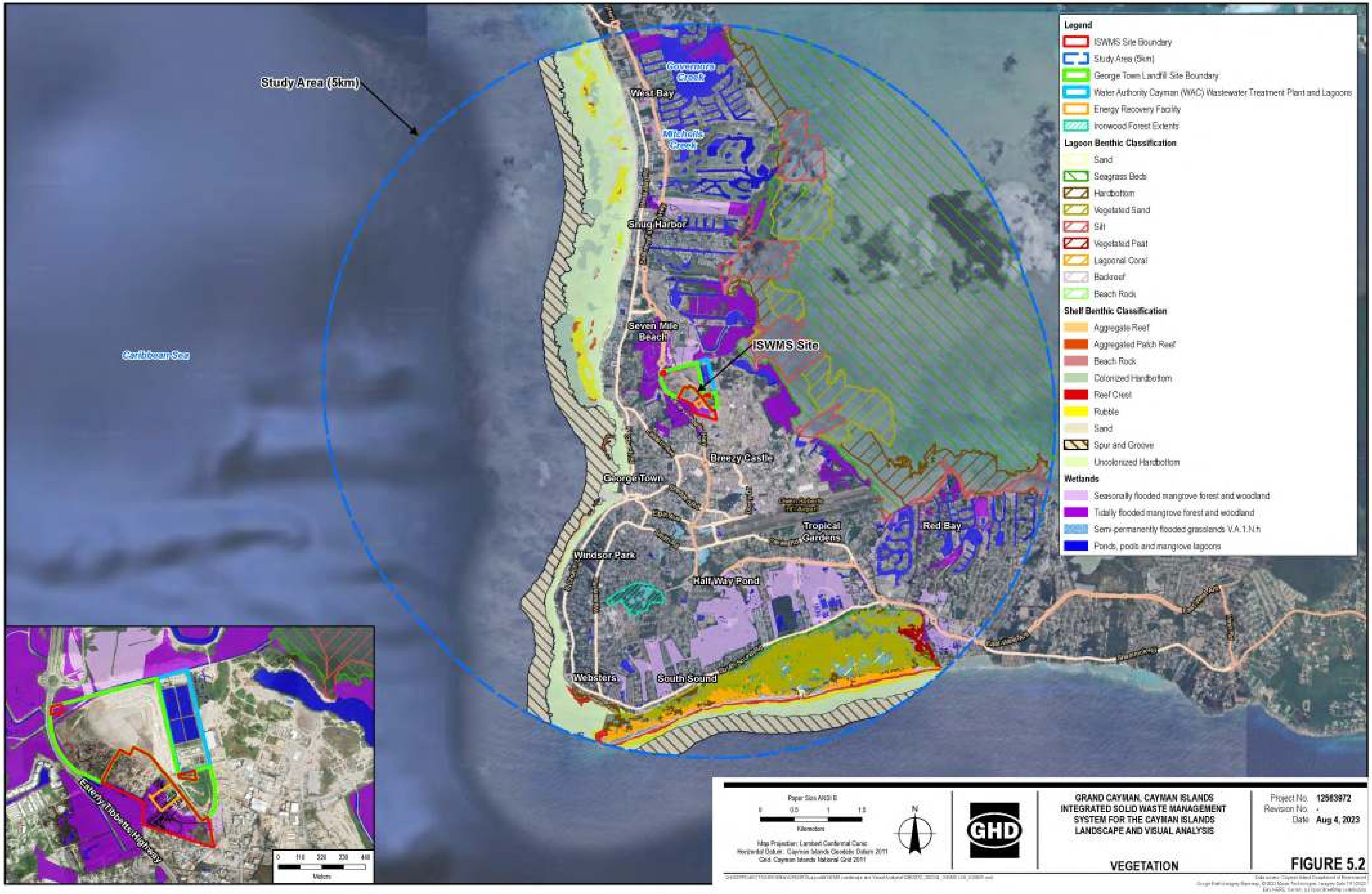


Figure 4 Vegetation

6. Landscape and seascape character assessment

The study area has been classified into five LCZs and SCZs.

These LCZs and SCZs have different associated sensitivities to potential changes as a result of the Project. The sensitivities are discussed below and have informed the assessment. Figure 5, and are as follows:

LCZ1: Tourism foreshore and George Town centre

LCZ2: Industrial, waste and airport

LCZ3: Residential settlement

SCZ4: Mangroves and recreation

SCZ5: Caribbean Sea and North Sound Lagoon

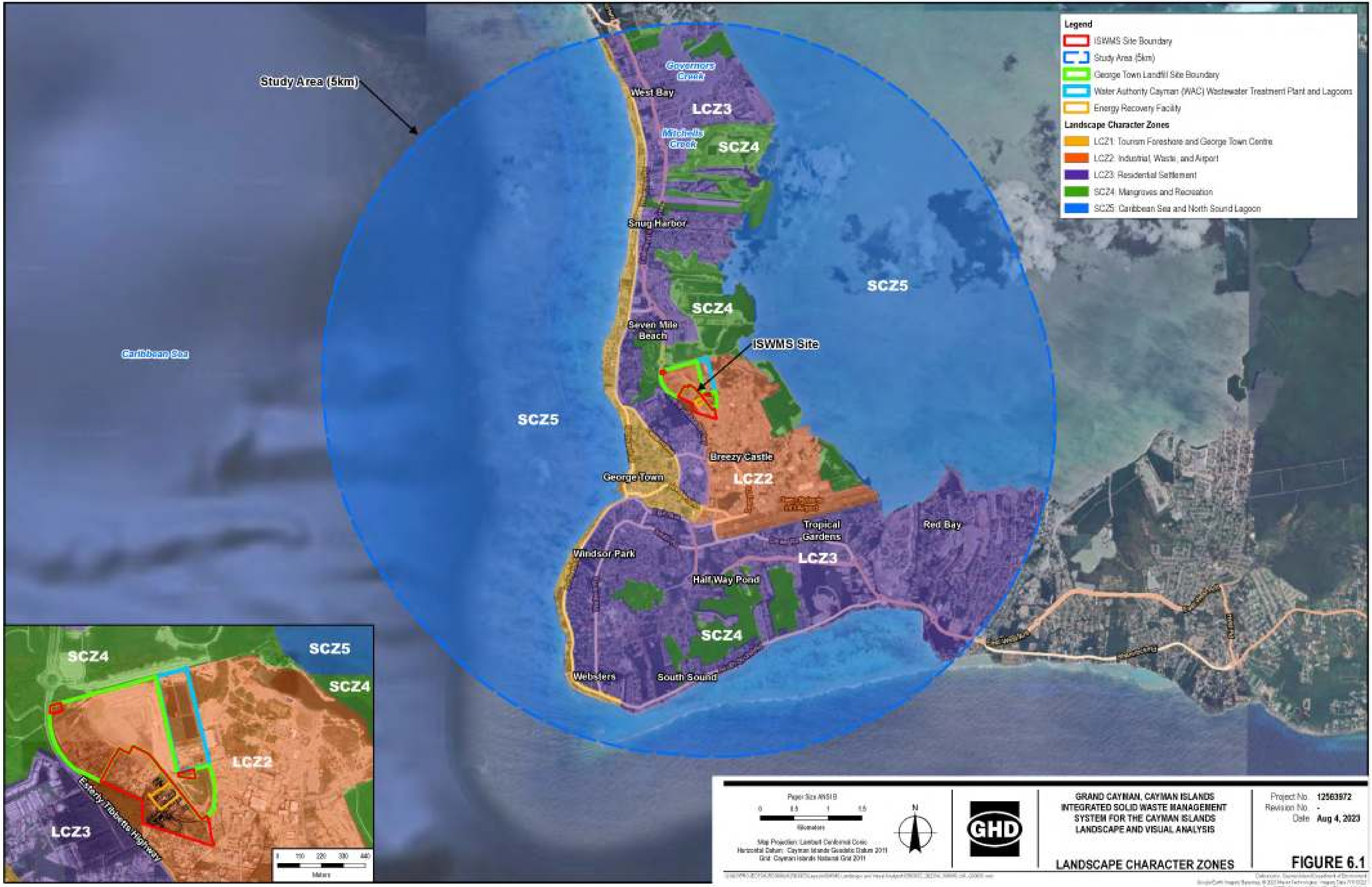


Figure 5 *Landscape character zones*

6.1 Landscape character zones

6.1.1 Landscape character zone 1: Tourism foreshore and George Town centre

The key features of LCZ1 are described below and illustrated in Photo 6.1 to

Photo ***6.6***. The LCZ1 assessment is outlined in Table 7.

Photo 6.1 View from South Church street looking west

Photo 6.2 View from Governors Beach looking north east

Photo 6.3 View from within Galleria Plaza looking west

Photo 6.4 South Church Street looking west towards Smiths Barcadere

Photo 6.5 View from Governors Beach looking north

Photo 6.6 View into George Town

Summary of LCZ 1

LCZ1 is a designated tourism industry zone with a concentration of tourism activities along the western coastal area. The site's topography is relatively flat, with a foreshore characterised by shallow coral reefs and beaches lined with palm trees and other tree species which provide a scenic backdrop for the linear tourist drive along West Bay Road. The streets' edges feature a mix of hotel buildings with direct beach access interspersed with popular tourist destinations such as eateries, fishing spots, cabana bars, and restaurants, which buffer the land and sea with the cruise ship docking points located just offshore.

George Town Centre, the bustling hub of Grand Cayman Island, is steeped in history, and remnants of the island's past are visible throughout. The Cayman Islands National Museum provides a glimpse into the island's rich heritage, with the building being one of the few surviving nineteenth-century structures on the Islands. Old launching ramp sites of the schooners cut into the bedrock around George Town still exist, while throughout the town centre, a mix of contemporary and historical architecture can be seen. The Paseo in Camana Bay offers a new urbanism development style featuring modern architecture and is home to popular tourist attractions.

Key characteristics of LCZ1 include the following:

– West Bay Road is the main tourist drive and runs through the tourist district.
– The observation tower is a popular tourist attraction in Camana Bay.
– George Town cruise port is a vital link for docking cruise ships.
– Ruins of an 18th-century fort on the corner of Harbour Drive and Fort Street stand as a testament to the island's past.
– The city's historical architecture includes buildings such as the George Town Library and Town Hall.
– Contemporary Caymanian architecture includes buildings such as The Harquail Theatre, the Government Administration Building, and The Paseo in Camana Bay.

Values associated with LCZ1 include:

– The zone is designated for tourism industry with a concentration of tourist activities along the western coastal area, which features beaches and palm trees that provide a backdrop for the linear tourist drive along West Bay Road.
– The George Town Centre is steeped in history, with remnants of the island's past visible throughout. The city features historical architecture, such as the ruins of an 18th-century fort, the George Town Library built-in 1939, and the Peace Memorial Town Hall built-in 1919.
– The Harquail Theatre and The Paseo in Camana Bay offer a new urbanism development style, featuring modern architecture.
– The area is home to popular tourist destinations such as eateries, fishing spots, cabana bars, and restaurants that offer a glimpse into the Caymanian culture.
– The George Town cruise port is a vital link for docking cruise ships, and the Cayman Islands National Museum provides a glimpse into the island's rich heritage, making it a hub for connectivity and cultural exchange.

Character elements make a strong contribution to the local character, including locally important landscape features. LCZ1 therefore has a **High** landscape value.

Table 7 LCZ1 assessment

Landscape character zone 1: Tourism foreshore and George Town centre	
Anticipated change to landscape character	The Project site is not in LCZ1. The anticipated change to the landscape character of LCZ1 would be indirect and relate to the modifications of the landscape character in LCZ2. The more prominent elements include a 48.1-metre-high ventilation stack and an enclosed processing facility at heights of between 37.8 m for the boiler house and 33.4 m for the waste bunker. These are likely to be the tallest and, therefore, the most visible components of the Project, but at and minimum distance of approximately one kilometre from the Project sight, the building height will be mitigated by the existing landscape, with the top of the stack being the most prominent element viewable at various locations throughout LCZ1.
Susceptibility to change	LCZ1 has a **Medium** susceptibility to change. The character is of high value to the tourism industry, which is a large part of the islands economy, any change caused by the type of development would be unlikely to have a significant adverse effect on the landscape character, condition or value that could not be mitigated.
Sensitivity to change	The sensitivity of a landscape is judged on a combination of the landscape value and the landscape's susceptibility to change from the type of proposed development. The sensitivity would be **Medium**, as the landscape value is High and the susceptibility to change is Medium.
Magnitude of change	The magnitude of change would be **Negligible**. There is no change in the landscape character as there is little or no change to the elements, features, or characteristics of the landscape.
Significance of effect	The significance of effect would be **Negligible**, as the sensitivity is **Medium** and the magnitude is **Negligible**.

6.1.2 Landscape character zone 2: Industrial, waste and airport

The key features of LCZ2 are described below and illustrated in Photo 6.7 to Photo 6.12. The LCZ2 assessment is outlined in Table 8.

Photo 6.7 Seymour Road looking toward Supermix in a southwest direction

Photo 6.8 Sleepy Hollow drive looking north

Photo 6.9 Seymour Road looking northwest

Photo 6.10 Taken at Central Laundry looking west towards proposal site which is visible in background

Photo 6.11 Sparkys Drive looking west

Photo 6.12 View of airport taken at Crewe Road and Desmond Drive

Summary of LCZ 2

LCZ2 is a designated area for industrial and waste industries as well as the Owen Roberts International airport located primarily to the east and south of the Project site. The zone's flat topography is characterised by industrial buildings and warehouses, which vary from automotive to construction. Two of the island's authorities are located within this zone. While there are some smaller undeveloped green sites. Owen Roberts International Airport is about 1.86 miles (3 km) southeast of the George Town centre on the southern side of North Sound Lagoon. The roads in the zone are a mix of sealed and unsealed roads, with some space undergoing redevelopment for industrial businesses. Overall, the area is dominated by large industrial buildings and warehouses, creating an industrial landscape.

Key characteristics of LCZ2 include the following:

– Automotive repair and bodyworks shops along with concrete batching plants form a considerable proportion of agency within the zone.
– Water Authority for the island and the Cayman Islands Aviation Authority are located here.
– Comprises sparse inclusions of mixed species vegetation.

Values associated with LCZ2 include:

– LCZ2 plays a vital role in the local economy as a hub for various industries, including automotive shops, cement and concrete refineries, and waste management.
– The zone houses essential infrastructure like the Water Authority and Cayman Islands Aviation Authority, which are crucial for supporting the island's population and industries.
– The industrial businesses within LCZ2 provide job opportunities for the local community and contribute to the island's economic growth.
– Despite being an industrial zone, LCZ2 has some undeveloped green sites that provide ecological benefits like carbon sequestration and habitat for wildlife.
– While not explicitly mentioned in the statement, the history and cultural significance of industrial activities on the island can be considered a value associated with LCZ2.

LCZ2 has a **Low** landscape value rating as the landscape character elements are in below-average condition and are not particularly distinctive local features.

Table 8 LCZ2 assessment

Landscape character zone 2: Industrial, Waste and airport	
Anticipated change to landscape character	The Project is located within LCZ2, and while it fits within the function of the designated zone, the height of the facility and its components will be almost three times higher than any other building within this zone, the ventilation stack being the tallest structure on the island.
Susceptibility to change	The Project is located within the industrial zone and on land which has been disturbed by previous waste management activities. Consequently, there are no sensitive landscape elements which could be significantly affected by the construction or operation of the proposed development it therefore has a **Low** susceptibility to change based on any change caused by the type of development would be unlikely to have a significant adverse effect on the landscape character, condition or value that could not be mitigated.
Sensitivity to change	The sensitivity of a landscape is judged on a combination of the landscape value and the landscape's susceptibility to change from the type of proposed development. The sensitivity would be **Low**, as the landscape value is Low and the susceptibility to change is Low.
Magnitude of change	Due to the height of the prosed design with the associated stack being the highest component and therefore being the highest point on the island the magnitude of change would be **High** as the type of development proposed could have a detrimental effect on the landscape character, condition, or value. Mitigation measures are unlikely to reduce the effects of the change due to the height of the associated buildings (37.8 m and 33.4 m) and ventilation stack (48.1 m).
Significance of effects	The significance of effects would be **Moderate**, as the sensitivity is Low, and the magnitude is High.

6.1.3 Landscape character zone 3: Residential settlement

The key features of LCZ3 are described below and illustrated in Photo 6.13 to Photo 6.18. The assessment is outlined in Table 9 .

Photo 6.15 North side of Keturah Street looking south.

Photo 6.16 East side of Sorrel Drive looking south west.

Photo 6.14 South side of Selkirk Drive looking west.

Photo 6.17 South side of Crewe Road looking north.

Photo 6.13 East side of Abbey Way looking west.

Photo 6.18 West side of Canal Lane looking north east.

Summary of LCZ3

LCZ3 is a mix of low to medium-height buildings and single-family homes - each showcasing unique Caymanian-style architecture from the 19th century. Modern homes have replaced wood with masonry while incorporating a pastel colour scheme. Picturesque palm trees are scattered throughout, sometimes in clusters and occasionally alone. Residential areas are sometimes uniform, while others have winding roads and cul-de-sacs. The northern portion of the zone has new residential developments and numerous community facilities and churches. Large green spaces are scattered throughout the zone.

Key characteristics of LCZ3 include the following:

– Unique Caymanian style of zinc-roofed, pastel-painted, wood-boarded cabins with louvred shutters and fretworked porch.
– New developments underway at the northern portion of the zone, featuring colonial-style masonry buildings and gated communities.
– Location of the Truman Bodden Sports Complex, the leading sports arena of the island.
– Other facilities include the University of the Cayman Islands, Grand Cayman's Hospital, and the National Art Gallery.
– Numerous churches represent the Cayman Islands' religious context.

Values associated with LCZ3 include:

– Unique blend of traditional and contemporary Caymanian architecture, including zinc-roofed, pastel-painted, wood-boarded cabins with louvred shutters and fretworked porches, and masonry buildings with pastel colour schemes.
– The presence of palm trees adds to the residential Zone's picturesque allure
– Residential facilities are abundant, including the Truman Bodden Sports Complex, The National Art Gallery and numerous churches that represent the religious context of the Cayman Islands.
– Educational and Healthcare Values: Several schools such as the University of the Cayman Islands, St. Ignatius High School, and Cayman Prep & High School, and The Grand Cayman's Hospital are located in the area.

As the environmental, recreational, and educational landscape values make a strong contribution to the local character, LCZ3 has a **High** landscape value rating.

Table 9 LCZ3 assessment

Landscape character zone 3: Residential settlement	
Anticipated change to landscape character	The Project is situated beyond LCZ3, and the expected effect on the landscape will vary based on how close residential areas are to it. The ventilation stack is the most noticeable feature, and any efforts to reduce its effect will have a minor effect due to its height. Depending on their location, residents may be able to see the top of the stack from their homes.
Susceptibility to change	The susceptibility to change for LCZ3 is **Medium**, this is due to the height of the ventilation stack exceeding that of any vegetation found in this or any other LCZ. The change caused by the proposed development would be likely to have an adverse effect on the landscape character, condition, or value, that could not be mitigated.
Sensitivity to change	The sensitivity of a landscape is judged on a combination of the landscape value and the landscape's susceptibility to change from the type of proposed development. The sensitivity would be **High**, as the landscape value is High and the susceptibility to change is Moderate.
Magnitude of change	Based on the height of the Project's buildings and ventilation stack, the magnitude of change for LCZ3 would be **Negligible.** With discernible changes in the landscape character due to partial loss of, or change to elements, features, or characteristics of the landscape, however, has potential to be partly mitigated by the current vegetation that would help obscure these elements of the Project from a distance. The change would be out of scale with the landscape character, and at odds with the local pattern and landform and would leave an adverse effect on the landscape character. Based on the Project being located in LCZ2, there would be no change to the landscape character of LCZ3. Therefore, the magnitude of change would be **Negligible**.
Significance of effect	The significance of effect would be **Minor**, as the Project is not in this landscape character zone.

6.1.4 Seascape character zone 4: Mangroves and recreation

The key features of LCZ 4 are described below and illustrated in Photo 6.19 to Photo 6.22. The SCZ4 assessment is outlined in Table 10.

Photo 6.20 North Sound Gated Community looking east

Photo 6.21 Pinehurst Road Looking east

Photo 6.19 North of Blue Lagoon Drive

Photo 6.22 East side of Safehaven Drive looking east

Summary of SCZ4

SCZ4 is defined by the remnant low-lying coastal mangroves and sedge vegetation dominating the study area's eastern and southern sides. These areas serve a dual purpose of tidal and flood mitigation while providing essential habitat for local fauna. Palm trees can be spotted growing amidst the mature mangrove vegetation. The vegetation has undergone modifications as the island has evolved, and the agency across the landscape has changed. The eastern areas have undergone significant changes, with channels and canals being cut through through the island to convert mangrove areas to residential waterfront properties.

The recreation aspects of this zone are characterised by heavily modified landscapes that serve as golf courses set on the borders of new residential developments set on a canal network, with all other recreational agencies taking place on the beach fronts of the island.

Key characteristics of SCZ4 include the following:

– Small pockets of public green areas, such as Airport Park and Dart family park.
– The public recreational agency taking place is on the beach fronts of the island.
– Private (Golf) recreational activities are undertaken in the golf courses.
– Vegetation has undergone modifications.

Values associated with SCZ4 include:

– The unique and important role of the remnant low-lying coastal mangroves and sedge vegetation in tidal and flood mitigation, as well as their essential habitat for local fauna.

– The presence of palm trees growing within the mature mangrove vegetation, adding to the area's biodiversity and visual appeal.
– The history of modifications and changes to the landscape as the island has evolved and the agency across the landscape has changed.
– The blending of recreation aspects with heavily modified landscapes such as golf courses, which are still in harmony with the natural surroundings.
– The existence of small accessible green spaces such as Airport Park and Dart family park, providing pockets of nature for public enjoyment.
– The prominence of beach fronts as the main recreational area on the island.

As the ecological and cultural landscape values make a strong contribution to the local character and overall character of Grand Cayman, SCZ4 has a **High** landscape value rating.

Table 10 SCZ 4 assessment

Landscape character zone 4: Mangroves and recreation	
Anticipated change to landscape character	The Project is not located within SCZ4. The approximate distance from the Project is a minimum of two kilometres. At this distance, the anticipated change to view would be negligible; this is due to the height of the stack that would be visible but due to the distance, it would appear blurry and distant, the existing vegetation and buildings that occur between the various locations throughout SCZ4 would also mitigate any significant change to the over character immediately discernible within the zone.
Susceptibility to change	With the Project site being approximately at a minimum two kilometres away in combination with the height of the Project from this distance, the susceptibility of change would be **Low** as the development of this type is unlikely to have an adverse effect on the landscape character, condition, or value. Mitigation measures would be effective in neutralising adverse effects.
Sensitivity to change	The sensitivity of a landscape is judged on a combination of the landscape value and the landscape's susceptibility to change from the type of proposed development. The sensitivity would be **Medium**, as the landscape value is **High** and the susceptibility to change is **Low**.
Magnitude of change	As the Project site not located within this zone, the magnitude of change would be **Negligible**; this is because there is almost imperceptible or no change in the landscape character as there is little or no loss of/or change to the elements, features, or characteristics of the landscape.
Significance of effect	The significance of effect would be **Negligible**, as the sensitivity is Medium and the magnitude is Negligible.

6.1.5 Seascape character zone 5: Caribbean Sea and North Sound Lagoon

The key features of SCZ 5 are described below and illustrated in Photo 6.23 to Photo 6.26. The SCZ5 assessment is outlined in Table 11.

Photo 6.23 View from shore toward cruise ship docking point in the Caribbean Sea

Photo 6.24 View from Governors beach out into Caribbean Sea

Photo 6.25 Coast of Blue Lagoon Drive looking northeast into North Sound Lagoon

Photo 6.26 Sorrel Drive looking east into North Sound Lagoon

Summary of SCZ 5

The Seascape Character Zone 5 (SCZ 5) consists of two distinct seascapes that encircle the project site on its eastern and western sides.

Contrasting the eastern seascape is the western seascape, a popular tourist destination catering to the needs of tourists and residents. The deeper sea sections serve as multiple anchor points for cruise ships that are a significant part of the economy of Grand Cayman. This seascape drives the beach topology that the hotels and tourist attractions rely on and creates the buffer zone between land and sea. Key characteristics of SCZ5 include the following:

– 60% of the North Sound Lagoon is covered by well-developed beds of *Thallassia testudinum* (Turtle Grass).
– The North Sound lagoon (eastern side) is a semi-enclosed, shallow lagoon spanning 85 km^2 and historically surrounded by mangrove swamps and fringed by an exposed acroporidae reef.
– Designated onshore fishing spaces, coral reefs, and sunken shipwrecks for recreational snorkelling and diving.
– The deeper sea sections of the Western seascape serve as anchor points for cruise ships, a significant part of the Grand Cayman economy.

Values associated with SCZ5 include:

– Ecological importance: The North Sound lagoon serves as critical breeding and nursery habitat for marine fauna, and the fringing mangroves and seagrass beds are vital for the ecosystem.
– Recreational opportunities: The western seascape offers recreational activities such as snorkelling, diving, and onshore fishing.
– Economic significance: The western seascape is a popular tourist destination and a significant source of income for the island through cruise ships and hotel establishments.
– Biodiversity: The North Sound lagoon is surrounded by mangrove swamps and an exposed acroporidae fringing reef, providing a diverse range of habitats for marine life.
– Underwater topography: The North Sound lagoon has two well-developed spur-and-groove terraces with varying depths, offering unique diving experiences.

Due to the ecological importance, recreational opportunities, and economic significance of SCZ5 combined with landscape character elements that are in good or above average condition, SCZ5 has a **High** landscape value rating.

Table 11 SCZ5 assessment

Seascape character zone 5: Caribbean Sea and North sound lagoon	
Anticipated change to seascape character	The Project is located outside of SCZ5, with the anticipated change to the seascape character being negligible. Although the top of the stack is anticipated to be viewable at varying locations throughout the zone and varying distances, the Project's site and development would have little effect on the landscape character.
Susceptibility to change	The height of the Project's ventilation stack in SCZ5 is the main contributing factor to the classification; the ventilation stack would unlikely be mitigated through vegetation planting; therefore, SCZ5 has a susceptible to a change rating of **High.** This is because although the top of the stack may be viewable at various locations throughout the zone, any change caused by the type of development would be unlikely to have a significant adverse effect on the seascape character, condition or value that could not be mitigated.
Sensitivity to change	The sensitivity of a seascape is judged on a combination of the landscape value and the landscape's susceptibility to change from the type of proposed development. The sensitivity would be **High,** as the seascape value is **High** and the susceptibility to change is **High**.
Magnitude of change	As the Project is not located within this zone, the magnitude of change would be **Negligible**; this is because there is almost imperceptible or no change in the landscape character as there is little or no loss to change to the elements, features, or characteristics of the seascape.
Significance of effect	The significance of effect would be **Minor**, as the sensitivity is high and the magnitude is negligible.

7. Visual consideration assessment

Based on the existing environment analysis, sensitive visual receivers were identified, and viewpoint locations selected for assessment.

Regarding potential receptors, consideration of the nature of the Project and the context within which it will be located (i.e., within an area that is zoned ‘Heavy Industrial’) has led to the judgement that receptors who may have an increased propensity to experience significant effects are those receptor groups assessed as being of a high or medium sensitivity to change.

Sensitive visual receivers within the Project viewshed include the following:

- Residents in dwellings with views to the Project
- Road users along the Esterly Tibbetts highway, including visitors exiting the National Gallery and the Harquail Cultural Centre
- Local road users of West Bay Road
- Nearby workers from the industrial zone
- Tourists/visitors to outdoor attractions
- People undertaking recreational activities where the focus of the activity involves an appreciation of the landscape or where it is likely that their surroundings have some influence upon their enjoyment (e.g., angling and golfing)
- People travelling through the landscape on roads or at sea.

7.1 Viewpoint locations

The following section provides a visual consideration assessment of the Project from the following selected representative viewpoint locations as shown in Viewpoints have been selected to appropriately represent the most sensitive visual receivers who are in close proximity to the site, may have prolonged views to the Project or are in LCZs of high value.

Refer to 7.1.1 to 7.3 for an assessment of the visual effect for each viewpoint location.

Viewpoints have been selected to appropriately represent the most sensitive visual receivers who are in close proximity to the site, may have prolonged views to the Project or are in LCZs of high value.

Table 12 Viewpoint locations

Viewpoint	Location	Description
Viewpoint 1: National Gallery of the Cayman Islands	National Galley of the Caymans Island	National Galley of the Caymans Island - entry drive intersection with Esterly Tibbetts Highway, looking towards GTLF
Viewpoint 2: United Pentecostal Church	Brushy Avenue and Woodlake Drive	Residential properties on Brushy Avenue and Woodlake Drive
Viewpoint 3: Residential properties on Marbel Drive Grand Cayman	Marbel Drive Grand Cayman	Residential properties on Marbel Drive
Viewpoint 4: Residential properties on Lakeside Villas	Residential properties on Lakeside Villas	Taken in the carpark of Residential properties on Lakeside Villas
Viewpoint 5: Camana Bay Observation Tower	Camana Bay Observation Tower	Taken from Camana Bay Observation tower at approximately 22 m above ground level.

Viewpoint	Location	Description
Viewpoint location 6: Tall residential properties on Seven Mile Beach	Tall residential properties on Seven Mile Beach	Located on Snooze Lane Tall residential properties on Seven Mile Beach taken at approximately 22 m above ground level
Viewpoint location 7: Cruise liner	Cruise Liner anchored off Seven Mile Beach	Located approximately 700 meters off the coast of Seven Mile Beach
Viewpoint Location 8: North sound lagoon	Boat located in the North sound lagoon	Located approximately one mile (1.5 km) off the foreshore of the lagoon.

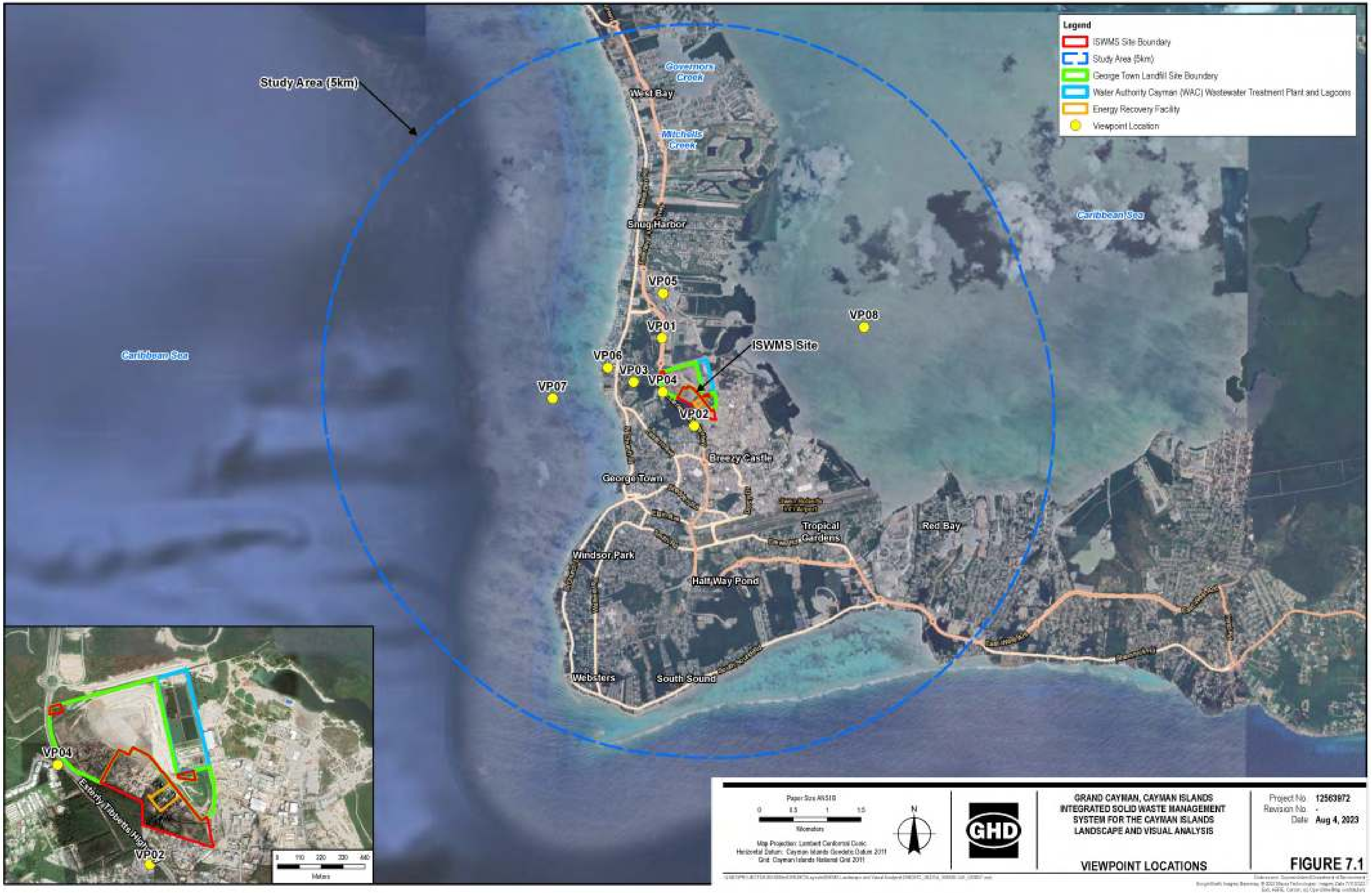


Figure 6 Viewpoint location map

7.1.1 Viewpoint 1: National Gallery of the Cayman Islands

VP01 is located at National Galley of the Caymans Island - entry drive intersection with Esterly Tibbetts Highway, looking in a south-eastern direction towards the Project Site. The assessment for VP01 is discussed in Table 13 VP01 assessment. The existing view is illustrated in Photo 7.1 and artistic impressions illustrating the Project design are shown in Photo 7.2.

Photo 7.1 Viewpoint 1: National Galley of the Caymans Island - entry drive intersection - existing view

Photo 7.2 Viewpoint 1: National Galley of the Caymans Island - entry drive intersection – Annotated after construction.

Table 13 VP01 assessment

Criteria	Comments
Location and view direction	Location (MGA Zone 55); 19.315997, -81.377728 Elevation: VP01 is situated 1,640 feet (500 m) from the Project and is facing in a southeast direction. This viewpoint is representative of views experienced by vehicles along Esterly Tibbetts Highway, as well as visitors to the National Gallery of the Cayman Islands, the users of the Cayman International school along with the users and visitors of the Harquail Theatre, FJ Harquail Cultural Centre.
Description of existing view	The foreground features a clearly defined, raised road division constructed from cement and stone retaining walls and flanked by the Esterly Tibbetts Highway on either side. A series of streetlights occasion the division. In the mid-ground of the image, there is an abundance of vegetation at varying heights. On the far-left side of the composition, several buildings can be seen, providing a sense of urbanity to the landscape. A partially obstructed glimpse of the Project site can be seen through the vegetation in the mid-range of the image. While on the right-hand side of the image, there is a varied and layered composition of mixed vegetation mirrored on the project's peripheral border. At the road edge, beyond the highway, the dense vegetation of shrubs and trees partially screens a construction site and crane in the centre of the background.
Anticipated change to view	In the centre background where the vegetation and tree line meet, a series of large industrial buildings and ventilation stack will be visible. The buildings are visually located behind the existing vegetation line and would be partially obscured from view with the stack being the most visible from this location. Plumes of white steam and gas would be exhausted from the stack during operation, which would make it more visible.
Sensitivity to change	The sensitivity to change is **Low**, as road users in motor vehicles, trains or on transport routes that are passing through or adjacent to the study area and therefore have short term views; Viewers indoor at their place of work, schools or similar.
Magnitude of change	The magnitude of change would be **Medium**, as there would be discernible changes in the existing view due to partial loss of, or change to elements, features, or characteristics of the view, however, has potential to be partly mitigated. The change would be out of scale with the existing view and would leave an adverse effect on the view.
Significance of effect	The significance of effect will be **Minor,** as sensitivity to change is low and magnitude of change is medium.

7.1.2 Viewpoint 2: United Pentecostal Church

VP02 is located at the northern point of Woodlake Drive in the United Pentecostal Church. The baseline and assessment for VP02 is discussed in Table 7.3 VP02 visual consideration assessment. The existing view is illustrated in Photo 7.3 and artistic impressions illustrating the Project design are shown in Photo ***7.4***.

Photo 7.3 Viewpoint 2 existing view

Photo 7.4 ***Artistic Impression showing the Project from viewpoint location 2***

Table 14 VP02 assessment

Criteria	Comments
Location and view direction	Location (MGA Zone 55); 460784.279 E, 2134528.682 N. Note elevation data not provided. VP02 is situated approximately 328 feet (100 m) from the Project and is facing in a northwest direction. This viewpoint is representative of views experienced by residents on Woodlake Drive and the users of the United Pentecostal church.
Description of existing view	The middle-foreground view is defined by the light-coloured concrete car park of the church. The church building can be seen in the far left of the image and is rendered in yellow and white colours. There are two white pillars supporting the roof of the covered entrance, with a minibus parked underneath. The car park is demarked by a low rectangular hedge, creating a low visual barrier to the property boundary and partially screening the Esterly Tibbetts highway beyond. The hedge runs in a linear direction through the mid-range of the view, making a vanishing point to the left of the image; the hedge is occasioned with small rectangular rises that have been trimmed into the hedge's shape, the largest of which can be seen in the centre of the image, of which a streetlight is situated to the left. Behind, runs Esterly Tibbetts Highway and associated chain-link fence, which has vegetation growing through in points. It follows the same linear direction as the hedge but stands taller, adding another layer of visual barrier to the landscape beyond the boundary. Behind the chain-link fence, the tops of mature vegetation can be seen, with the project site visible over this and creating the composition's horizon line. Tall vertical infrastructure creates visual clutter in the mid-ground across the view from left to right, with two utility poles, transmission lines and the lamppost extending above the horizon line. The background consists of tree canopies, filtered views through to the land fill mound of the GTLF and expansive views to the sky.
Anticipated change to view	In the centre background, a series of large industrial ERF buildings and a ventilation stack will be visible. The facilities are visually located behind the existing vegetation line. The lower level of the ERF building will be partially obscured from view by vegetation, however the upper half will be visible above the horizon line, but below the height of the utility pole, transmission lines and church roof, when viewed from this viewpoint.
Sensitivity to change	The sensitivity to change would be **High** as the occupiers of residential properties, users of the car park and church goers would have direct and prolonged views of the project.
Magnitude of change	The magnitude of change would be **High** as a substantial change to the existing view would be undertaken, which would cause the view to be permanently changed and its quality diminished.
Significance of effect	The significance of effect will be **Major** as sensitivity to change is High and magnitude of change is High.

7.1.3 Viewpoint 3: Residential properties on Marbel Drive Grand Cayman

VP03 is located on Marbel Drive. The assessment for VP03 is discussed in Table 7.4. The existing view is illustrated in Photo 7.5 and artistic impression illustrating the Project design are shown in Photo 7.6.

Photo 7.5 Viewpoint 3: Residential properties on Marbel Drive - existing view

Photo 7.6 Artistic impression showing the Project from viewpoint location 3

Table 15 VP03 assessment

Criteria	Comments
Location and view direction	Location (MGA Zone 55); 19.310064N 81.381961W VP03 is situated 650 meters from the Project and is facing in an eastern direction. This viewpoint is representative of views experienced by residents of Marbel drive and the users of the road to access the joining roads of Jacada Close and Surrey Lane.
Description of existing view	In the image's foreground, the main feature is a road running through the neighbourhood, flanked on the left side by a single-story building painted white with a terracotta linear detail. The building is surrounded by a garden wall that borders the road, creating a sense of enclosure and privacy. Behind the wall, a variety of vegetation can be seen peeking over the top; a single species of sedge and a small linear-shaped grassed area on the exterior provides a buffer between the wall and the road. A solitary palm tree can be seen in the midground on the left. On the right-hand side of the image, the foreground is dominated by lush and verdant vegetation composition. A well-maintained hedge lines the road on this side, with equally spaced palm trees set into the hedge. A single-story dwelling can be seen nestled among the greenery, creating a sense of seclusion and privacy. The composition's vanishing point comprises a mix of mature tree species.
Anticipated change to view	The Project will not be visible from this location, due to the vegetation blocking the view. Refer to Photo 7.6.
Sensitivity to change	The sensitivity to change would be **High** as occupiers of residential properties, at home or going to or from, with long viewing periods, within close proximity to the proposed development; Communities that place value upon the landscape and enjoyment of views of their setting.
Magnitude of change	The magnitude of change would be **Negligible** as minor loss or alteration to one or more key view elements, features or characteristics, or the introduction of components that may be visible but may not be uncharacteristic within the existing view.
Significance of effect	The significance of effect will be **Minor** as sensitivity to change is High and magnitude of change is Negligible.

7.1.4 Viewpoint 4: Residential properties on Lakeside Villas

VP04 is located in Lakeside Villas carpark looking east towards the Project site across the Esterly Tibbetts Highway. The assessment for VP04 is discussed in Table 7.5. The existing view is illustrated in Photo 7.7 and artistic impression illustrating the Project design are shown in Photo 7.8.

Photo 7.7 ***Viewpoint 4: Located in Lakeside Villas car park looking east towards Project site across Esterly Tibbetts Highway - existing view***

Photo 7.8 ***Viewpoint 4: Lakeside Villas car park looking east towards Project site across Esterly Tibbetts Highway - Artistic Impression***

Table 16 VP04 assessment

Criteria	Comments
Location and view direction	Location (MGA Zone 55); 19.308675N 81.377910W VP04 is situated 250 meters from the Project and is facing in an eastern direction. This viewpoint is representative of views experienced by the residents and visitors of Lakeside Villas that use the carparking spaces.
Description of existing view	A car park is featured in the foreground to mid-ground of the image, displaying various car models. The border of the car park is lined with palm trees, and trim liner hedges are maintained between the spaces. Moving towards the centre midground, the visual frame is created by the palm trees lining the area, providing a clear view of the mound of the GTLF. The central midground is free of vegetation hedges but is instead adorned with palm trees, three mature, three recently planted and of small stature, that contributes to the frame. To the left-hand side of this palm tree-lined centre view, a mixed-height hedge composed of various species is visible. The crash barrier running from left to right in the centre midground indicates the presence of a freeway, with a chain-link fence visible behind it, marking the boundary of the project site. Directly behind the fence is a hedge consisting of an unknown species. A series of utility wires run from left to right, with a single lamp post positioned at the centre of the frame.
Anticipated change to view	In the centre midground to the mid right where the vegetation and tree line meet, a series of large industrial buildings and ventilation stack will be visible. The buildings are visually located behind the existing vegetation line and would be partially obscured from view with the stack being the most visible from this location. Plumes of white steam and gas would be exhausted from the stack during operation, which would make it more visible.
Sensitivity to change	The sensitivity to change would be **High** as occupiers of residential properties, at home or going to or from, with long viewing periods, within proximity to the proposed development; Communities that place value upon the landscape and enjoyment of views of their setting.
Magnitude of change	The magnitude of change would be **Low** as minor loss or alteration to one or more key view elements, features or characteristics, or the introduction of components that may be visible but may not be uncharacteristic within the existing view.
Significance of effect	The significance of effect will be **Moderate** as sensitivity to change is High and magnitude of change is Low.

7.1.5 Viewpoint 5: Camana Bay Observation Tower

VP05 is located on the Camana Bay Observation Tower (approximately 74 feet (22.5 m) high). The assessment for VP05 is discussed in Table 7.6. The existing view is illustrated in Photo 7.9 and artistic impression illustrating the Project design are shown in Photo 7.10.

Photo 7.9 Viewpoint 5: Camana Bay Observation Tower existing view

Photo 7.10 Artistic impression showing the Project from viewpoint location.

Table 17 VP05 assessment

Criteria	Comments
Location and view direction	Location (MGA Zone 55); 19.321814N 81.377712W Elevation: 74 feet (22.5 m) VP05 is situated approximately one kilometre from the Project and is facing in a southern direction. This viewpoint is representative of views experienced by users of the observation tower.
Description of existing view	On the left-hand side of the image's foreground, there are two tall palm trees with a linear planting of smaller palm trees behind them, extending further into the mid-ground. A similar planting style can be seen on the far-right side of the image, bordering one of the buildings. The image's foreground, middle ground, and parts of the background feature buildings of various heights and designs, all showcasing a contemporary architectural finish. In the centre of the mid-ground, a tall office building stands out. Towards the right side of the centre of the image, an open space reveals a view of the vegetation line, creating a contrast to the otherwise urban and artificial environment.
Anticipated change to view	The Project will not be visible from this location, due to the office building obscuring the buildings and stack from view.
Sensitivity to change	The sensitivity to change would be **High** as occupiers of residential properties, at home or going to or from, with long viewing periods, within proximity to the proposed development; Communities that place value upon the landscape and enjoyment of views of their setting.
Magnitude of change	The magnitude of change would be **Negligible** as almost imperceptible or no change in the view as there is little or no loss of/or change to the elements, features, or characteristics of the view.
Significance of effect	The significance of effect will be **Minor** as sensitivity to change is high and magnitude of change is Negligible.

7.1.6 Viewpoint 6: Tall residential properties on Seven Mile Beach

VP06 is taken from a tall residential building on Seve mile beach located on Snooze Lane. The assessment for VP06 is discussed in Table 18 VP06 assessment . The existing view is illustrated in Photo 7.11 and artistic impression illustrating the Project design are shown in Photo 7.12 and Photo 7.13.

Photo 7.11 Viewpoint 6: Tall residential properties on Seven Mile Beach on Snooze Lane looking east – existing view

Photo 7.12 Viewpoint 6: Tall residential properties on Seven Mile Beach on Snooze Lane looking east – showing the Project at year 0

Photo 7.13 Viewpoint 6: Tall residential properties on Seven Mile Beach, looking east – showing the proposal at year 10

Table 18 VP06 assessment

Criteria	Comments
Location and view direction	Location (MGA Zone 55); 19.311931N 81.385333W Elevation: 74 feet (22.5 m) approx. VP06 is situated approximately one kilometre from the Project and is facing in an eastern direction. This viewpoint is representative of views experienced by the residences of the building.
Description of existing view	The photo taken from an elevated position provides a panoramic view of the project site. In the foreground, a public service building with a roof and a surrounding car park is visible. Towards the centre of the image, a main road runs horizontally from right to left. The middle ground shows an urban setting with substantial vegetation, mainly consisting of palm trees planted linearly along the boundary lines of the properties and the road. The central background offers a clear view of the GTLF, with the sea visible beyond it. On the right side of the GTLF, the urban matrix can be seen extending towards the vanishing points of the composition while non-human made elements rise above the horizon line.
Anticipated change to view	In the centre background a series of large industrial buildings and a ventilation stack will be visible. Plumes of white steam and gas would be exhausted from the stack during operation, which would make it more visible.
Sensitivity to change	The sensitivity to change would be **High** as the occupiers of residential properties, at home or going to or from, with long viewing periods, within proximity to the proposed development; Communities that place value upon the landscape and enjoyment of views of their setting.
Magnitude of change	The magnitude of change would be **High** as a substantial/obvious change to the existing view due to total loss of, or change to, elements, features, or characteristics of the view. Would cause a view to be permanently changed and its quality diminished.
Significance of effect	The significance of effect will be **Major** as sensitivity to change is High and magnitude of change is High.

7.1.7 Viewpoint 7: Cruise Liner anchored off Seven Mile Beach

VP07 is taken from the deck of a cruise ship located approximately 700 meters off the coast of Seven Mile Beach. The assessment for VP07 is discussed in Table 7.7. The existing view is illustrated in Photo 7.14 and artistic impression illustrating the Project design are shown in Photo 7.15.

Photo 7.14 Viewpoint 7 Cruise Liner anchored off Seven Mile Beach - existing view looking east

Photo 7.15 Viewpoint 7: Cruise Liner anchored off Seven Mile Beach – showing the Project year 10

Table 19 VP07 assessment

Criteria	Comments
Location and view direction	Location (MGA Zone 55); 19.311931N 81.385333W Elevation: 74 feet (22.5 m) approx. VP07 is situated approximately one kilometre from the Project and is facing in an eastern direction. This viewpoint is representative of views experienced by the tourists and staff of the cruise liners.
Description of existing view	The photo taken from an elevated position provides a panoramic view of the project site. In the foreground, the sea and bay that make up seven-mile beach is viewable. Towards the centre of the image, seven-mile beach and its hotels, residencies and small port can be seen. The middle ground shows an urban setting with substantial vegetation. The central background offers a clear view of the GTLF, with the sea visible beyond it.
Anticipated change to view	In the centre background a series of large industrial buildings and a ventilation stack will be visible. Plumes of white steam and gas would be exhausted from the stack during operation, which would make it more visible.
Sensitivity to change	The sensitivity to change would be **High** as the occupiers of residential properties, at home or going to or from, with long viewing periods, within proximity to the proposed development; Communities that place value upon the landscape and enjoyment of views of their setting.
Magnitude of change	The magnitude of change would be **High** as a substantial/obvious change to the existing view due to total loss of, or change to, elements, features, or characteristics of the view. Would cause a view to be permanently changed and its quality diminished.
Significance of effect	The significance of effect will be **Major** as sensitivity to change is High and magnitude of change is High.

7.1.8 Viewpoint 8: North Sound

VP08 is taken from a boat located approximately one mile (1.5 km) off the coast of the North Sound lagoon. The baseline and effect assessment for VP08 is discussed in Table 20. The existing view is illustrated in Photo 7.16 and the artistic impression illustrating the Project design are shown in Photo 7.17.

Photo 7.16 Existing view looking west

Photo 7.17 Artistic render showing the project from the viewpoint.

Table 20 VP08 assessment

Criteria	Comments
Location and view direction	Location (MGA Zone 55); 463235.771 E, 2137471.258 N Elevation: Not provided VP08 is situated approximately one and a half kilometres east of the Project and is looking west. This viewpoint is representative of views experienced by the users of the North Sound Lagoon.
Description of existing view	The image's composition consists of the expansive water of the North Sound Lagoon across the foreground, the land of Grand Cayman Island in the mid-ground, creating the thin horizon line, with the expansive heavily clouded blue sky above. The water's surface is textured by the wind, evident in the choppy and undulating waves. The midground of this composition depicts the North Sound Lagoon's mangroves, with dense dark green vegetation creating a strong delineation between the turquoise sea and dark green land. The mangroves upper vegetation has varied heights creating a filtered horizon line with the sky. The views are predominately to natural elements, with the exception of the landfill mound to the right of view. To the left of the view stand two communication towers that rise above any existing element in the landscape, above the horizon line.
Anticipated change to view	A series of large industrial buildings and a ventilation stack will be visible in the central background. Plumes of white steam and gas may be exhausted from the stack during operation, making it more visible. However, from this location, the buildings and stack sit below or are equal to the height of communications towers within the viewpoint. The Project is visually located behind the mangroves
Sensitivity to change	The sensitivity to change would be **High** for users and communities of the North Sound who hold a appreciation for the landscape's significance and the scenic views of their surroundings.
Magnitude of change	The magnitude of change is deemed **High**, as it would lead to a permanent alteration of the landscape, causing a reduction in its overall quality.
Significance of effect	The significance of effect will be **Major** as sensitivity to change is High and magnitude of change is High.

7.2 Other Views

Photo 7.18 Additional view of Looking East down Courts Road from Eastern Avenue

Photo 7.19 Additional view of typical residential area within Zone 3

8. Construction effects

At present, it is anticipated that the construction period will be over a 24–33-month period from 2024 to 2027. During this period, construction activities may be within view, including the temporary presence of cranes, concrete pumps, and other machinery, as well as construction compounds and other ancillary structures.

The presence of the above elements is not anticipated to be significantly out of character within the existing visual environment due to the location of the Project within an industrial area. Furthermore, existing and anticipated future construction sites are expected to be present within the surrounding visual environment. The visual effects associated with construction are temporary and therefore do not influence the overall ratings of the viewpoints in this report.

9. Mitigation measures

The below mitigation measures are to be considered to reduce the effects of the project. These include:

– Consider colour gradations to reflect the surrounding sky, landscape, and seascape.
– Consider materials of low reflectivity.
– Consider façade treatment or alternative use to create visual variation (such as artistic mural, outdoor cinema, rock climbing etc.).

10. Conclusion

This Landscape and Seascape Visual Assessment has been undertaken to identify the potential effects of the Project based on its concept design.

The Project area is located to the north of central George Town towards the western coast of Grand Cayman, immediately south-west of the existing George Town Landfill. The Project site sits within the identified LCZ2, bordering with LCZ3 and SCZ4. The scale and location of the Project within this zone which already contains similar land uses reduces the potential for significant direct landscape effects upon Grand Caymans key landscape and townscape characteristics.

A total of five landscape and seascape character zones were identified within the study area: Tourism foreshore and George Town centre (LCZ1), Industrial, waste and airport (LCZ2), Residential settlement (LCZ3), Mangroves and recreation (SCZ4), Caribbean Sea and North Sound Lagoon (SCZ5). In terms of indirect landscape effects upon surrounding character areas, these will primarily be a consequence of a visual effect i.e., where some components of the Project during the construction and/or operation periods will become visible in outward views available from these character areas. However, the likely level of screening provided by built form within the northern and central parts of George Town to the south; and the development associated with Seven Mile Beach and Camana Bay to the west allied with the context within which the development will be viewed (i.e. within a zone in which industrial development and construction activities are common), will reduce the potential for the Project to have a significant influence upon the character and key characteristics of these neighbouring landscape and seascape character areas.

LCZ2 Industrial, waste and airport was found to have a **Moderate** effect associated with location of the Project within LCZ2, along with the tall stack height (158 ft or 48.1 m) which will have high visibility. The landscape and seascape character zones LCZ3 and SCZ5 were found to have **Minor** landscape character effects, due to their high sensitivity and negligible magnitude of change. LCZ1 and SCZ4 were found to have **Negligible** landscape character effects as a result from the Project, due to their medium sensitivity and negligible magnitude of change.

Sensitive visual receivers in the study area include residents, pedestrians, road users, cruise liner users, and workers of the industrial zone. Eight viewpoint locations were chosen to assess the visual effects of the Project on sensitive receivers within the study area. Visual effects were assessed using panoramas of the existing view and seven artistic impressions were created illustrating the proposed view of the Project, from eight viewpoint locations. The assessment found that the Project would have a **Major** visual effect on VP02, VP06, VP07 and VP08, due to the high sensitivity of residents on Brushy Avenue and Woodlake Drive, residents on Seven Mile Beach and tourists and staff of the cruise liners off Seven Mile Beach, and users of North Sound Lagoon. A **Moderate** visual effect is experienced from VP04, while VP01, VP03 and VP05 experience a **Minor** overall visual effect.

Mitigation measures proposed for the construction and operational stages should be incorporated into detailed design and construction management plans to reduce visual effects. Mitigation measures such as screening vegetation may be useful locally to screen views from the residential areas, however the size of the project as seen from VP06 and VP07 would not be mitigated by this approach.

The following Table 21and Table 22 provide a summary of landscape and visual effects for the Project.

Table 21 Summary of landscape effects

LCZ	Description	Sensitivity to change	Magnitude of change	Overall Rating
LCZ1	Tourism foreshore and George Town centre	Medium	Negligible	**Negligible (Not significant)**
LCZ2	Industrial, waste and airport	Low	High	**Moderate (Probably significant)**
LCZ3	Residential settlement	High	Negligible	**Minor (Not significant)**
SCZ4	Mangroves and recreation	Medium	Negligible	**Negligible (Not significant)**
SCZ5	Caribbean Sea and North Sound Lagoon	High	Negligible	**Minor (Not significant)**

Table 22 Summary of visual effects

Viewpoint	Location	Sensitivity to change	Magnitude of change	Overall Rating
VP01	National Galley of the Caymans Island	Low	Medium	**Minor (Not significant)**
VP02	Viewpoint location 2: United Pentecostal Church	High	High	**Major (Significant)**
VP03	Residential properties on Marbel Drive	High	Negligible	**Minor (Not significant)**
VP04	Residential properties on Lakeside Villas	High	Low	**Moderate (Probably significant)**
VP05	Camana Bay Observation Tower	High	Negligible	**Minor (Not significant)**
VP06	Tall residential properties on Seven Mile Beach	High	High	**Major (Significant)**
VP07	Cruise Liner anchored off Seven Mile Beach	High	High	**Major (Significant)**
VP08	North Sound Lagoon	High	High	**Major (Significant)**

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Appendix 11.A

Air Quality Assessment

Quantitative Air Quality Assessment for Cayman Islands Integrated Solid Waste Management System

DECCO Limited

18 July 2023

→ The Power of Commitment

Project name	Cayman ISWMS Planning & EIA Work
Document title	Quantitative Air Quality Assessment
Project number	12563972-RPT-3
File name	12563972-RPT-3-Air Quality Assessment

Status Code	**Revision**	**Author**	**Reviewer**		**Approved for issue**		
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S0	DRAFT	Punith Nallathamby	Gord Reusing		Gord Reusing		
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S4	01	Punith Nallathamby	Gord Reusing		Gord Reusing		July 18/23

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Appendices

1. Introduction

The Cayman Islands Government in partnership with DECCO Consortium (the Proponent) is proposing the development of an Integrated Solid Waste Management Facility (ISWMS) in the Cayman Islands, on Grand Cayman ('the Project'). The following report details the Air Quality Assessment (Assessment) that was conducted in support of the Project's Environmental Impact Assessment (EIA).

Each year, approximately 115,000 tons of solid waste is produced in the Cayman Islands, with the overwhelming majority of the material presently being managed by the George Town Landfill (GTLF). This landfill capacity is, however, finite and in accordance with the provisions of both the National Solid Waste Management Strategy for the Cayman Islands (2016) and the National Planning Framework (draft for public consultation) (2018), a Terms of Reference was prepared in relation to the proposed development of a replacement ISWMS for the Cayman Islands.

The proposed ISWMS site is located to the north of central George Town towards the western coast of Grand Cayman, immediately south-west of the existing GTLF. The proposed ISWMS is a multi-facility development, including an energy recovery facility (ERF) and supporting non-ERF waste processing, treatment, and disposal facilities. Construction and operation of the ISWMS would allow the existing landfills in George Town, Cayman Brac and Little Cayman to be closed and remediated. This Assessment was prepared to provide an assessment of the air quality impacts resulting from the proposed Project. The air quality impacts were compared to relevant standards and guidelines and to the existing air quality conditions. Using monitored background air quality data, the Assessment discusses the existing air quality in the vicinity of the proposed Project and the potential impacts of the proposed Project on local air quality.

1.1 Overview of Report Contents

This Report describes the existing air quality conditions in the area of the Proposed ISWMS Site (Site) followed by an analysis of potential effects, mitigation measures and net effects of the Project on the air quality. The key components of the Report are as follows:

– Study methodology
– Applicable regulatory requirements
– Existing ambient air quality
– Dispersion Modelling
– Emission Inventory
– Comparison of model predictions to applicable air quality criteria

2. Study Methodology

During the Project's operational time, airborne dispersion of contaminants will serve as the main conduit for air contaminants to reach human and sensitive receptors.

The assessment of the Project's effect on air quality was performed by conducting dispersion modelling to predict the downwind concentrations of air contaminants and comparing these predictions to regulatory standards, and guidelines. There are several steps to building a plume dispersion model. The preparation of a representative emissions inventory is key to a successful modelling prediction.

The assessment of air quality effects related to the Project consisted of the following elements:

– Assessment of existing baseline ambient air quality conditions for Chemicals of Potential Concern (CoPCs) from the existing air emissions sources at the Site and its vicinity through emission inventory and air monitoring measurements.
– Compilation of emissions estimates for CoPCs from point and mobile sources in the proposed Project.
– Dispersion modelling of the existing emissions from the Site and significant sources identified in the vicinity to establish a baseline model and compare to monitored data.
– Comparison of dispersion model predictions to ambient air quality criteria as well as evaluation of the incremental change in air quality associated with the Project.

The impact assessment methodology primarily consisted of ensuring that there would be no exceedances to the air quality limits defined in the air quality criteria, defined further in Section 3.1. This was the main consideration for whether the air quality changes would have a significant impact.

2.1 Timeframes Considered for Analysis

The following timeframes were considered for dispersion modelling, in order to assess potential impacts on the air quality.

Baseline

Existing emission sources at the Site and its vicinity would be contributing towards the baseline or background air concentrations.

Construction Phase

The time during which the construction activities occur on the site to setup the facilities associated with the Project. Predominantly emission from the construction phase is expected to be dust.

Operational

This phase includes the fully operational state of the Project. Estimated maximum emissions of the CoPCs are modelled and the maximum offsite concentrations are added to the baseline monitored concentrations for a cumulative impact assessment.

2.2 Study Area

For the purpose of this Assessment, an Air Quality Study Area (Study Area) was defined to extend up to 10 km in all four cardinal directions. Air quality impacts outside the Site Property line are assessed. Onsite impacts are not included in the scope of this Assessment.

2.3 Contaminants of Potential Concern

A wide range of substances can be emitted from the operations associated with the Project. Facilities associated with the Project include the following:

– An Energy Recovery Facility (ERF) for the treatment of Municipal Solid Waste (MSW)
– A Green Waste Facility for outdoor processing (composting and mulching) of organic waste
– An End-of-Life Vehicle (ELV) and Scrap Metal Processing Facility
– A Construction and Demolition (C&D) Waste Facility
– A Bottom Ash Processing Facility
– A Medical Waste Processing Facility
– A Landfill Gas Facility and

– A Residual Waste Landfill

The expected emissions, based on the Project-specific design and operation, formed the basis of selecting the substances for evaluation. A comprehensive list of CoPCs was developed in consultation with the Environmental Assessment Board (EAB) and published in the Terms of Reference and Air Quality Method Statement, included in Appendix A. The CoPCs are listed below.

– Dioxins and Furans (PCDD/PCDF)
– Total Dust, assessed as:
  - Particulate (particulate matter < 10 microns [PM_{10}])
  - Particulate (particulate matter < 2.5 microns [$PM_{2.5}$])
– Volatile organic compounds (VOC) as Total Organic Carbon (TOC)
– Hydrogen Chloride (HCl)
– Hydrogen Fluoride (HF)
– Sulphur Dioxide (SO_2)
– Oxides of Nitrogen (NOx) expressed as NO_2
– Carbon Monoxide (CO)
– Heavy Metals:
  - Cadmium (Cd)
  - Thallium (Tl)
  - Mercury (Hg)
  - Antimony (Sb)
  - Arsenic (As)
  - Lead (Pb)
  - Chromium (Cr)
  - Cobalt (Co)
  - Copper (Cu)
  - Manganese (Mn)
  - Nickel (Ni)
  - Vanadium (V)

Dust was assessed as $PM_{2.5}$ and PM_{10}. In addition, as part of the odour assessment, hydrogen sulphide (H_2S) from the landfilling activities and the surrounding potential odour sources was identified as a compound of concern. Polycyclic Aromatic Hydrocarbons (PAHs) was also included as a compound of concern due to fuel combustion background sources. The most significant VOC from the fuel combustion sources is benzene and it was used as the indicator for VOCs.

3. Regulatory Framework

The following section includes a review of the regulatory framework that governs the ambient air quality as well as the industrial emission limits.

3.1 Ambient Air Quality

The standards that were used for the determination of compliance with ambient air criteria were taken from the **UK National Air Quality Objectives**. These applicable air quality standards and associated time averaging periods are provided in Table 1.

Although the **UK National Air Quality Objectives** has an air quality standard for H_2S, the Ontario (Canada) 10-minute limit for odour is used because the purpose of assessing H_2S for this study is in relation to an odour assessment.

There are no ambient air quality limits for dioxins and furans in the **UK National Air Quality Objectives**. For reference, the Ontario limits have been used which is based on WHO guidance. Industrial Emission Limits

The primary EU tool for controlling pollutant emissions from industrial units, such as waste incinerators and Energy Recovery Facilities (ERF), is the EU Industrial Emissions Directive (IED – 2010/75/EU). By lowering harmful industrial emissions throughout the EU, particularly through improved application of Best Available Methods, it strives to ensure a high degree of protection for human health and the environment as a whole. The ERF included in the Project will have one primary exhaust stack for emissions from the ERF activities, referred to hereafter as the “ERF stack”. The applicable EU emission standards for the ERF stack is summarized in Table 2.

4. Existing Baseline Conditions

The following sections describe the existing physical environment of the Study Area.

4.1.1 Topography

The general topography of the study area is flat landscape with mangrove swathes. The general land use in the area is a mix of industrial and residential developments. The highest point on Grand Cayman, is about 70 feet above sea level. There are no rivers located on the island. The coasts are usually shielded by offshore reefs and, in some locations, a mangrove fringe that occasionally reaches inland marshes.

4.1.2 Climate

All year long, the Cayman Islands have a tropical climate that is hot and humid. The northeast trade winds provide a dry, comparatively cold season from late November to mid-April, and a wet, muggy season from late April to early November. The Cayman Islands see relatively lower winter temperatures than summer ones. The islands occasionally experience cool breezes from the United States from December to March, which can cause the nighttime temperature to drop to about 15 °C (59 °F). Maximum temperatures during the rainy season are around 32 °C (90 °F).

According to the Cayman Island national Weather Service, the annual average temperature is about 28°C, with maximum temperatures reaching up to 33°C and lowest temperatures of 18°C. The Grand Cayman on an annual basis receives about 1400 mm of rainfall, with an annual average relative humidity of 77%. The predominant winds are mostly blowing from the east to the west, with an average wind speed of 4.6 m/s.

4.1.3 Sensitive Receptors

The Site is located in a predominantly industrial area with sensitive receptors such as residential areas and schools located primarily to the southwest, west and northwest. The following sensitive receptors, as shown in Figure 1, were included as part of the Assessment.

– Locations within the Lakeside Development (residential dwellings immediately west of the ISWMS development, on the opposite side of the Esterly Tibbetts Highway).
– Locations within the OLEA residential development approximately 800 m north of the ISWMS development.

- Properties on Parkside Close (residential dwellings approximately 800 m to the northwest of the ISWMS development).
- The Cayman International School (educational institute approximately 800 m to the north of the ISWMS development).
- The Seven Mile Beach corridor which starts approximately 1,500 m to the northwest of the ISWMS development, which includes residential tourism properties.
- Health City-Camana Bay's Cancer Research facility approximately 600 m to the north of the ISWMS development, estimated to be operational by the year 2024.
- Jasmine Hospice facility located on West Bay Road, approximately 1,000 m west of the ISWMS development.
- Royale Medical and Wellness Center is a medical laboratory located approximately 1,000 m west of the ISWMS development.
- Cayman Medical located approximately 900 m south of the ISWMS development.
- George Town Primary School located approximately 900 m southwest of the ISWMS development

4.1.4 Background Air Quality

An ambient air monitoring programme was run as part of the Environmental Impact Assessment (EIA) for the Cayman Islands Integrated Solid Waste Management System (ISWMS). The Cayman Islands Government and their consultants assessed an Air Quality Method Statement (Method Statement) that GHD had submitted. On October 8, 2021, the Method Statement was reviewed, approved, and given comments. An ambient air monitoring programme (AAMP) was developed to establish the baseline ambient air concentrations of air contaminants in the Study Area. GHD, Valley Environmental Services (VES), Dart Enterprises Cayman, and the Department of Environmental Health (DEH) all contributed to the creation and management of the AAMP.

The list of air pollutants that were tracked and measured for the programme included the CoPC emissions that are anticipated to come from new sources connected to the ISWMS plant as well as other emissions that are already being produced by fuel combustion emissions sources in the Study Area, such as nitrogen oxides. The potential emission sources that make contributions to the current baseline are shown in Figure 2.

On October 24, 2021, the AAMP was launched and lasted for about four months, with around one month of the wet season and three months of the dry season. Staff from Dart and DEH managed the AAMP after GHD and VES completed the assembly of the monitoring stations and initial calibration of the monitoring apparatus. GHD and VES gave training on all facets of the equipment being utilised in the AAMP prior to the start of the Program. GHD and VES provided remote support and had access to the CEM data during the monitoring period. The Ambient Air Monitoring Report prepared by GHD in March 2023 describes the AAMP in detail, included in Appendix B.

4.1.4.1 General Description and Purpose of Each Monitoring Station

The choices for the sampling sites and technique were based on a hybrid strategy that combined Ontario (Canada) monitoring methods, USEPA ambient air monitoring methods, and United Kingdom/European Union (UK/EU) ambient air monitoring methods. Labs in North America were selected for analysis of collected samples because of their proximity to ensure compliance with sample holding times. The methods used in the UK/EU, USEPA, and Ontario for sampling, analysis, and continuous/passive ambient air monitoring are generally relatively comparable. There were three types of monitoring: passive, intermittent, and continuous. The seven locations for the air monitoring stations are shown in Figure 3, along with the parameters that were monitored at each station.

Station 1 – Cox Lumber

Station 1 was the primary monitoring station, consisting of an air-conditioned container that housed the following Federal Reference Method (FRM)/Federal Equivalent Method (FEM) and associated equipment:

- Teledyne API (TAPI) T200 NO_x Chemiluminescence analyzer.
- TAPI T300 CO Gas Filter Correlation analyzer.

- TAPI T100 SO2 UV Fluorescence analyzer.
- MetOne Beta Attenuation Monitor (BAM) 1020 Continuous $PM_{2.5}$ Monitor.
- Zero Air Generator.
- EPA Protocol 1 Calibration Gases (NO, SO_2 and CO).
- HF and HCl impinger samplers.
- A 20 ft meteorological tower (above the roof of the container) with an RM Young wind speed (WS) and wind direction (WD) monitor including relative humidity (RH), and ambient temperature (AT).
- A dedicated sample recovery area including a refrigerator for interim storage of samples requiring cool storage.

A rooftop area with a railing also housed non-continuous samplers such as:

- FRM high volume PM_{10} sampler for the collection of PM_{10} and metals in the PM_{10} fraction for 24-hours every six days.
- FRM medium volume (PUF) sampler for the collection of semi-volatiles including PCDD/PCDF and PAH compounds for 24-hours every six days.
- Summa canister for the collection of VOCs using Method TO 15 for 24-hours every six days.
- Passive monitors for NO_2 and SO_2 for correlation purposes.

This station was located according to the criteria for the location of a background monitoring station away from major roads and trees and was not influenced significantly by any specific emissions source. The station was located downwind of the future site of the ISWMS and the ERF and other significant emissions sources in the area.

Figure 4, below, shows a photograph of the Cox Lumber monitoring station.

Figure 4 ***Cox Lumber Monitoring Station***

Station 2 – Paddington Place

Station 2 was used for passive monitoring of NO_2 and SO_2 from industrial areas, the Caribbean Utilities Company (CUC), and road traffic emissions. Paddington Place was located close to the Esterly Tibbetts highway and a major roundabout.

Station 3 – George Town Primary School

Station 3 was used for passive monitoring of NO_2 and SO_2 for sensitive receptors at the George Town Primary school.

Station 4 – OPY 20

Station 4 was used for passive monitoring of NO_2 and SO_2 and continuous monitoring of PM_{10} and WS/WD from the downtown core.

Station 5 – Lakeside

Station 5 was used for passive monitoring of NO_2 and SO_2, continuous monitoring of PM_{10} and H_2S, and WS/WD near sensitive receptors at this residential complex located directly downwind of the George Town Landfill (GTLF). The Lakeside monitors are also located very close to the edge of Esterly Tibbetts highway and will therefore show impacts from road traffic.

Station 6 – Cayman International School (CIS)

Station 6 was used for passive monitoring of NO_2 and SO_2 for the sensitive receptors at CIS.

Station 7 – Laundry

Station 7 was used for continuous monitoring of H_2S from the Wastewater Treatment Plant (WWTP) and other H_2S sources upwind of the GTLF, as well as continuous monitoring of WS/WD.

4.1.4.2 Background Values

The background concentrations for the air contaminants measured at each Station during the 4-month air monitoring campaign are summarized in Table 3. For the various air contaminants and their averaging periods (except for the annual averaging period), the 90th percentile value was used to represent the background concentration at each station. For the air contaminants with annual limits, the average background concentration from the full range of data collected was used. To estimate the background concentration for the Study Area for compounds that were monitored at multiple monitoring stations, the average of the 90th percentile values were used, as summarized in Table 3.

NO_2

The NO_2 concentrations were measured at Station 1 with CEMS. Passive samples for NO_2 were monitored at six Stations (1 through 6), including a co-located passive sampler at Station 1. The 1-hour and annual background concentrations are provided in Table 3. Combustion gas emissions were relatively stable with low concentrations measured throughout the monitoring period.

CO

The TAPI CEM located at Station 1 was used for the baseline concentrations for CO. The 8-hour background concentration for CO is provided in Table 3.

SO_2

Continuous samples for SO_2 were monitored at Station 1 and passive samples were collected at six Stations (1 through 6), including a co-located passive sampler at Station 1. The 1-hour, 24-hour and 15-minute background concentrations are provided in Table 3.

$PM_{2.5}$

The BAM 1020 CEM with the $PM_{2.5}$ cut cyclone located at Station 1 was used for the baseline concentrations for $PM_{2.5}$. The $PM_{2.5}$ annual background concentration is provided in Table 3.

H_2S

H_2S was monitored continuously upwind and downwind of the GTLF at Station 7 and Station 5 respectively. These stations were located to monitor specific sources of H_2S, namely the WWTP and the GTLF, so they may not be representative of true background concentrations of areas outside of the influence of these two specific sources. H_2S data collected at Station 5 was potentially influenced by a large holding tank containing sewage located close to the instrument. The comparison of this limit to H_2S concentrations measured at Lakeside Station 5 produced the only air quality limit exceedance during the program. This exceedance was likely influenced by the location of the monitor as noted above. It should also be noted that H_2S is not considered as a by-product of the emissions from the ERF, so ambient concentrations should be lower after construction of the ISWMS

PM_{10}

PM_{10} was measured non-continuously from Station 1 every 6 days for a 24-hour period for the monitoring duration, for a total of 20 samples. PM_{10} was also measured continuously from Stations 4 and 5. The continuous PM_{10} concentrations from these two stations show the impacts of vehicle traffic in the downtown areas and the Esterly Tibbetts highway. The 24-hour and annual PM_{10} background concentrations from the continuous and non-continuous samplers are provided in Table 3.

Metals

Metals were measured non-continuously from the PM_{10} fraction at Station 1 every 6 days for a 24-hour period for the monitoring duration for a total of 20 samples. The annual background concentrations for cadmium, arsenic, lead, and nickel are provided in Table 3.

PCDD/PCDF

Dioxins and furans were measured non-continuously at Station 1 every 6 days for a 24-hour period for the monitoring duration for a total of 20 samples. The 24-hour dioxin and furan background concentrations are provided in Table 3.

PAHs

PAHs were measured non-continuously at Station 1 every 6 days for a 24-hour period for the monitoring duration, for a total of 20 samples. The PAH standard is based on benzo(a)pyrene (BaP) as noted in Table 1. The annual BaP background concentration is provided in Table 3.

VOCs

VOCs were measured non-continuously at Station 1 every 6 days for a 24-hour period for the monitoring duration, for a total of 19 samples. Benzene is the VOC of most concern for this Assessment because it is present in fuel combustion exhausts, the primary sources of VOCs in the area, and it has a low air quality standard. The ambient air standard for benzene is shown in Table 1. The hourly and annual benzene background concentrations are provided in Table 3.

HF/HCl

HCl/HF were measured non-continuously at Station 1 every 6 days for a 24-hour period for the monitoring duration, for a total of 20 samples. The hourly background HCl concentration and the hourly and annual background HF concentrations are provided in Table 3.

Passive Monitoring for NO_2 and SO_2

Passive samples for NO_2 and SO_2 were deployed at Stations 1, 2, 3, 4, 5 and 6 for nine (9) two-week periods. The hourly and annual NO_2 concentrations from each Station are provided in Table 3. The 15 minute, 1-hour, and 24-hour SO_2 concentrations from each Station are provided in Table 3.

Odour

An odour assessment survey was conducted by GHD, DEH and Dart staff during daylight and after sundown as part of the background monitoring, and the following sources were assessed qualitatively:

- CUC
- WWTP
- GTLF
- Mangroves and shoreline areas
- Medical Waste Incinerator (MWI)
- Asphalt Plant

In addition, the following sensitive receptor locations were assessed qualitatively for odour:

- Cayman International School
- Lakeside Condominiums

Details of the odour assessment survey are included in the Ambient Air Monitoring Report. The odour assessment concluded that once the Project becomes operational there will be a reduction in odour due to diversion of waste from landfilling activities which can generate fugitive odours from the working face and from landfill gas. Therefore, the implementation of the ISWMS should result in less odour emissions from the Site.

There is a potential for odour emissions from the Green Waste Facility (GWF) composting area. According to the "Guidance on the Assessment of odour for planning (Version 1.1)" by the Institute of Air Quality Management, odour emissions from aerated green waste composting is classified as 'moderately offensive'. However, the facility will only be used to process leaf and yard waste, which is a small subset of the types of waste typically included in a composting facility. The material received is significantly less odourous than other types of green waste such as food and animal byproducts. Odour emitted from yard waste compost is described as 'earthy' and is therefore categorized as 'less offensive'. The nearest sensitive receptors to the GWF are properties approximately 300 meters southwest of the development. Per the UK Environment Agency's policy on composting, there is a recommended separation distance of 250 meters buffer separating the nearest sensitive receptors. This policy is in relation to bioaerosols which would be a strong contributor to potential odour effects. Additionally, the ISWMS facility will conform to a Code of Good Practice to adopt operations and mitigation measures to control activities that may generate and affect the release of odours. In addition to the setback distance and odour management procedures, the frequency of the historical wind data is observed to have less than 2% 'calms' which would be the wind condition most likely to propagate odour complaints due to low dispersion. There may also be some potential for low dispersion in low wind conditions when the wind is blowing from the northeast direction. Wind from the northeast that has a speed less than 3 meters per second occurs less than 3% of the time. These conditions combined with the variable nature of the odour emitted from a composting area would cause any odour impacts to be highly infrequent. The location of the GWF results in an increased separation distance for most of the identified sensitive receptors discussed in Section 4.1.3 compared to the existing GTFL. Therefore, overall, the GWF is not expected to have a significant risk of odour impact and the ISWMS project is expected to be a net reduction in odour impacts.

5. Greenhouse Gas Impact

Currently, GTLF receives over 115,000 tons of solid waste per year. Organic material in waste degrades into methane (CH_4) over time which can emit from landfills. Because methane is a greenhouse gas (GHG) that has 30 times more global warming potential than carbon dioxide over (CO_2) a 100-year period, most landfills, including GTLF, include a landfill gas capture system in which the landfill gas is flared to instead be emitted as carbon dioxide. However even a highly efficient landfill capture system will only capture 60%-90% of CH_4 emissions (United States Environmental

Protection Agency's (US EPA) Benefits of Landfill Gas Energy Projects) (https://www.epa.gov/lmop/benefits-landfill-gas-energy-projects).

By diverting solid waste from a conventional landfill to an energy recovery process, the 10%-40% of uncontrolled CH_4 emissions are avoided from the source and the CO_2 emissions are classified as biogenic as the same CO_2 would have been a natural decomposition of the organic material. Therefore, the energy recovery process would emit significantly less GHG and will offset emissions with every ton of avoided waste to a landfill.

According to the Cayman Islands Department of Environment (DOE), power generation accounts for 65% of Cayman Island GHG emissions as of 2007. In addition to the landfill offsets, surplus power generated through the energy recovery facility will be sold to the Cayman power grid. This will further reduce greenhouse gas emission through the displacement of higher GHG emission power generation.

6. Emissions Inventory

The emissions estimates for the Project and the existing background emissions sources were based on available data of similar units, published emission factors or manufacturer emissions guarantees. The US EPA's Compilation of Air Pollutant Emissions Factors (AP-42) is the primary resource of published emission factors relied on for the emission calculations. Emissions estimates are estimated to be conservative and represent worst-case short-term emissions from each source considered.

6.1 Background Emissions Sources

The purpose of modelling the background emissions was to provide a comparison to the ambient air monitoring program results. The ambient air monitoring program was used to establish the background air quality in the Study Area and the background emissions modelling was used to verify the reasonableness of the background air monitoring data for the primary background air contaminant (NO_x). The modelling of the background NO_x emissions involved many assumptions about the various emissions sources, and GHD took a generally conservative approach.

The background air emissions of concern from the existing emissions sources are primarily related to fuel combustion. The major fuel combustion contaminant is NO_x. The emissions of NO_x, from existing fuel combustion sources (traffic, industry, power generation and airport) was modelled to compare with the measured concentration of NO_x at the ambient air monitoring program stations. The emissions of NO_x were estimated based on best available references for emissions data and published emission factors for the known major contributors (sources) of NO_x in and around the Site. These sources have been identified in Figure 2.

A description of each background source and how the emission estimates are calculated is included in Appendix C.

6.2 Construction

According to the "Guidance on the Assessment of Dust from Demolition and Construction (Version 1.1)" by the Institute of Air Quality Management, a preliminary screening was carried out for the particulate emissions that might occur due to construction activities. The nearest sensitive receptor (a residence) is more than 350 m away from the construction site, and the route taken by construction vehicles is mainly through an industrial area. There are no significant effects likely to occur due to the construction activities at the Project with the implementation of appropriate site-specific dust mitigation plans that will be outlined in the Facility's Environmental Management Plan (EMP). Hence the emissions from the construction phase were not considered as a part of this Assessment.

6.3 Project Operation

This Section provides a description of the proposed ISWMS Facility, and the emissions estimates associated with the significant emissions sources.

6.3.1 Key Features

The proposed ISWMS development consists of various new waste management facilities. The components of the ISWMS subject to this Assessment is as follows:

– Energy Recovery Facility (ERF)
– Non-Energy Recovery Facilities:
  - Site weighbridges
  - Green Waste Processing Facility
  - Construction and Demolition Waste Processing Facility
  - Bottom Ash Processing Facility
  - Abandoned and End-of-Life Vehicle / Scrap Metal Processing Facility
  - Medical Waste Facility
  - Materials Recycling Facility
  - Household Waste Recycling Centre
  - Landfill Gas Facility
  - Residual Waste Landfill
– Ancillary Facilities:
  - Admin Building
  - Maintenance Building

The project layout, and building dimensions are provided in Appendix D.

6.3.2 Energy Recovery Facility

The design life of the new Facility is 25 years. By transforming waste into electrical energy and ash, the Energy Recovery Facility will enhance the recovery and diversion levels in the Cayman Islands. The bottom ash is expected to be recovered through recycling as construction-grade aggregate.

Contract waste will be transported to the ERF by Approved Vehicles, which may include bulk trailers, roll-on/roll-off trucks, and/or waste collection vehicles. The driver of the Approved Vehicles is in charge of emptying the Contract Waste into the reception bunker at the tipping hall.

The Project Site will receive wrapped bales of contract waste from the sister islands of Cayman Brac and Little Cayman. The bales will be held in a storage area next to the Materials Recovery Facility before being moved to the tipping hall for debaling and processing in the ERF.

Two grab cranes will be used to drop the contract waste into the furnace hoppers, where it will then be moved onto the moving grate of the furnace. On the moving grate, waste is burned, producing bottom and fly ash as by products as well as radiant heat and hot flue gases. The steam boiler makes a series of passes where energy in the form of heat is recovered. To lower NOx generation, urea solution is introduced into the first vertical boiler pass. To help with combustion, combustion air is delivered through the grate bars. Before entering the flue gas treatment plant, combustion flue gases flow via the various boiler channels, transferring heat to water- and steam-filled superheater tubes.

Induced draught fans encourage flue gas flow through the boiler, the gas treatment plant, and the bag filter system before being released to the atmosphere through the stack. Combustion air is supplied by primary and secondary air systems. The flue gas treatment facility absorbs dioxins and furans by injecting activated carbon into the acidic gases to neutralise them. To remove particulates, the gas is subsequently passed through bag filters. Flue gas treatment system waste will be stabilised before being placed in the landfill facility.

The steam turbine and linked generator are propelled by superheated steam, which produces power that is used both on the project site and exported to the transmission grid.

As it is transported to the bottom ash storage bunker, bottom ash produced during the combustion process is quenched. From the bottom ash, metals will be removed and recycled.

A logical flow of materials and processing will be provided from input to output by the Facility's design. A secondary weighbridge will be used to weigh recovered ferrous and non-ferrous metals as they are transported to the end-of-life vehicle (ELV) facility for baling and storage before being shipped to metal re-processors. Material that is too large and unusable will either be delivered to the Landfill Facility for disposal or to the Construction & Demolition (C&D) Facility for additional processing.

6.3.3 Energy Recovery Facility Stack

The stack associated with the ERF facility will emit combustion products along with some particulate, metals, HCl, HF, and VOCs. The emissions from this stack will be governed by the EU Industrial Emissions Directive (IED – 2010/75/EU). The manufacturer has guaranteed that the emissions from the ERF stack will not exceed the IED – 2010/75/EU Part 3 air emission limit values for waste incineration plants and the new limits introduced by the Best Available Techniques (BAT) Reference Document for Waste Incineration (2019), Table 5.3. A table of the maximum emission limit values provided by the manufacturer is included in Appendix E. The emissions from the ERF stack are calculated by assuming the maximum IED – 2010/75/EU in-stack concentration limits are emitted at the maximum design flow rate. This conservatively estimates the maximum possible contaminant emissions from the ERF stack based on the manufacturer's guarantee. The contaminant emission rates and stack parameters for the ERF stack are summarized in Table 4.

For CO, the IED – 2010/75/EU in-stack limits have a daily average, half-hour average, and 10-minute average limits. For the purpose of assessing against the air quality standard described in Table 1, which has an 8-hour average, the half-hour average in-stack limit is conservatively used as the maximum emission concentration.

For some of the heavy metals emitted, there are no individual emission guarantees, but a combined emission guarantee. For example, the manufacturer guarantees that Cd and Tl together will be emitted at 0.05 mg/Nm^3 as a conservative approach these heavy metals were each modelled at an emission rate assuming an exhaust concentration 0.05 mg/Nm^3. For arsenic, the manufacturer provided a separate in-stack limit of below 0.1 mg/Nm^3 based on measurements from other similar plants.

Regular emissions monitoring will be conducted in accordance with IED – 2010/75/EU section 2.1. This requires continuous emission monitoring of NO_x, CO, particulate, TOC, HCl, HF, and SO_2 as well as semi-annual monitoring of metals and D&F. This monitoring will ensure that the emissions remain below the manufacturer's guarantee.

6.3.4 Landfill Flares

Landfill Gas emissions from the capped section of GTLF are currently collected and directed to 5 landfill flares. The combustion of LFG in these flares reduce the Greenhouse Gas impacts on the environment. The flares will be de-commissioned when the proposed enclosed Landfill Gas Flare System becomes operational. when the Project is commissioned. To be conservative, the emissions from these flares are included in the maximum future emissions assessment to allow for the potential overlap in EFW stack emissions in addition to the landfill flares. Details of the flares, along with its emission estimates are provided in Table 5.

6.3.5 Landfill Gas Flare

A dedicated enclosed Landfill Gas Flare system is proposed to flare excess landfill gas during the operational phase of the Project. The Landfill Gas Flare can handle a maximum flowrate of 500 Nm^3/hr. Details of this flare, along with its emission estimates are provided in Table 6.

6.3.6 Medical Waste Incinerator

An existing medial waste incinerator (MWI) was included in the background NOx emissions assessment, discussed in Appendix C. The incinerator processes about 6,400 pounds of waste in one batch and the burn and cooldown cycle lasts about 24 hours. The site operates 2 batches per week to process the current inflow of medical waste. The Project will include a replacement of the existing Medical Waste Incinerator, in kind. Emissions information for current MWI is not available nor is info on operational practices. The operations of the MWI under the operation of the Project will follow standard protocols. The emissions from this source will be relocated with a new exhaust stack towards the northern to the eastern section of the Site. See Table C.5 for details of the emission estimate and source parameters.

6.3.7 Haul Road within ISWMS

Currently, the road to unload material at the existing facility is predominantly unpaved. A paved haul road will be constructed from the ISWMS entrance to the ERF to facilitate movement of traffic. Paving the onsite roads will significantly reduce potential emissions from the road as a source. The formula 13.2.1.3 (2) from AP-42 was used to estimate the road particulate emissions. This formula takes into account the number of days in a year that had rain, since the resuspension of particulates on a rainy day would be negligible. A rain day is defined to be any day with at least 0.01 inches of rain, and this information was sources from "The Cayman Islands' Compendium of Statistics 2021". The ISWMS Facility plans on implementing a fugitive dust management program that will be outlined in the EMP to control particulate emissions from the haul roads. Details of the emissions factor and parameters used for estimating emission rates are mentioned under Table 7.

7. Dispersion Modelling

This section provides a description of how the dispersion modelling was conducted for the Project to calculate the maximum concentration at a point of impact, and for comparison to the monitored background concentrations. The Assessment for this Project was carried out using AERMOD, one of the United States Environmental Protection Agency's (USEPA) preferred and recommended atmospheric dispersion models. The AERMOD modelling system includes the Plume Rise Model Enhancements (PRIME) algorithms for assessing the effects of buildings on air dispersion.

The AERMOD modelling system is made up of the AERMOD dispersion model, the AERMET meteorological pre-processor and the AERMAP terrain pre-processor. The following dispersion model and pre-processors were used in the assessment:

- AERMOD dispersion model (v. 22112)
- AERMAP surface pre-processor (v. 18081)
- BPIP building downwash pre-processor (v. 04274)

A summary of the AERMOD source input parameters is provided in Appendix F.

Same structure contamination was not considered. General building vents, roof exhausts, building heating, ventilation, and air conditioning were considered as negligible sources and not considered as a part of this modelling Assessment.

7.1 Co-ordinate System

The Universal Transverse Mercator (UTM) coordinate system was used to specify model object sources, buildings, and receptors. All coordinates were defined in the North American Datum of 1983 (NAD83), zone 17 north.

7.2 Meteorology

7.2.1 Meteorological Records

The Owen Roberts International Airport is the nearest meteorological station with available hourly meteorological data. Data for this station was retrieved from the US National Oceanic and Atmospheric Administration (NOAA) Integrated Surface Database (ISD; also referred to as theTD-3505 ISHD full archival format) for review. The Owen Roberts station is identified as ID 783840-11813 in the ISD. Data from 2011 to 2020 was retrieved and reviewed.

Review of the Owen Roberts station data indicated that the ISD data was incomplete since approximately 35% of total records were missing. Nighttime-hours represented the majority of the missing-hours, typically the eight-hour span between 10 PM and 6 AM. Nighttime-hours typically have cooler conditions resulting in more calm and low wind conditions.

Some data elements were also determined to be missing from otherwise complete hourly records. These missing elements varied randomly and at different rates. Missing elements included: wind speed, wind direction, temperature, humidity, pressure, cloud cover and precipitation.

As a result of the review, the ISD data was not used. A wind rose plot of the Owen Roberts station data is provided as Figure 5.

7.2.2 Prognostic Meteorological Data

Due to the incompleteness of the Owen Roberts data, prognostic meteorological data was used instead. AERMET-ready data was acquired from Lakes Environmental Software. The simulation data was produce using the Weather Research and Forecasting (WRF) model and further processed using the USEPA Mesoscale Model Interface Program (MMIF) for use with the AERMET meteorological preprocessor (surface .DAT and upper air .FSL files). The prognostic WRF data was generated with the following parameters:

– Center Point: Latitude, 19.311 N; Longitude, 81.374 W
– WRF Grid Cell: 4 km x 4 km
– Start/End Data: January 1, 2017 hour 00 to December 31, 2021 hour 23
– Datum: WGS 84
– UTM Zone: 17

A wind rose of the Prognostic data is provided in Figure 6. A comparison of Figures 5 and 6 shows similar distributions of wind directions and wind speeds. The Prognostic data set is a therefore a reasonable data set to use for this Assessment.

7.2.3 Land Use Preprocessing

Land use was extracted from the Global Land Cover Characterization (GLCC) dataset for use in calculating the surface characteristics (albedo, Bowen ratio, surface roughness) surrounding the facility using AERSURFACE v.20060. Surface characteristics were calculated on a monthly basis and for the maximum number of wind sectors. The AERMET output surface characteristics are tabulated in Appendix G.

7.2.4 AERMET Processing

The prognostic data was processed using AERMET v.22112 into AERMOD-ready surface (.SFC) and profile (.PFL) files.

7.3 Terrain

AERMOD captures the essential physics of dispersion in complex terrain though the use of a separate height scale factor for each receptor (USEPA, 1998 – AERMAP UG). The highest scale factor represents the terrain that would dominate flow in the vicinity of the receptor. The height scale factor that is used by AERMOD is generated by an AERMAP terrain pre-processor. AERMAP utilizes terrain data, or Digital Elevation Model (DEM) data in conjunction with a layout of receptors and sources to generate height scale factors that can be directly used in AERMOD. Terrain data used in this assessment was obtained from United States Geological Survey's Shuttle Radar Topography Mission (SRTM) 1 Arc-Second (~30m) Global data.

7.4 Receptors

For this Assessment two sets of receptor grids were used. One set for the simulation of background concentrations using existing emissions sources, and the second set for determining the maximum concentrations from the full-time operation of the Project.

For the modelling of background concentrations, a 5 km x 5 km uniform grid was used, with a uniform spacing of 500 m between each receptor. Uniform polar grid (5 rings with increments of 20 m, with 36 direction radials in increments of 10 degrees) receptors were also placed at the location of the background air monitoring stations. At the Site's property line, ground level receptors with a 20 m spacing was used to evaluate the maximum property boundary concentrations. No receptors were placed within the Site's property line.

The background concentrations modelling grid is provided in Appendix F. Figure F.1 shows the receptors used for modelling background concentrations.

For the determination of maximum concentrations due to emissions from the Site, a tiered receptor grid was defined starting with a rectangular boundary that encloses all the modelled sources (bounding box). A tiered grid was then defined starting from the edge of the bounding box with a fine resolution, to coarser resolutions further away. All tiered distances were defined relative to the bounding box. The receptor grid used is described as follows:

- 20 m spacing within 200 m of the edge of the bounding box
- 50 m spacing from 200 to 500 m
- 100 m spacing from 500 to 1,000 m
- 200 m spacing from 1,000 to 2,000 m
- 500 m spacing from 2,000 to 5,000 m
- 1000 m spacing from 5,000 m to 10, 000 m

Although the above tiered receptor grid would capture impacts at the sensitive receptors identified under Section 4.1.3, additional uniform polar grid receptors (5 rings with increments of 20 m, with 36 direction radials in increments of 10 degrees) were placed at all these sensitive receptors, except for the seven mile beach corridor. The above mentioned tiered receptor grid should sufficiently capture impacts along the seven-mile beach corridor.

The maximum concentrations modelling grid is provided in Appendix F. Figure F.2 and Figure F.3 shows the receptors used for modelling maximum concentrations.

7.5 Building Downwash

The Facility buildings were entered into the model using the USEPA Building Profile Input Program (BPIP-PRIME). The inputs into this pre-processor include the co-ordinates and heights of the buildings and stacks. The BPIP program was executed to evaluate any building cavity downwash effects. Cavity downwash can result in air contaminants being forced to ground level prematurely under certain meteorological conditions. The on-site buildings and structures were modelled with their respective average roof heights.

The PRIME plume rise algorithms include vertical wind shear calculations (important for buoyant releases from short stacks (i.e., stacks at release heights within the recirculation zones of the buildings). The PRIME algorithm also allows for the wind speed deficit factors to improve the accuracy of predicted concentrations within building wake zones that form in the lee of buildings.

The layout of the ISWMS facility used for the purpose of this Assessment is provided in Appendix D.

7.6 Deposition

AERMOD has the ability to account for wet and dry deposition of substances that would reduce ground level concentrations at points of impact. However, the deposition algorithm has not been implemented in this assessment and therefore, the predicted concentrations are considered to be more conservative.

7.7 Averaging Time and Conversions

The shortest time scale that AERMOD predicts is a 1-hour average value. Many of the standards are based on 1-hour, 24-hour, and annual averaging times, which are averaging times that can also be calculated by AERMOD. In cases where a standard has an averaging period less than 1-hour (e.g., 10-minute), a conversion to the appropriate averaging period was completed using the Ontario's Ministry of the Environment, Conservation and Parks recommended conversion factors, as documented in the Air Dispersion Modelling Guideline for Ontario (Guideline A-11) Version 3.0.

8. Modelling Results and Discussion

The estimated emissions for background sources of NO_x and the estimated Project emissions, as described in Section 4 and Section 5, were used in the AERMOD modelling, as described in Section 6. This Section provides a discussion of the results of the background NO_x modelling and the future Project emissions modelling. The existing background NO_x emissions model results are compared with the background monitoring results for NO_x. The future Project model results, including the addition of the background air contaminant concentrations, are compared with the air quality standards listed in Table 1.

8.1 Background Emissions

The modelled 90th percentile NO_x (as NO_2) results were compared to the measured background monitoring values. A summary of which is shown in Table 8. The modelled 90th percentile results are consistent with the measured values at each monitoring station.

8.2 Project Operation

The modelled maximum off-site contaminant concentrations from the Project were added to the measured background concentration (Table 3) for each air contaminant to obtain the cumulative impact. The off-site concentrations from the Project are conservatively based on the highest modelled values for the maximum potential emission rates. The data was not refined to remove any meteorological anomalies or to apply any statistics. The cumulative concentrations (modelled Project concentration plus background) were compared to the appropriate limits (Table 1) for compliance. A summary of the results is shown under Table 9.

All contaminants are shown to have a cumulative concentration that is below the applicable air quality standard. This shows that the implementation of the Project will not result in any air quality exceedances.

Dioxins and Furans (PCDD/PCDF)

PCDD/PCDF are expected contaminants from the ERF stack. The PCDD/PCDF concentrations were assessed with background concentrations and maximum potential emissions from the ERF stack. The Project emissions contribute up to 54% of the cumulative concentration.

There are no ambient air quality limits for dioxins and furans in the **UK National Air Quality Objectives**, therefore the air quality standard from Ontario, Canada is used instead. With the Project in full operation, the PCDD/PCDF cumulative concentration is 23% of the defined air quality standard limit.

Particulate Matter

PM_{10} and $PM_{2.5}$ are expected contaminants from the EFR stack and from the haul roads. The haul roads are located close to the Site property line and therefore the maximum cumulative concentrations of PM are observed to occur directly on the property line and contribution is dominated by the haul road emission source. The Project emissions contribute up to 61% of the daily and 38% of the annual cumulative concentrations of PM_{10}.

The cumulative concentration from the background air quality and the future project are shown to be below the **UK National Air Quality Objectives** for both the 24-hour and annual standards. The cumulative concentrations for PM_{10} are 81% of the 24-hour limit and 77% of the annual limit. The cumulative concentration for $PM_{2.5}$ is 40% of the annual limit.

Hydrogen Chloride

HCl is an expected contaminant from the ERF stack. The HCl concentrations were assessed with background concentrations and maximum potential emissions from the ERF stack. The Project emissions contribute up to 7% of the cumulative concentration. The 1-hour maximum cumulative concentration is 5% of the air quality standard limit.

Hydrogen Fluoride

HF is an expected contaminant from the ERF stack. The HF concentrations were assessed with background concentrations and maximum potential emissions from the ERF stack. The Project emissions contribute up to 1% of the hourly and less than 1% of the annual cumulative concentrations. The 1-hour maximum cumulative concentration is 14% and the annual maximum cumulative concentration is 44% of the air quality standard limit.

Sulphur Dioxide

SO_2 is an expected contaminant from the ERF stack and the future landfill gas enclosed flare. The SO_2 concentrations were assessed with background concentrations and maximum potential emissions from the Project. The Project emissions contribute up to 19% of the 15-minute, 47% of the hourly, and 40% of the daily cumulative concentrations. Of the three SO_2 air quality standard limits, the highest percent of limit that SO_2 reaches is 36% of the 15-minute limit.

Oxides of Nitrogen

NO_2 is an expected contaminant from the ERF stack, the future landfill gas enclosed flare, and the existing landfill flares. Assessment of the maximum NO_2 emissions included both the flare types to allow for overlap between the decommissioning of the existing flares and the installation of the new flare. The NO_2 concentrations were assessed with background concentrations and maximum potential emissions from the Project. The Project emissions contribute up to 70% of the hourly and 41% of the annual cumulative concentrations. The 1-hour maximum cumulative concentration is 83% and the annual cumulative concentration is 54% of the air quality standard limit.

Carbon Monoxide

CO is an expected contaminant from the ERF stack, the future landfill gas enclosed flare, and the existing landfill flares. Assessment of the maximum CO emissions included both the flare types to allow for overlap between the decommissioning of the existing flares and the installation of the new flare. The CO concentrations were assessed with background concentrations and maximum potential emissions from the Project. The Project emissions contribute up to 13% of the cumulative concentration. The existing landfill flares are the highest contributors to this maximum concentration. This concentration is 26% of the air quality standard limit.

Heavy Metals

The CoPCs, defined in Section 2.3, includes twelve metals that may emit from the ERF activities. For the purpose of detailed monitoring and assessment, four metals were selected as the worst-case metals that have the lowest emission standards to compare against. Cadmium, arsenic, lead, and nickel are therefore assessed as the most stringent air quality standard metals.

Background monitoring for these metals showed that ambient concentrations are very low. Emissions from the ERF stack contribute between 65% to 83% of the cumulative concentration for each of these metals. Of the four metal air quality standard limits, the highest percent of limit is 86% for arsenic.

9. Conclusions

This Assessment was prepared to provide an assessment of the air quality impacts resulting from the proposed Project.

Background monitoring was conducted in the Study Area to determine site-specific background air quality data for contaminants of concern. Using emission estimates and dispersion modelling, a theoretical background emissions assessment for NO_2 was conducted and compared to the results of the NO_2 monitoring program. The calculated assessment demonstrated similar background concentrations to the measured concentrations, thereby demonstrating the reliability of the monitoring program results.

Existing air quality in the Study Area was shown to be in compliance with the applicable air quality standards with one exception of an odour-based standard for H_2S. This outlier is further explained in the odour assessment documented in the Air Monitoring Report.

The potential impacts of the proposed Project on local air quality were assessed by modelling the estimated maximum emissions of each contaminant to determine the maximum potential concentration of each contaminant that could occur off-site of the property. The cumulative air quality impacts that included the determined background concentrations were compared to relevant standards and guidelines and to the existing air quality conditions.

The results of this Assessment showed increased contaminant concentrations due to the additional emissions from the Project. The contaminants with the most significant increase are the metals due to the background monitoring not detecting significant background concentrations. All cumulative impacts are shown to be below the air quality standards. The standard values of pollutants used as reference for this assessment are protective of human health.

LEGEND

PROPERTY BOUNDARY

0 500 1000 1500m

1:50000

Coordinate System: UTM, Nad83, Zone 17F

N

GHD

DART
GEORGE TOWN, GRAND CAYMAN ISLAND
QUANTITATIVE AIR QUALITY ASSESSMENT REPORT

KEY SENSITIVE RECEPTORS

Project No. 12563972
Date June 2023

FIGURE 1

Filename: N:\CA\Whitby\Projects\401\12563972\Digital_Design\ACAD\Figures\RPT003\12563972-GHD-00-00-RPT-EN-D101_WA-003.dwg
Plot Date: 06 June 2023 4:52 PM

Source: Image ©2022 Google (Imagery Date 5/11/2023)

Coordinate System: UTM, Nad83, Zone 17F

GHD

DART
GEORGE TOWN, GRAND CAYMAN ISLAND
QUANTITATIVE AIR QUALITY ASSESSMENT REPORT

Project No. 12563972
Date July 2023

POTENTIAL EMISSION SOURCES

FIGURE 2

Filename: N:\CA\Whitby\Projects\401\12563972\Digital_Design\ACAD\Figures\RPT003\12563972-GHD-00-00-RPT-EN-D102_WA-003.dwg
Plot Date: 17 July 2023 11:00 AM

Source: Image ©2022 Google (Imagery Date 5/11/2023)

LEGEND

PROPERTY BOUNDARY

AIR MONITORING STATION LOCATION

SAMPLES

- PASSIVE (NO_2, SO_2)
- CONTINUOUS (PM10)
- CONTINUOUS (H_2S)
- CONTINUOUS (NO_x, SO_2, CO, PM2.5)
- NON-CONTINUOUS (PM10, METALS, HCl/HF, DIOXINS AND FURANS, PAH, VOC)
- METEOROLOGY

0 500 1000 1500m

1:50000

Coordinate System:
UTM, Nad83, Zone 17F

N

DART
GEORGE TOWN, GRAND CAYMAN ISLAND
QUANTITATIVE AIR QUALITY ASSESSMENT REPORT

PARAMETERS AND LOCATIONS FOR MONITORING

Project No. **12563972**
Date **July 2023**

FIGURE 3

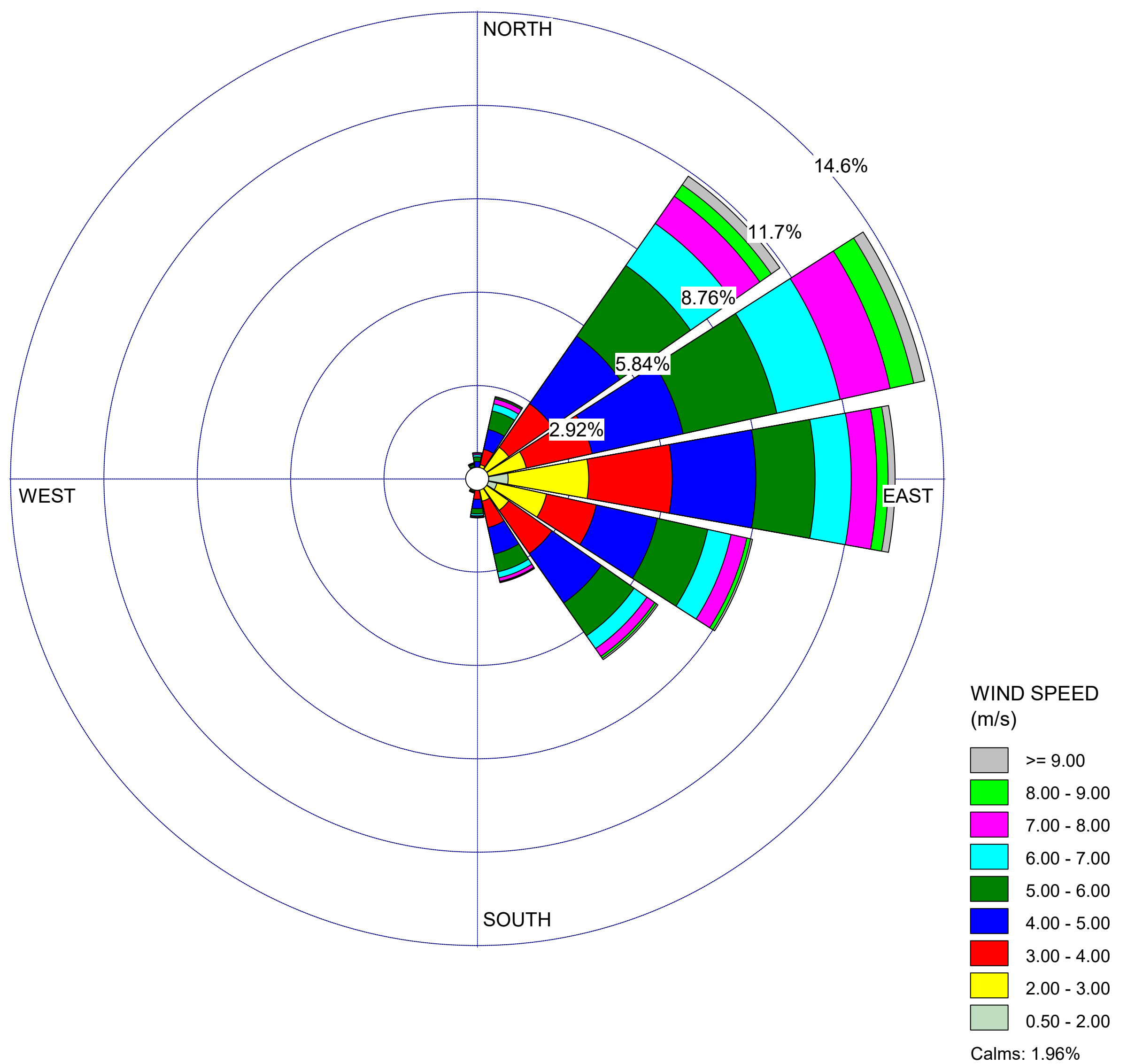
Filename: N:\CA\Whitby\Projects\401\12563972\Digital_Design\ACAD\Figures\RPT003\12563972-GHD-00-00-RPT-EN-D103_WA-003.dwg
Plot Date: 17 July 2023 11:03 AM

Source: Image ©2022 Google (Imagery Date 5/11/2023)

Figure 5

Wind Rose Plot
Owen Roberts AP - 2011 to 2020

DISPLAY:
Wind Speed
Direction (blowing from)



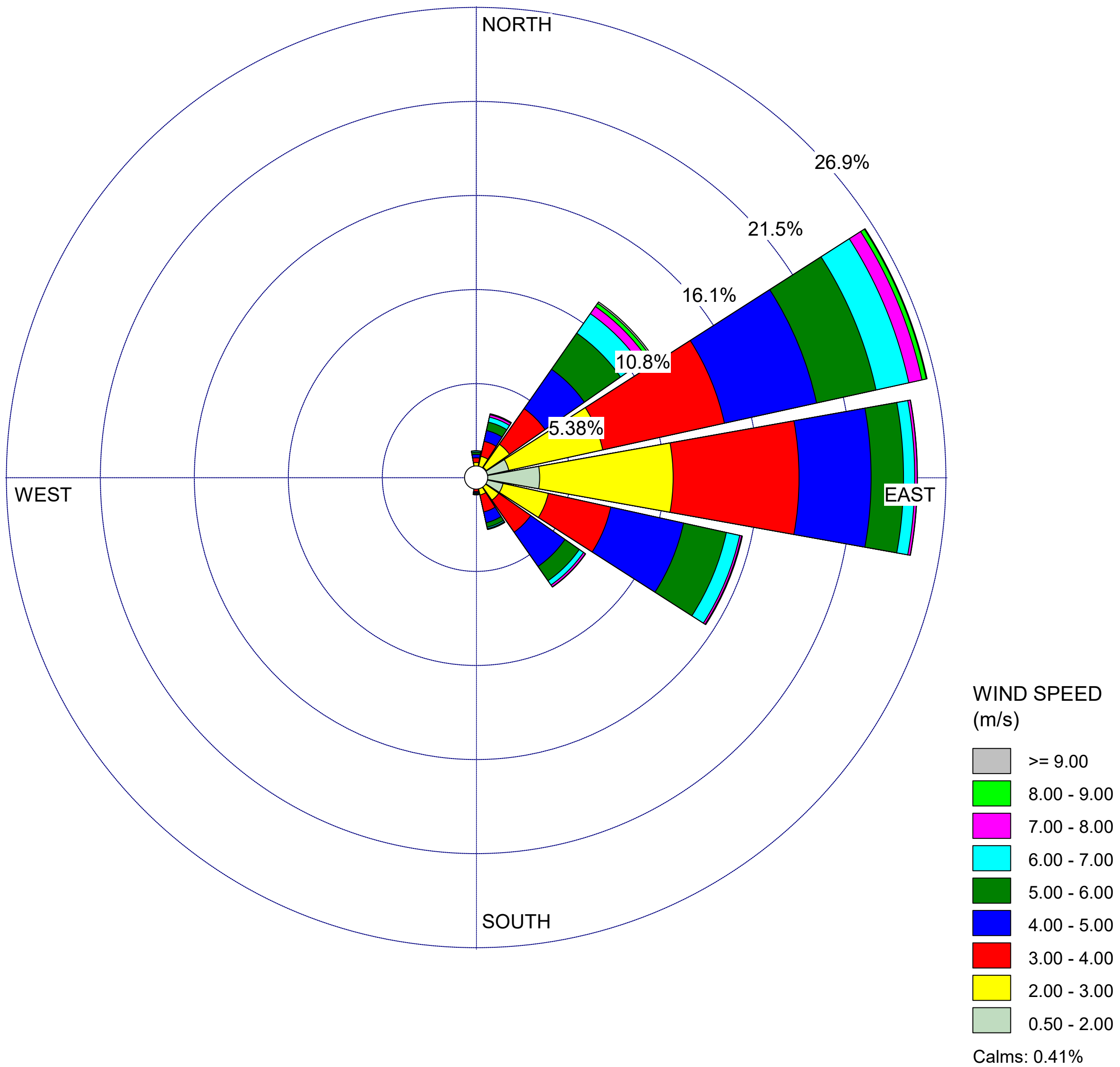
COMMENTS:	DATA PERIOD:	COMPANY NAME:	
Source: NOAA	**Start Date: 1/1/2011 - 01:00** **End Date: 12/31/2020 - 23:59**	**Energy Recovery Facility, Georgetown, Cayman Islands**	
		MODELER: **GHD**	GHD
	CALM WINDS: **1.96%**	TOTAL COUNT: **57066 hrs.**	
	AVG. WIND SPEED: **4.46 m/s**	DATE: **1/25/2023**	PROJECT NO.: **11263972**

WRPLOT View - Lakes Environmental Software

Figure 6

Wind Rose Plot
WRF/MMIF Prognostic Data - 2017 to 2021

DISPLAY:
Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
Source: Lakes Environmental Software	**Start Date: 1/1/2017 - 00:00** **End Date: 12/31/2021 - 23:59**	**Energy Recovery Facility, Georgetown, Cayman Islands**	
		MODELER: **GHD**	
	CALM WINDS: **0.41%**	TOTAL COUNT: **43824 hrs.**	
	AVG. WIND SPEED: **3.78 m/s**	DATE: **1/25/2023**	PROJECT NO.: **11263972**

Table 1

Summary of Applicable Air Quality Standards and Averaging Periods

Category	Contaminant	CAS#	Averaging Period	Compliance Limit	Standard [1]
Contaminants of Potential Concern (CoPCs) [9]	Carbon Monoxide (CO)	630-08-0	8 Hour running average across a 24 hour period	10 mg/m^3	AAD Limit Value and AQS Objective
	Nitrogen Dioxide (NO_2)	11104-93-1	1 Hour	200 µg/m^3 (2)	AAD Limit Value
	Nitrogen Dioxide (NO_2)	11104-93-1	Annual	40 µg/m^3	AAD Limit Value
	Particulates (PM10)	NA - 1	24 Hour	50 µg/m^3 (3)	AAD Limit Value
	Particulates (PM10)	NA - 1	Annual	40 µg/m^3	AAD Limit Value
	Particulates (PM2.5)	NA - 2	Annual	20 µg/m^3 (10)	AAD Limit Value
	Sulphur Dioxide (SO_2)	7446-09-5	1 Hour	350 µg/m^3 (4)	AAD Limit Value
	Sulphur Dioxide (SO_2)	7446-09-5	24 hour	125 µg/m^3 (5)	AAD Limit Value
	Sulphur Dioxide (SO_2)	7446-09-5	15-Minute Mean	266 µg/m^3 (6)	UK AQS Objective
	Hydrogen Chloride (HCl)	7647-01-0	Hourly Limit in µg/m3	750 µg/m^3	EAL
	Hydrogen Fluoride (HF)	7664-39-3	Monthly	16 µg/m^3	EAL
	Hydrogen Fluoride (HF)	7664-39-3	Hourly Limit in µg/m^3	160 µg/m^3	EAL
	Cadmium (Cd)	7440-43-9	Annual	5 ng/m^3	AAD Target Value
	Arsenic (As)	7440-38-2	Annual	6 ng/m^3	AAD Target Value
	Lead (Pb)	7439-92-1	Annual	0.25 µg/m^3	UK AQS Objective
	Nickel (Ni)	7440-02-0	Annual	20 ng/m^3	AAD Target Value
	Dioxins and Furans [7]	NA - 3	24 Hour	0.1 pg TEQ/m^3	AAQC
Additional contaminants included for background monitoring assessment [8]	Polycyclic Aromatic Hydrocarbons (PAHs) [8]	50-32-8	Annual	0.25 ng/m^3 of benzo(a)pyrene (BaP) total content within the PM10 fraction	UK AQS Objective
	Volatile Organic Carbon (VOCs) (Benzene) [8]	71-43-2	Annual-Running Mean	5 µg/m^3	EAL
	Volatile Organic Carbon (VOCs) (Benzene) [8]	71-43-2	24 Hour	30 µg/m^3	EAL
	Hydrogen Sulphide [7, 8]	7783-06-4	10 Minute	13 µg/m^3	AAQC

Notes:

(1) Reporting Standards sourced from National Air Quality objectives and European Directive limit and target values 'or the protection of human health (applicable to the UK).
https://uk-air.defra.gov.uk/assets/documents/Air_Quality_Objectives_Update.pdf
(2) NO_2 not to be exceeded more than 18 times a year.
(3) PM_{10} (24 hour average) not to be exceeded more than 35 times a year.
(4) SO_2 (1 hour average) not to be exceeded more than 24 times a year.
(5) SO2 (24 hour average) not to be exceeded more than 4 times a year.
(6) SO2 (15 minute average) not to be exceeded more than 35 times a year.
(7) Reporting Standards for Hydrogen Sulphide (odour based) and Dioxins and Furans were sourced from "The Ministry of the Environment, Conservation and Parks" of Ontario, Canada.
https://www.ontario.ca/page/ontarios-ambient-air-quality-criteria#section-4
(8) These contaminants were measured for the background air quality assessment, however are not included in the Project modelling due to the Project not being expected to emit these contaminants.
(9) CoPCs were defined in the Terms of Reference and Air Quality Method Statement. Total dust is assessed using Particulates (PM_{10} and $PM_{2.5}$). VOCs and TOCs represent a grouping of substances and does not have applicable air quality standards to list in this table.
(10) The UK AAD Limit value for PM2.5 was updated in 2020 from 25 µg/m^3 to 20 µg/m^3. Therefore, the updated value was used as it is more conservative than the limit defined in the terms of reference.

EAL - Environmental Assessment Levels
AAD - Ambient Air Quality Directive
AQS - Air Quality Strategy Value
AAQC - Ambient Air Quality Criteria

Table 2

Industrial Emissions Limits for Energy Recovery Facilities

Pollutant	Emission Limit Values[1] (mg/Nm^3)
SOx	50
CO [3]	50
CO [4]	100
CO [5]	150
TOC	10
HCl	10
HF	1
NOx	200
TOC	10
Dust [2]	10
Cd Tl	Total 0.05
Hg	0.05
Sb As Pb Cr Co Cu Mn Ni V	Total 0.5
PCDD & PCDF	1.00E-07

Notes:

(1) Directive 2010/75/EU (Annex VI Part 3) of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control).
(2) Dust is assessed as PM_{10} and $PM_{2.5}$
(3) Daily average value
(4) Half-hour average value
(5) 10-minute average value

Table 3

Monitored Background Air Concentrations and Averaging Periods

Parameters	Station #	Station Name	CAS#	Averaging Period	Units	Background Concentration	Standard	% of the Standard
Carbon Monoxide 8 Hour Background Concentrations								
Carbon Monoxide (CO)	1	COX Lumber	630-08-0	8 Hour running average across a 24 hour period	(mg/m^3)	**2.258**	**10**	**23%**
Nitrogen Dioxide 1 Hour Background Concentrations								
Nitrogen Dioxide (NO_2) - CEMS	1	COX Lumber	11104-93-1	1 Hour	$\mu g/m^3$	14.340	200	7%
Nitrogen Dioxide (NO_2) - Passive	1	COX Lumber	11104-93-1	1 Hour	$\mu g/m^3$	20.559	200	10%
Nitrogen Dioxide (NO_2) - Passive	2	Paddington Place	11104-93-1	1 Hour	$\mu g/m^3$	82.805	200	41%
Nitrogen Dioxide (NO_2) - Passive	3	George Town Primary School	11104-93-1	1 Hour	$\mu g/m^3$	103.160	200	52%
Nitrogen Dioxide (NO_2) - Passive	4	OPY 20	11104-93-1	1 Hour	$\mu g/m^3$	68.625	200	34%
Nitrogen Dioxide (NO_2) - Passive	5	Lakeside	11104-93-1	1 Hour	$\mu g/m^3$	50.395	200	25%
Nitrogen Dioxide (NO_2) - Passive	6	Cayman International School	11104-93-1	1 Hour	$\mu g/m^3$	11.222	200	6%
Average	-	-	11104-93-1	1 Hour	$\mu g/m^3$	**50.158**	**200**	**25%**
Nitrogen Dioxide Annual Background Concentrations								
Nitrogen Dioxide (NO_2) - CEMS	1	COX Lumber	11104-93-1	Annual	$\mu g/m^3$	5.796	40	14%
Nitrogen Dioxide (NO_2) - Passive	1	COX Lumber	11104-93-1	Annual	$\mu g/m^3$	5.499	40	14%
Nitrogen Dioxide (NO_2) - Passive	2	Paddington Place	11104-93-1	Annual	$\mu g/m^3$	21.641	40	54%
Nitrogen Dioxide (NO_2) - Passive	3	George Town Primary School	11104-93-1	Annual	$\mu g/m^3$	25.990	40	65%
Nitrogen Dioxide (NO_2) - Passive	4	OPY 20	11104-93-1	Annual	$\mu g/m^3$	16.016	40	40%
Nitrogen Dioxide (NO_2) - Passive	5	Lakeside	11104-93-1	Annual	$\mu g/m^3$	11.228	40	28%
Nitrogen Dioxide (NO_2) - Passive	6	Cayman International School	11104-93-1	Annual	$\mu g/m^3$	2.509	40	6%
Average	-	-	11104-93-1	1 Hour	$\mu g/m^3$	**12.668**	**200**	**6%**
Particulates (PM10) 24 hour Background Concentrations								
Particulates (PM10) - Non-Continuous	1	COX Lumber	NA - M09	24 Hour	$\mu g/m^3$	31.215	50	62%
Particulates (PM10) - Continuous	4	OPY 20	NA - M09	24 Hour	$\mu g/m^3$	6.965	50	14%
Particulates (PM10) - Continuous	5	Lakeside	NA - M09	24 Hour	$\mu g/m^3$	8.915	50	18%
Average	-	-	NA - M09	24 Hour	$\mu g/m^3$	**15.698**	**50**	**31%**
Particulates (PM10) Annual Background Concentrations								
Particulates (PM10) - Non-Continuous	1	COX Lumber	NA - M09	Annual	$\mu g/m^3$	25.768	40	64%
Particulates (PM10) - Continuous	4	OPY 20	NA - M09	Annual	$\mu g/m^3$	14.948	40	37%
Particulates (PM10) - Continuous	5	Lakeside	NA - M09	Annual	$\mu g/m^3$	16.525	40	41%
Average	-	-	NA - M09	24 Hour	$\mu g/m^3$	**19.080**	**50**	**38%**
Particulates (PM2.5) Annual Background Concentrations								
Particulates (PM2.5)	1	COX Lumber	NA - M10	Annual	$\mu g/m^3$	**5.117**	**20**	**26%**
Sulphur Dioxide 1 Hour Background Concentrations								
Sulphur Dioxide (SO_2) - CEMS	1	COX Lumber	7446-09-5	1 Hour	$\mu g/m^3$	3.087	350	1%
Sulphur Dioxide (SO_2) - Passive	1	COX Lumber	7446-09-5	1 Hour	$\mu g/m^3$	17.932	350	5%
Sulphur Dioxide (SO_2) - Passive	2	Paddington Place	7446-09-5	1 Hour	$\mu g/m^3$	8.450	350	2%
Sulphur Dioxide (SO_2) - Passive	3	George Town Primary School	7446-09-5	1 Hour	$\mu g/m^3$	5.742	350	2%
Sulphur Dioxide (SO_2) - Passive	4	OPY 20	7446-09-5	1 Hour	$\mu g/m^3$	5.144	350	1%
Sulphur Dioxide (SO_2) - Passive	5	Lakeside	7446-09-5	1 Hour	$\mu g/m^3$	38.610	350	11%
Sulphur Dioxide (SO_2) - Passive	6	Cayman International School	7446-09-5	1 Hour	$\mu g/m^3$	15.960	350	5%
Average	-	-	7446-09-5	1 Hour	$\mu g/m^3$	**13.561**	**350**	**4%**
Sulphur Dioxide 24 Hour Background Concentrations								
Sulphur Dioxide (SO_2) - CEMS	1	COX Lumber	7446-09-5	24 hour	$\mu g/m^3$	1.268	125	1%
Sulphur Dioxide (SO_2) - Passive	1	COX Lumber	7446-09-5	24 hour	$\mu g/m^3$	17.515	125	14%
Sulphur Dioxide (SO_2) - Passive	2	Paddington Place	7446-09-5	24 hour	$\mu g/m^3$	7.423	125	6%
Sulphur Dioxide (SO_2) - Passive	3	George Town Primary School	7446-09-5	24 hour	$\mu g/m^3$	5.339	125	4%
Sulphur Dioxide (SO_2) - Passive	4	OPY 20	7446-09-5	24 hour	$\mu g/m^3$	3.795	125	3%
Sulphur Dioxide (SO_2) - Passive	5	Lakeside	7446-09-5	24 hour	$\mu g/m^3$	37.038	125	30%
Sulphur Dioxide (SO_2) - Passive	6	Cayman International School	7446-09-5	24 hour	$\mu g/m^3$	11.039	125	9%
Average	-	-	7446-09-5	1 Hour	$\mu g/m^3$	**11.917**	**350**	**3%**

Table 3

Monitored Background Air Concentrations and Averaging Periods

Parameters	Station #	Station Name	CAS#	Averaging Period	Units	Background Concentration	Standard	% of the Standard
Sulphur Dioxide 15 Min Background Concentrations								
Sulphur Dioxide (SO_2) - CEMS	1	COX Lumber	7446-09-5	15-Minute	μg/m^3	4.551	266	2%
Sulphur Dioxide (SO_2) - Passive	1	COX Lumber	7446-09-5	15-Minute	μg/m^3	119.325	266	45%
Sulphur Dioxide (SO_2) - Passive	2	Paddington Place	7446-09-5	15-Minute	μg/m^3	47.258	266	18%
Sulphur Dioxide (SO_2) - Passive	3	George Town Primary School	7446-09-5	15-Minute	μg/m^3	30.717	266	12%
Sulphur Dioxide (SO_2) - Passive	4	OPY 20	7446-09-5	15-Minute	μg/m^3	22.447	266	8%
Sulphur Dioxide (SO_2) - Passive	5	Lakeside	7446-09-5	15-Minute	μg/m^3	251.646	266	95%
Sulphur Dioxide (SO_2) - Passive	6	Cayman International School	7446-09-5	15-Minute	μg/m^3	64.979	266	24%
Average	-	-	7446-09-5	15-Minute	μg/m^3	**77.275**	**266**	**29%**
Hydrogen Chloride 1 Hour Background Concentrations								
Hydrogen Chloride (HCl)	1	COX Lumber	7647-01-0	1 Hour	μg/m^3	**32.279**	**750**	**4%**
Hydrogen Fluoride Annual Background Concentrations								
Hydrogen Fluoride (HF)	1	COX Lumber	7664-39-3	Annual	μg/m^3	**6.971**	**16**	**44%**
Hydrogen Fluoride 1 Hour Background Concentrations								
Hydrogen Fluoride (HF)	1	COX Lumber	7664-39-3	1 Hour	μg/m^3	**22.888**	**160**	**14%**
Metals Annual Background Concentrations								
Cadmium (Cd)	1	COX Lumber	NA-03	Annual	μg/m^3	**0.0002**	**5**	**0.003%**
Arsenic (As)	1	COX Lumber	NA-02	Annual	μg/m^3	**0.0018**	**6**	**0.031%**
Lead (Pb)	1	COX Lumber	NA-08	Annual	μg/m^3	**0.0020**	**0.25**	**0.816%**
Nickel (Ni)	1	COX Lumber	NA-11	Annual	μg/m^3	**0.0022**	**20**	**0.011%**
Polycyclic Aromatic Hydrocarbons (PAHs) Annual Background Concentrations								
PAHs (Benzo(a)Pyrene)	1	COX Lumber	50-32-8	Annual	ng/m^3	**0.0765**	**0.25**	**31%**
Volatile Organic Compounds Annual Background Concentrations								
VOCs (Benzene)	1	COX Lumber	71-43-2	Annual	μg/m^3	**0.503**	**5**	**10%**
Volatile Organic Compounds 1 Hour Background Concentrations								
VOCs (Benzene)	1	COX Lumber	71-43-2	1 Hour	μg/m^3	**1.587**	**30**	**5%**
Hydrogen Sulphide 10 Min Background Concentrations								
Hydrogen Sulphide	5	Lakeside	7783-06-4	10 Min	μg/m^3	**34.847**	**13**	**268%**
Hydrogen Sulphide	7	Laundry	7783-06-4	10 Min	μg/m^3	2.788	13	21%
Dioxin and Furans 24 Hour Background Concentrations								
Mid Point PCDD/F TEQ (WHO 2005)	1	COX Lumber	-	24	pgTEQ/m^3	**0.013**	**0.1**	**13%**

Notes:

(1) For the various parameters and their averaging periods (except for the annual averaging period), the 90th percentile value was used to represent the background concentration.
(2) For the various parameters for which the annual averaging period is applicable, the average of the entire sampling duration was used.
(3) PCDD/F - Polychlorinated Dibenzo-p-dioxins (PCDDs, Dioxins) and Polychlorinated Dibenzofurans (PCDFs, Furans),
(4) TEQ - Toxic equivalency of a dioxin or furan homologue to that of 2,3,7,8 PCDD.
(5) The background concentrations that are in BOLD font for each parameter, are the maximum from all the monitored stations.

Table 4

Estimated Pollutant Emission Rates
Main Stack at ERF

Pollutant	Emission Limit Values [4] (mg/Nm^3)	Gas Concentration [8] STP-Dry (mg/Nm^3)	Emission Rate (g/s)
SOx	50	50	6.54E-01
CO	100 [6]	100	1.31E+00
TOC	10	10	(5)
HCl	10	10	1.31E-01
HF	1	1	1.31E-02
NOx	200	200	2.62E+00
Dust	10	10	1.31E-01
Cd	Total 0.05	0.02	2.62E-04
Tl		0.02	2.62E-04
Hg	0.05	0.02	2.62E-04
Sb	Total 0.5	0.3	3.93E-03
As [7]		0.1 (7)	1.31E-03
Pb		0.3	3.93E-03
Cr		0.3	3.93E-03
Co		0.3	3.93E-03
Cu		0.3	3.93E-03
Mn		0.3	3.93E-03
Ni		0.3	3.93E-03
V		0.3	3.93E-03
PCDD & PCDF	1.00E-07	6.00E-08	7.85E-10

Stack Parameters

Stack UTM X Coordinate (m)	Stack UTM Y Coordinate (m)	Exhaust Flow rate (m^3/s)	Gas Exit Temperature (°C)	Stack Tip Inside Diameter (m)	Stack Tip Release Height (m above msl)
460836.68	2134829.23	24.982	141	1.3	44.58

Notes:

(1) Stack parameters and stack emissions were communicated by METKA, through their email on August 8, 2022. The stack concentration of Cd and Tl together is 0.05 (mg/Nm^3), but was conservatively assumed to be 0.05 (mg/Nm^3) each. Similarly the stack concentration of Sb, As, Pb, Cr, Co, Cu, Mn, Ni, and V together is 0.5 (mg/Nm3), but was conservatively assumed to be 0.5 (mg/Nm^3) each.
(2) Exhaust volumetric flow rate is 47,108 m^3/hr STP-Dry.
(3) As communicated by Iona Capital Ltd. in their email on December 23, 2022; the actual stack height is designed to be 41.23 m, but after grading and construction, the Stack Tip Release height is designed to be at 44.58 m above mean sea level. The Stack Tip Release height was adjusted in the dispersion model, such that it represented 44.58 m above mean sea level.
(4) Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control).
(5) In-stack limit only. Not included in dispersion modelling. See Report text for discussion.
(6) Half-hour average value selected to conservatively assess CO emissions against 8 hour average air standard
(7) Although the emission limit value for Arsenic is a cumulative limit for the group of heavy metals, the manufacturer has provided that measurements from other plants have shown arsenic concentrations well below 0.1 mg/m^3
(8) Some concentrations limited by the BAT conclusions (WI-BREF 2019) - See Appendix C.

Table 5

Estimated Emission Rates - Passive Vent Flares on the Landfill

Make and Model of Passive Vent Flare	Landfill Gas Flow Rate per Vent(Nm^3/hr)	NOx Emission Factor (kg/10^6m3 methane) [1]	CO Emission Factor (kg/10^6m3 methane) [1]	NOx Emission Rate [2] (g/s)	CO Emission Rate [2] (g/s)
Solar Spark Flare CF-5	153	650	1.20E+04	0.015	0.281

Stack Parameters

Source ID	Stack UTM X Coordinate (m)	Stack UTM Y Coordinate (m)	Gas Exit Flow rate [3] (m^3/s)	Gas Exit Temperature [4] (°C)	Stack Tip Inside Diameter (m)	Effective Release Height (m)
FLARE1	460726.97	2135220.77	0.043	350	0.038	3.626
FLARE2	460661.81	2135308.15	0.043	350	0.038	3.626
FLARE3	460746.13	2135345.71	0.043	350	0.038	3.626
FLARE4	460791.35	2135271.36	0.043	350	0.038	3.626
FLARE5	460807.44	2135183.22	0.043	350	0.038	3.626

Notes:

(1) Emission factors used as provided by USEPA AP-42 in Chapter 2.4, Table 2.4.2 (1998) for landfill gas flares as these are the factors with the highest data quality available.
(2) The emission rates have been determined based on an estimated 55% methane in biogas
(3) A reasonably conservative assumption of maximum design flow rate was used.
(4) A typical open flare specification can range from 350-950°C. The lowest temperature of 350°C is used as the conservative value.

Table 6

Estimated Emission Rates - Landfill Gas Flare

Maximum Biogas Flow Rate **500** Nm^3/hr

Compound	CAS No.	Emission Factor (kg/10^6m^3 methane) (1)	Concentration in Biogas mg/Nm^3	Estimated Maximum Emission Rate for Flare (S3) (g/s) (2)
Carbon Monoxide	630-08-0	1.20E+04	-	9.17E-01
Nitrogen Oxides	10102-44-0	6.50E+02	-	4.97E-02
Sulphur Dioxide	7446-09-5		50	6.94E-03

Stack Parameters

Source ID	Stack UTM X Coordinate (m)	Stack UTM Y Coordinate (m)	Gas Exit Flow rate (m^3/s)	Gas Exit Temperature (°C)	Stack Tip Inside Diameter (m)	Release Height (m)
STCK17	460932.21	2134956.19	0.139	875	1	10

Notes:
(1) Emission factors used as provided by USEPA AP-42 in Chapter 2.4, Table 2.4.2 (1998) for landfill gas flares as these are the factors with the highest data quality available.
(2) The emission rates have been determined based on an estimated 55% methane in biogas
(3) The concentration of SO_2 is based on the 50 mg/Nm^3 SOx emission limit from Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control).

Table 7

Estimated Particulate Emission Rates - Future Paved Haul Route within ISWMS

Variable or Constant	$PM_{2.5}$	PM_{10}
k (g/VKT)	1.1	4.6
sL (Silt Loading)[1]	0.33	0.33

Formula (AP-42 13.2.1.3 (2)):
EF(g/VKT) = [k * (sL)^0.91 * (W)^1.02] *(1-P/4N) * (100% - CE)
Where P = 138 (number of days in a year with at least 0.254 mm (0.01 in) of precipitation.)
N = 365 days in a year
CE = 50% Control Efficiency

		Emission Factors	
Truck Route	**W - Mean Vehicle Weight of Haul Truck (ton)**	**PM_{10} (g/VKT)**	**$PM_{2.5}$ (g/VKT)**
ISWMS			
Entrance->Tipping Face	13	1.05E+01	2.50E+00

Estimated Particulate Emission Rates - Haul Route within ISWMS
ER(g/s) = EF(g/VKT) * # of trips * Distance (km) / (3600 s/hr)

Distance from Entrance to Tipping Face (km) = 0.61

		Hourly Emission Rates	
Truck Route	**# of One-way Trips per hour**	**PM_{10} (g/s)**	**$PM_{2.5}$ (g/s)**
ISWMS			
Entrance->Tipping Face	26	4.59E-02	1.10E-02

Notes:

(1) The paved road surface silt loadings from Site C of Reference 31 and Commercial/Industrial roads of Reference 8 from Emission Factor Documentation for Ap-42 Section 13.2.1 (January, 2011) were averaged to get a representative silt loading for this Facility.
https://www.epa.gov/sites/default/files/2020-10/documents/emission_factor_documentation_for_ap-42_section_13.2.1_paved_roads_.pdf
(2) Tailpipe particulate emissions have not been included as they are insignificant when compared to road dust emissions.
(3) The Mean Vehicle Weight was estimated using a weighted average of the truck traffic data for the month of October in the year 2022.
(4) The number of rain days data was obtained from "The Cayman Islands' Compendium of Statistics 2021". The average number of rain days from the years 2017 through 2021 was used.
(5) According to the State of Utah Department of Environmental Quality Guidelines memo (January 12, 2015), a control efficiency of 95% can be achieved through vacuum sweeping and watering of paved roads.
https://documents.deq.utah.gov/air-quality/permitting/operating-permits/DAQ-2015-020242.pdf

Table 8

Measured and Modelled NO_2 Background Concentrations (1 hour averaging)

Station #	Station Name	Units	Measured Background Concentration (90th Percentile)	Modelled Background Concentration (90th Percentile) [1]	Modelled Concentrations by Source Group [1]					
					Roads	Airport	Port	CUC	Hot Mix Asphalt & Concrete Batch Mixers	Small Boilers
1	Cox Lumber	$\mu g/m^3$	20.559	65.076	4.702	0.952	9.621	40.584	3.074	1.528
2	Paddington Place	$\mu g/m^3$	82.805	71.503	14.567	2.274	4.721	46.165	3.206	1.811
3	George Town Primary School	$\mu g/m^3$	103.160	63.935	8.169	2.750	6.278	42.912	2.030	0.908
4	OPY 20	$\mu g/m^3$	68.625	69.229	1.843	2.362	9.555	52.171	1.618	0.390
5	Lakeside	$\mu g/m^3$	50.395	72.757	16.621	0.512	6.942	41.177	1.808	3.525
6	Cayman International School	$\mu g/m^3$	11.222	14.764	0.000	0.013	4.366	3.519	0.062	0.240

Notes:
(1) A 1 km polar grid receptor was set at the location of each monitoring station. The 90th percentile modelled results at each of these polar receptors were averaged and represented here.

Table 9

Maximum Concentrations from the Project, Including Background Concentration

Parameters	CAS#	Averaging Period	Units	Project Concentrations [1]	Background Concentration	Cumulative Concentration	Project Contribution to Cumulative	Limit	% of Limit
Carbon Monoxide (CO)	630-08-0	8 Hour	mg/m^3	0.34	2.26	2.60	13%	10	26%
Nitrogen Dioxide (NO_2)	11104-93-1	1 Hour	$\mu g/m^3$	116	50	166	70%	200	83%
Nitrogen Dioxide (NO_2)	11104-93-1	Annual	$\mu g/m^3$	8.9	12.7	21.5	41%	40	54%
Particulates (PM10)	NA - 1	24 Hour	$\mu g/m^3$	25	16	40	61%	50	81%
Particulates (PM10)	NA - 1	Annual	$\mu g/m^3$	12	19	31	38%	40	77%
Particulates (PM2.5)	NA - 2	Annual	$\mu g/m^3$	2.8	5.1	7.9	35%	20	40%
Sulphur Dioxide (SO_2)	7446-09-5	1 Hour	$\mu g/m^3$	12	14	26	47%	350	7%
Sulphur Dioxide (SO_2)	7446-09-5	24 hour	$\mu g/m^3$	8.0	11.9	19.9	40%	125	16%
Sulphur Dioxide (SO_2)	7446-09-5	15-Minute Mean	$\mu g/m^3$	18	77	95	19%	266	36%
Hydrogen Chloride (HCl)	7647-01-0	1 Hour	$\mu g/m^3$	2.4	32.3	34.6	7%	750	5%
Hydrogen Fluoride (HF)	7664-39-3	Annual	$\mu g/m^3$	0.033	6.971	7.004	0.5%	16	44%
Hydrogen Fluoride (HF)	7664-39-3	1 Hour	$\mu g/m^3$	0.24	22.89	23.12	1%	160	14%
Cadmium (Cd)	7440-43-9	Annual	$\mu g/m^3$	0.0007	0.0002	0.0008	80%	0.005	17%
Arsenic (As)	7440-38-2	Annual	$\mu g/m^3$	0.003	0.002	0.005	65%	0.006	86%
Lead (Pb)	7439-92-1	Annual	$\mu g/m^3$	0.010	0.002	0.012	83%	0.25	5%
Nickel (Ni)	7440-02-0	Annual	$\mu g/m^3$	0.010	0.002	0.012	82%	0.02	61%
Dioxins and Furans	NA - 3	24 Hour	$pgTEQ/m^3$	0.009	0.013	0.023	41%	0.1	23%

(1) Concentrations are the maximum modelled values that occur. No data is removed from meteorological anomalies and no statistics are applied.

Appendices

Appendix A

Air Quality Method Statement

Technical Memorandum

September 07, 2021

To	Richard McAree (Dart), Martin Edelenbos (Dart)	**Tel**	519-884-0510
Copy to	Blair Shoniker, GHD	**Email**	gordon.reusing@ghd.com/ john.macrae@ghd.com
From	Gordon Reusing/John MacRae	**Ref. No.**	12500295-MEM-1
Subject	Revised Air Quality Method Statement		

1. Introduction

This Revised Air Quality Method Statement (Method Statement) describes the baseline monitoring of ambient air quality (Monitoring) that will occur in the local area of the George Town Landfill (GTLF) on Grand Cayman Island (Cayman) to support an Environmental Impact Assessment (EIA) for the proposed Integrated Solid Waste Management System (ISWMS).

The Method Statement is intended to address the **Responses to Comments - Review of the Integrated Solid Waste Management System for the Cayman Islands: Environmental Impact Assessment Final Draft Terms of Reference provided on 4 March 2021,** specifically with respect to Section 5: Air Quality. The Method Statement addresses the following comments:

– The locations of monitoring.
– The duration of monitoring.
– The key pollutants which will be monitored.
– The seasonality of the monitoring duration.
– Comprehensive and representative of baseline conditions.
– Current sources of key pollutants.
– Additional comments were received on August 26, 2021 from the Environmental Assessment Board (EAB) and their consultants, which have been considered in this revised Air Quality Method Statement.

1.1 Objective

The objective of the Monitoring will be to accurately measure the baseline concentrations of air contaminants in the area to determine existing conditions in support of the EIA for the ISWMS that will incorporate the following potential air emission sources:

– An Energy Recovery Facility (ERF) for the treatment of Municipal Solid Waste (MSW)

– A Green Waste Facility for outdoor processing (composting and mulching) of organic waste
– An End-of-Life Vehicle (ELV) and Scrap Metal Processing Facility
– A Construction and Demolition (C&D) Waste Facility
– A Bottom Ash Processing Facility
– A Medical Waste Processing Facility
– A Landfill Gas Facility
– A Residual Waste Landfill

Baseline air monitoring is necessary since air quality monitoring is not routinely undertaken on the Cayman Islands, and no data is publicly available on existing levels of air pollutants. The monitoring data will be used in conjunction with predictive dispersion modelling using the AERMOD dispersion model to determine the cumulative effects of the ISWMS.

2. Guidance

Cayman Islands is an overseas British Territory. Air quality guidance will therefore be referenced from the current EU Directives as noted in Table 5.30 of the ToR.

2.1 EU Industrial Emissions Directive (IED – 2010/75/EU)

As stated in the ToR, emissions in the Cayman Islands are guided by the **EU Industrial Emissions Directive (IED – 2010/75/EU)** which stipulates acceptable emission values to atmosphere for industry including waste incineration processes such as the ERF.

Chapter IV of the IED entitled **Special Provisions for Waste Incineration Plant and Waste Co-Incineration Plants** sets forth the guidance through which the emissions into air from waste incineration and waste co-incineration are to be monitored and the emission limit values that the monitored emissions shall not exceed. Based on Chapter IV, reference is made to Annex VI, Parts 3 and 4 that describe the parameters that should be monitored continuously and non-continuously from the emissions of these types of facilities. These parameters are as follows:

– Dioxins and Furans
– Total Dust
– Gaseous and vaporous organic substances (VOC) as Total Organic Carbon (TOC)
– Hydrogen Chloride (HCl)
– Hydrogen Fluoride (HF)
– Sulphur Dioxide (SO_2)
– Oxides of Nitrogen (NOx) expressed as NO_2
– Carbon Monoxide (CO)
– Heavy Metals:
  - Cadmium (Cd)
  - Thallium (Tl)
  - Mercury (Hg)
  - Antimony (Sb)
  - Arsenic (As)
  - Lead (Pb)
  - Chromium (Cr)

- Cobalt (Co)
- Copper (Cu)
- Manganese (Mn)
- Nickel (Ni)
- Vanadium (V)

Baseline monitoring should therefore include these compounds that will be attributable to the future ERF as well as local air emission sources.

2.2 Ambient Air Sampling Methods

The European Commission, acting through the European Committee for Standardisation (CEN) has produced a series of Standard Methods for monitoring air pollutants. These documents outline minimum performance requirements for analyzers, to ensure that measurement methods comply with the Data Quality Objectives (DQO) set down in the **Ambient Air Quality Directive (2008/50/EC)** and in the amending **Directive (EU) 2015/1480**. The current versions of these standards are listed below:

– EN14211:2012 Nitrogen Oxides

– EN14212:2012 Sulphur Dioxide

– EN14626:2012 Carbon Monoxide

– EN12341:2014 PM_{10} and $PM_{2.5}$
(EN16450:2017 Automatic PM analyzers)

– EN14662-1:2005 and 14662-3:2015 Benzene

– EN 14902:2005 'Standard method for measurement of Pb/Cd/As/Ni in the PM10 fraction of suspended particulate matter

The baseline monitoring will follow these standards.

2.2.1 UK Type Approval of Gaseous Analyzers: MCERTS

For gaseous analyzers, the Type Approval testing process is managed in the UK by the Environment Agency under its MCERTS scheme with certification provided by SIRA the appointed certification body. The MCERTS Performance Standards mirror the requirements of the CEN Standard Methods. The relevant performance standard for gases is: **MCERTS: Performance Standard for Continuous Ambient Air Quality Monitoring Systems**. This standard will be followed with regard to the Quality Assurance and Quality Control (QA/QC) of the continuous monitoring data.

2.2.2 UK Deployed Monitoring Methods

The techniques used for monitoring within the UK's national compliance monitoring network, the Automatic Urban and Rural Network (AURN) are summarized below. Except for the automatic PM10 analyzers, the reference methods of measurement are defined in the relevant EU Directives.

Based on this guidance the ambient air monitoring methods that will be used for the continuous monitoring of gaseous pollutants, and the methods that will be considered for continuous monitoring of dust (PM10 and PM2.5) will be as follows:

NO/NO_2	Chemiluminescence
SO_2	UV fluorescence
CO	IR Absorption

PM_{10} and $PM_{2.5}$	• Tapered Element Oscillating Microbalance • Beta Attenuation Monitor • Gravimetric Monitor • Filter Dynamics Measurement System (FDMS) • Optical Light Scattering • Fine Dust Analysis System (FIDAS)

2.3 Non-Continuous Methods

Since the Cayman Islands are located closer to the US and Canada than the UK, consideration needs to be given to the ways in which non-continuous samples that require external laboratory analysis are handled. Laboratories in the US and Canada are not normally accredited for EN or UK analytical approaches although they are essentially the same in most cases. Therefore, for the non-continuous methods that require laboratory analysis of samples, this program will utilize equivalent ambient air methods with analyses that are normally completed in North America due to hold times of samples. As such the following approaches for the non-continuous samples are based on North American references and methodologies. All ambient air samples will be analyzed by environmental laboratories that are accredited in the analysis of environmental air samples, namely, ALS Laboratory Group and Bureau Veritas.

2.3.1 Dust and Metals

Dust (PM10) and metals in the PM10 fraction will be determined by United States Environmental Protection Agency (USEPA) **Method IO-2.1 Sampling of Ambient Air for Total Suspended Particulate Matter (SPM) and PM10 Using High Volume (HV) Sampler**. Metals noted in Section 2.1 will be analyzed by **USEPA Method IO-3.5 Determination of Metals in Ambient Particulate Matter Using Inductively Coupled Plasma/Mass Spectrometry (ICP/MS).** Samples will be collected every 6 days for the baseline monitoring duration based on the North American schedule.

2.3.2 Hydrogen Chloride

A non-continuous method for measurement of acid gases is provided in the USEPA **Method OTM-40** that uses sorbent traps to collect acid gases with subsequent analysis by Ion Chromatography (IC). This approach will be modified to collect HCl and HF in ambient air for this project.

2.3.3 Dioxins and Furans and Polycyclic Aromatic Hydrocarbons (PAH)

A non-continuous method for measurement of dioxins and furans in ambient air is provided in the USEPA **Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air: Method TO-9A Determination of Polychlorinated, Polybrominated and Brominated/Chlorinated Dibenzo-p-Dioxins and Dibenzofurans in Ambient Air.** This non-continuous method uses a polyurethane foam plug or XAD-2 to capture dioxins and furans using a medium volume sampler. Laboratory analysis is by High Resolution Mass Spectroscopy (HR/MS). PAH can also be analyzed from the XAD-2 if required. Samples will be collected every 6 days for the baseline monitoring duration based on the North American schedule.

2.3.4 VOC and TOC

A non-continuous method for measurement of VOCs in ambient air is provided in the USEPA **Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air: Method TO-15 Determination of Volatile Organic Compounds (VOCs) in Air Collected in Specially Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS)**. This non-continuous method uses evacuated canisters to collect VOCs in ambient air and analyzes a specific list (TO-15) of toxic organic VOCs. TOC will be calculated as the total of the VOCs detected and reported as toluene.

VOC samples may also be analyzed for methane and other compounds associated with landfill odours. Samples will be collected every 6 days for the baseline monitoring duration based on the North American schedule.

2.3.5 Applicable Air Quality Standards and Averaging Periods

A summary table has been provided to detail the applicable air quality standards and averaging periods to which the baseline measurements will be compared. The summary is provided in Table 1. The values in Table 1 are the UK National Air Quality Standards.

2.4 Other Air Notable Air Contaminants Existing Conditions

Odour and bioaerosols l are assessed to determine existing conditions of the GTLF and local surrounding areas. Landfilling of organic wastes will significantly decrease after the ISWMA is operational, therefore odour is expected to decrease.

2.4.1 Odour Assessment

The assessment of odour for planning purposes is guided in the UK by the document entitled, **Guidance on the Assessment of Odour for Planning** (Institute of Air Quality Management July, 2018).

As per Section 3 of this document, the existing conditions of sources of odour will be determined as follows:

1. A description of existing baseline odour conditions (including complaints history if available).
2. A description of the location of receptors and their relative sensitivities to odour effects.
3. Details of potential odour sources (whether existing or proposed), including the activities and materials involved (including a brief outline of quantities, durations, methods of handling and storage, etc) and the resulting potential for generating odours, covering fugitive sources, diffuse sources and point sources as applicable.
4. A description of control/mitigation measures incorporated into the scheme (including management controls and, where appropriate, engineering controls).
5. A prediction or observation (or combination of both), using appropriate assessment tools, of the likely odour impact and resulting effects at relevant sensitive receptors, and taking into account:
    a. The likely magnitude of odour emissions (after control by measures incorporated into the scheme, if applicable).
    b. The meteorological characteristics at the site.
    c. The dispersion and dilution afforded by the pathway to the receptors and the resulting magnitude of odour that could result.
    d. The sensitivity of the receptors.
    e. The potential cumulative odour effects with any odours of a similar character.

Odour assessment surveys are guided by EN 264086 Parts 1 and 2. A combination of odour assessment tools will be used for determining the existing conditions as follows:

1. Sensory Assessment using field olfactometry (Nasal Ranger™ or equivalent) to measure the concentrations of existing landfill odours including all upwind sources (mangroves and WWTP) and all onsite sources including all processes currently in use.
2. Compound analysis of existing upwind and downwind H2S readings from the gold-film analyzers.

The measured odour values of point and area sources along with the inferred odour concentrations from collected H2S data will be used to determine existing conditions of odour as well as performing dispersion modelling using the AERMOD dispersion model to predict current odour concentrations at the sensitive receptors.

2.4.2 Bioaerosols

Bioaerosols were considered as part of the determination of existing conditions for the project. In consideration of the potential effect of bioaerosols at sensitive receptors the following UK guidance documents were referenced:

- **Technical Guidance Note (Monitoring) M9 Environmental Monitoring of Bioaerosols at Regulated Facilities, Environmental Agency, July 2018**
- **Occupational and Environmental Exposure to Bioaerosols from Composts and Potential Health Effects - A Critical Review of Published Data, 2003**
- **Guidance on the Evaluation of Bioaerosol Risk Assessments for Composting Facilities; Leeds University, 2008**
- **Site Specific Bioaerosol Risk Assessment, WRM, 2020**

Bioaerosols are found naturally within the environment. They consist of airborne particles that contain living organisms, such as bacteria, fungi and viruses or parts of living organisms, such as plant pollen, spores and endotoxins from bacterial cells or mycotoxins from fungi. The components of a bioaerosol range in size from around 0.02 to 100 micrometres (μm) in diameter. The size, density and shape of a bioaerosol will affect its behaviour, survivability and ultimately its dispersion in the atmosphere.

Composting and anerobic digestion appear to be the largest sources of bioaerosols. The dependence on microorganisms to degrade the organic material, and the way in which the material is processed make biological treatment facilities a source of bioaerosols.

Bioaerosols degrade and disperse in the air a short distance away from the source. This distance appears to be within 200 to 250m depending on the meteorological conditions. Because of the nature of bioaerosols, their impact is largely on the workers who are exposed to them daily at close proximity and therefore can be a worker exposure issue.

The UK Environment Agency's policy position on composting and potential health effects from bioaerosols (2007) is that they will:

> "take into account the potential effects of bioaerosols on human health when authorizing new waste composting facilities or changes to existing facilities. To do this, applicants will have to provide us with a site-specific bioaerosol risk assessment if there is a workplace or dwelling within 250 metres of the composting site boundary. The assessment must be based on clear scientific evidence and show that bioaerosols can and will be maintained at appropriate levels at any workplace or boundary of a dwelling"

Dispersion models can accurately predict the movement of dusts and aerosols on which bioaerosols are attached, but cannot accurately predict efficacy, so the 250 m buffer is used.

Neither composting nor anerobic digestion are currently occurring at the GTLF. Composting of green waste will be a component of the proposed ISWMS which will be well within a 250 m buffer separating the nearest sensitive receptors. The ISWMS facility will conform to a Code of Good Practice to adopt operations and mitigation measures to control activities that may generate and affect the release of bioaerosols.

Therefore. an assessment of the existing conditions of bioaerosols will not be undertaken as part of the EIA. The ISWMS will be designed such that the potential health affects to workers and sensitive receptors will be well within UK Guidance, and a risk assessment will not be necessary.

3. Local Sources of Emissions

The existing sources of local emissions in the area of the proposed ISWMS and their primary emissions constituents are identified in Figure 1 and described further below:

- Esterley Tibbetts Highway (NOx, CO, PM2.5)

- GTLF (dust, methane (CH_4), hydrogen sulphide (H_2S), CO_2, metals from car dismantling)
- Wastewater Treatment Plant (Total Reduced Sulphur (TRS), H_2S)
- Current Medical Waste Incinerator at GTLF (emissions profile similar to the proposed ERF in Section 2.1)
- Asphalt Plant (NOx, SO_2, CO, CO_2, dust, PAH)
- Cement, Concrete and Concrete Batching Plants (NOx, SO_2, CO, CO_2, dust)
- Cayman Spirits Company (Ethanol)
- Caribbean Utilities Power Plant (NOx, SO_2, CO, CO_2, PM2.5)
- New Airport Connector Road Construction (dust, metals)

3.1 Meteorology

GHD created a wind rose with data from 2011 to 2020 from the Owen Roberts International Airport located in George Town, Grand Cayman. The data shows that the prevailing wind directions are well defined and are almost exclusively blowing in an east to west direction with slight deviations. It should be noted that the data is only 65.1% complete as the monitor doesn't appear to record anything for about 6 hours every morning (4-10 am). Additionally, the radiosonde data contains between 50-95% of the data, so some years are more complete than others.

This wind rose is provided in Figure 2.

3.2 Current Air Monitoring Data

Monitoring for H_2S using Jerome H_2S analyzers (Gold-film) is currently being undertaken on and around the GTLF. This data collection will continue during the proposed baseline air monitoring program to quantify baseline concentrations of H_2S upwind and downwind of the proposed facility.

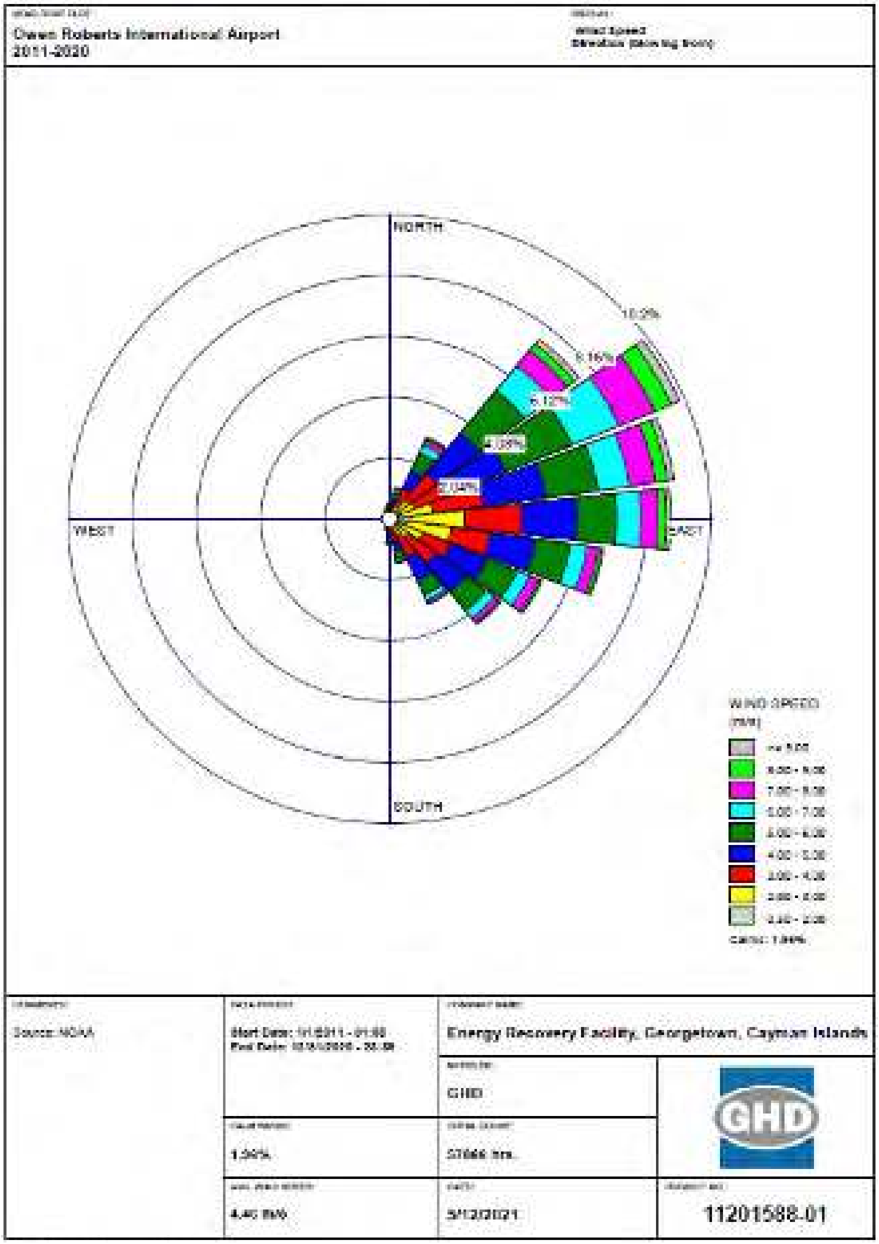


Figure 2 **Windrose**

4. Baseline Monitoring Station Locations

As per the UK Department of Environment, Food and Rural Affairs (DEFRA) at https://uk-air.defra.gov.uk/networks/site-types, a background monitoring station should be located as follows:

> *Located such that its pollution level is not influenced significantly by any single source or street, but rather by the integrated contribution from all sources upwind of the station e.g., by all traffic, combustion sources etc. upwind of the station in a city, or by all upwind source areas (cities, industrial areas) in a rural area. These sampling points shall, generally, be representative for several square kilometres.*

Based on this guidance the baseline monitoring station will be located downwind of the proposed ISWMS facility, but also downwind of other significant sources of emissions including the all the emissions sources noted in Section 3. Other siting criteria such as distance from trees, distance from major roads, absence of building downwash effects, probe siting criteria and probe materials will be adhered to according to the Guidance. Monitoring station siting consideration will also include suitable and available spaces with power.

An upwind monitoring station is normally located as a background reference for comparison with the data collected at the downwind station. The purpose of the upwind station is to subtract any upwind concentrations of contaminants collected in the downwind station. This station would normally be located upwind of the proposed ISWMS and major sources of emissions as noted in Section 3.

However, a station located upwind of the ISWMS is not likely to be impacted by any of the emissions sources noted in Section 3, based on the 10-year wind rose provided since it will be located very close to the shoreline and winds are not predicted to blow from the direction of the industrial sections of George Town to this location. The only likely emissions sources upwind of the ISWMS could be H_2S from the mangrove swamps and the temporary emissions from construction of the new Airport Connector Road (dust).

GHD is therefore proposing a single fully instrumented monitoring station (Station 1) downwind of the ISWMS to measure baseline air quality for this project. The values measured at this station will be conservative, since no upwind values will be subtracted from the values measured at this location.

H_2S is currently being monitored around the landfill as noted in Section 3.2 and this will carry on throughout the baseline monitoring duration including locations upwind of the ISWMS. H_2S will therefore be the only parameter monitored upwind of the proposed ISWMS.

4.1 Additional Sampling for Local Sources and Sensitive Receptors

The single station ambient Monitoring program described above will provide a measure of the baseline concentrations of target pollutants in the vicinity of the project impact area and based on the windrose, will also encompass all the of the existing industrial emissions sources. There are individual existing sources that may be having localized effects on the baseline that may not be captured by the single station. Several areas may be affected by heavy vehicle traffic, industrial operations and power generation facilities. For this reason, three additional monitoring locations will be sampled for select contaminants. The parameters identified that may impact these areas have been determined to consist primarily of PM10, NOx and SO_2.

Similarly, several sensitive receptors have been identified close to the proposed ISWMS. These include the Lakeside Villas residential development the Cayman International School and Glenwood Drive. Two additional sampling locations have been located at Lakeside Villas and the Cayman International School to measure baseline concentrations of select contaminants at these sensitive receptors.

4.1.1 PM10

One battery/solar powered continuous PM10 monitor will be installed at a site representative of the airshed downwind of the industrial and power generation area south of the site. Another will be placed at the Lakeside Villas. The small footprint of this analyzer will allow for placement where a full monitoring station would not be possible.

The PM10 instrument will be a Met-One E-Sampler or equivalent. These instruments operate on the principle of optical light scattering, a principle approved in the UK as noted in Section 2. These instruments have a linear response to particulate mass concentrations across their range.

4.1.2 NO_2 and SO_2 Passive Samplers

Diffusion based NO_2/SO_2 ambient air samplers will be used during the monitoring program. Three will be at sites that may be impacted by local combustion sources and another will be collocated with the continuous monitors at the primary monitoring station. Two more stations will be located at the sensitive receptor sites at Lakeside Villas and the Cayman International School.

Diffusion samplers are a type of passive sampler; that is, they absorb the pollutant to be monitored directly from the surrounding air and need no power supply. Passive samplers can be deployed over a wider area than permanent monitoring stations, they are ideal for identifying locations where NO_2/SO_2 concentrations may be highest.

The NO_2 passive sample system uses a specially designed rain shelter to allow the passive sampler to be installed face downwards and to allow the air movement to cross the surface of the diffusion barrier. After exposure, the sampler media is extracted in the laboratory with de-ionized (DI) water. The extract is analyzed by Ion Chromatography. The sampling rate of the passive sampler is calculated using an equation which takes into account the dependence on associated meteorological factors.

The SO_2 passive sample system uses a specially designed rain shelter to allow the passive sampler to be installed face downwards and to allow the air movement to cross the surface of the diffusion barrier. After exposure, the sampler media is extracted in the laboratory with hydrogen peroxide. The extract is analyzed by using ion chromatography (IC). The sampling rate of the passive sampler is calculated using an equation, which takes into account the dependence on associated meteorological factors.

After an exposure period of approximately two weeks the passive samplers are collected and replaced with new ones. The absorbent material is returned to an accredited analytical laboratory for analyses of NO_2 and SO_2.by Ion Chromatography (IC).

Since the exposure period for the passive samplers is two weeks and the applicable standards for SO_2 are 15-minute, 1-hour and 24-hour means, conversion between averaging periods will be necessary. The Ontario Ministry of the Environment provides guidance on converting between averaging periods in their guidance document entitled “Procedure for Preparing an Emission Summary and Dispersion Modelling Report”, dated March 2018 (ESDM Procedure Document). Using this guidance, the two week samples can be converted to the averaging times of the air quality standards in Table 1 as follows:

C0 = C1 x F

where, C0 = the concentration at the averaging period t0

C1 = the concentration at the averaging period t1

F = factor to convert from the averaging period t1 to the averaging period t0

= (t1/t0)n

and where, the exponent n is 0.28, which is generally representative of average conditions across a range of atmospheric stabilities.

4.1.3 Meteorological Equipment

Meteorological (met) equipment will be located at three (3) stations to continuously monitor wind speed, wind direction and ambient temperature at a minimum. The fully instrumented station will monitor wind speed, wind direction, ambient temperature and barometric pressure.

Therefore, the entire network that will be monitored to provide the baseline concentrations of air contaminants for the project will consist of seven (7) stations. These stations, including the pollutants to be monitored and the exact method/equipment to be used at each station is detailed in Table 2. The locations of each station are provided in Figure 3.

4.2 Duration of Baseline Monitoring

Seasonality on the Cayman Islands consists of a wet and a dry season. The dry season usually begins in early November and lasts until April. It is proposed for the EIA that four (4) months of baseline monitoring will be sufficient to cover all seasons in the Cayman Islands. The monitoring will take place beginning in October 2021 which will measure emissions occurring during the end of the rainy season. It is proposed that the baseline monitoring continue through November until early February covering 3 months during the dry season. The dry season will be the worst-case scenario for local emissions as rain will wash gaseous and particulate bound emissions from the air during the wet season.

Should you have any questions on the above, please do not hesitate to contact us.

Regards

Gord Reusing
Business Group Leader

John MacRae
Technical Leader

Encl.

0 200 400 600m

1:20000

Coordinate System:
UTM, Nad83, Zone 17F

N

GHD

DART
GEORGE TOWN, GRAND CAYMAN ISLAND

POTENTIAL EMISSION SOURCES

Project No. 11201588
Date June 2021

FIGURE 1

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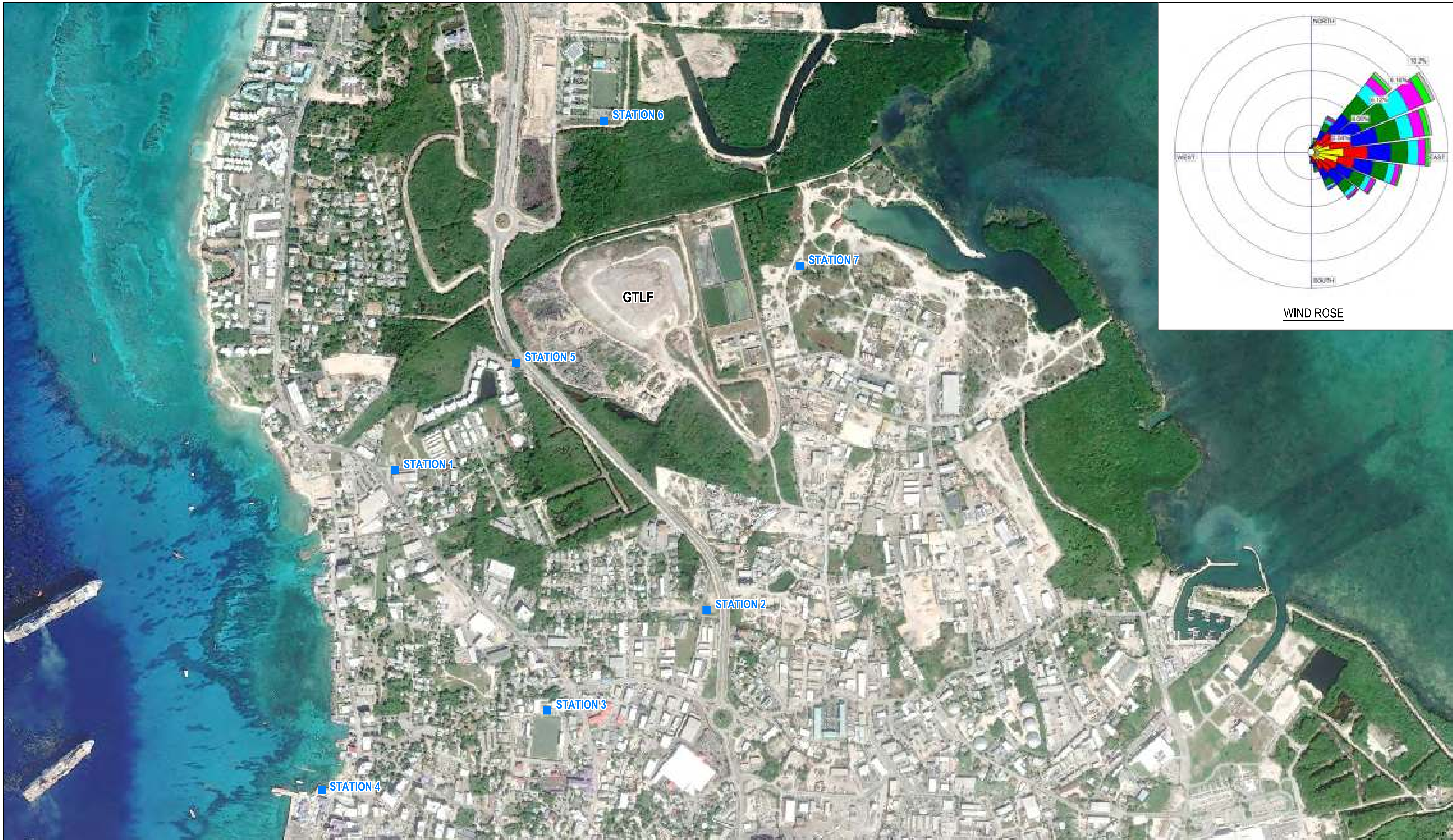

LEGEND

■ AIR MONITORING STATION LOCATION

0 350 700 1050m

1:35000

Coordinate System:
UTM, Nad83, Zone 17F

N

GHD

DART
GEORGE TOWN, GRAND CAYMAN ISLAND

AIR MONITORING STATION LOCATIONS

Project No. **11201588**
Date **September 2021**

FIGURE 3

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Plot Date: 03 September 2021 11:24 AM

Source: Microsoft Product Screen Shot(s) Reprinted with permission from Microsoft Corporation, Accessed: 2021

Table 1

Summary of Applicable Air Quality Standards and Averaging Periods

Parameters	CAS#	Averaging Period	Limit Time Average	Standard
Carbon Monoxide (CO)	630-08-0	8 Hour running average across a 24 hour period	10 mg/m^3	AAD Limit Value and AQS Objective
Nitrogen Dioxide (NO_2)	11104-93-1	1 Hour	200 $\mu g/m^3$	AAD Limit Value
Nitrogen Dioxide (NO_2)	11104-93-1	Annual	40 $\mu g/m^3$	AAD Limit Value
Particulates (PM10)	NA - M09	24 Hour	50 $\mu g/m^3$	AAD Limit Value
Particulates (PM10)	NA - M09	Annual	40 $\mu g/m^3$	AAD Limit Value
Particulates (PM2.5)	NA - M10	Annual	25 $\mu g/m^3$	AAD Limit Value
Sulphur Dioxide (SO_2)	7446-09-5	1 Hour	350 $\mu g/m^3$	AAD Limit Value
Sulphur Dioxide (SO_2)	7446-09-5	24 hour	125 $\mu g/m^3$	AAD Limit Value
Sulphur Dioxide (SO_2)	7446-09-5	15-Minute Mean	266 $\mu g/m^3$	AAD Limit Value
Hydrogen Chloride (HCl)	7647-01-0	Hourly Limit in µg/m3	750 $\mu g/m^3$	Environmental Assessment Levels (EAL)
Hydrogen Flouride (HF)	7664-39-3	Annual Limit	16 $\mu g/m^3$ (monthly average)	Environmental Assessment Levels (EAL)
Hydrogen Flouride (HF)	7664-39-3	Hourly Limit in $\mu g/m^3$	160 $\mu g/m^3$	Environmental Assessment Levels (EAL)
Cadmium (Cd)	NA-03	Annual	5 ng/m^3	AAD Target Value
Arsenic (As)	NA-02	Annual	6 ng/m^3	AAD Target Value
Lead (Pb)	NA-08	Annual	0.25 $\mu g/m^3$	UK AQS Objective
Nickel (Ni)	NA-11	Annual	20 ng/m^3	AAD Target Value
Polycyclic Aromatic Hydrocarbons (PAHs)	50-32-8	Annual	0.25 ng/m^3 of benzo(a)pyrene (BaP) total content within the PM10 fraction	AAD Target Value
Volatile Organic Carbon (VOCs) (Benzene)	71-43-2	Annual-Running Mean	16.25 $\mu g/m^3$	Environmental Assessment Levels (EAL)
Volatile Organic Carbon (VOCs) (Benzene)	71-43-2	Hourly Limit in $\mu g/m^3$	195 $\mu g/m^3$	Environmental Assessment Levels (EAL)

Source: UK National Air Quality Objectives

Table 2

Summary of Ambient Air Monitoring Stations and Principles of Measurement

Station	Name	Parameters	Type	Equipment	Reference Method	Analytical Method	Interval/Frequency
1	Cox Lumber	NOx	Continuous	Teledyne API T200 (or equivalent)	EN14211:2012	Chemiluminescence	One-hour Average
		NO2	Passive	NO2 Passive Diffusion Sampler	BVC-00148	IC	Two Weeks
		SO2	Continuous	Teledyne API T100U (or equivalent)	EN14212:2012	UV Fluorescence	One-hour Average
		SO2	Passive	SO2 Passive Diffusion Sampler	BVC-00149	IC	Two Weeks
		CO	Continuous	Teledyne API T300U (or equivalent)	EN14626:2012	Gas Filter Correlation	One-hour Average
		PM2.5	Continuous	Met-One BAM-1020	EN16450:2017	Beta Attenuation	One-hour Average
		PM10	Non-Continuous	PM10 High Volume Sampler	USEPA IO-2.1	Gravimetric	24-hour Average/6 day
		Metals	Non-Continuous	PM10 High Volume Sampler	EN 14902:2005	ICP/MS	24-hour Average/6 day
		HCl/HF	Non-Continuous	Sorbent Trap	OTM-40 (Modified)	IC	
		Dioxins and Furans	Non-Continuous	Medium Volume Sampler/PUF/XAD Trap	USEPA TO-9A	HR/MS	24-hour Average/6 day
		PAH	Non-Continuous	Medium Volume Sampler/PUF/XAD Trap	USEPA TO-9A	HR/MS	24-hour Average/6 day
		VOC	Non-Continuous	Summa Canister	USEPA TO-15	GC/MS	24-hour Average/6 day
		WS, WD, AT, BP	Continuous	Met-One (or equivalent)	OMAQO	NA	One-hour Average
2	Paddington Place	NO2	Passive	NO2 Passive Diffusion Sampler	BVC-00148	IC	Two Weeks
		SO2	Passive	SO2 Passive Diffusion Sampler	BVC-00149	IC	Two Weeks
3	George Town Primary School	NO2	Passive	NO2 Passive Diffusion Sampler	BVC-00148	IC	Two Weeks
		SO2	Passive	SO2 Passive Diffusion Sampler	BVC-00149	IC	Two Weeks
4	OPY 20	NO2	Passive	NO2 Passive Diffusion Sampler	BVC-00148	IC	Two Weeks
		SO2	Passive	SO2 Passive Diffusion Sampler	BVC-00149	IC	Two Weeks
		PM10	Continuous	Met-One E-sampler	EN16450:2017	Optical Light Scattering	One-hour Average
		WS, WD, AT	Continuous	Met-One (or equivalent)	OMAQO	NA	One-hour Average
5	Lakeside	NO2	Passive	NO2 Passive Diffusion Sampler	BVC-00148	IC	Two Weeks
		SO2	Passive	SO2 Passive Diffusion Sampler	BVC-00149	IC	Two Weeks
		PM10	Continuous	Met-One E-sampler	EN16450:2017	Optical Light Scattering	One-hour Average
		H2S	Continuous	Jerome 631	NA	Gold film sensing	One-hour Average
		WS, WD, AT	Continuous	Met-One (or equivalent)	OMAQO	NA	One-hour Average
6	Cayman International School	NO2	Passive	NO2 Passive Diffusion Sampler	BVC-00148	IC	Two Weeks
		SO2	Passive	SO2 Passive Diffusion Sampler	BVC-00149	IC	Two Weeks
7	Laundry	H2S	Continuous	Jerome 631		Gold film sensing	One-hour Average
		WS, WD, AT	Continuous	Met-One (or equivalent)	OMAQO	NA	One-hour Average

PAH	Polycylclic Aromatic Hydrocarbons
PUF	Polyurethane Foam
XAD	XAD Sorbent
B(a)P	Benzo-a-Pyrene
VOC	Volatile Organic Compounds
GC/MS	Gas Chromatography/Mass Spectrometry
ICP/MS	Inductively Coupled Plasma Mass Spectrometry
HR/MS	High Resolution Mass Spectroscopy
WS	Wind Speed
WD	Wind Direction
AT	Ambient Temperature
BP	Barometric Pressure
OMAQO	Operations Manual for Air Quality Monitoring in Ontario
IC	Ion Chromatography

Appendix B

Ambient Air Monitoring Report

Ambient Air Monitoring Report for Cayman Islands Integrated Solid Waste Management System

DECCO Limited

03 March 2023

→ The Power of Commitment

Project name		Cayman ISWMS Planning & EIA Work					
Document title		Ambient Air Monitoring Report					
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File name		Document1					
Status Code	**Revision**	**Author**	**Reviewer**		**Approved for issue**		
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1. Introduction

The following report details the ambient air monitoring program (Program) that was conducted in support of the Cayman Islands Integrated Solid Waste Management System (ISWMS) Environmental Impact Assessment (EIA).

An Air Quality Method Statement (Method Statement) was submitted by GHD and reviewed by the Cayman Islands Government and their consultants. The Method Statement received comments and was approved on October 8, 2021. It was agreed that an ambient air monitoring program (AAMP) be established to monitor the background (baseline) ambient air concentrations of air contaminants in the vicinity of the future location of the ISWMS that will be located proximate to the current site of the George Town Landfill (GTLF).. The AAMP was initiated and operated by GHD, Valley Environmental Services (VES), Dart Enterprises Cayman (Dart) and the Department of Environmental Health (DEH).

The list of air contaminants that were monitored and measured for the program consisted of air emissions that are currently being emitted from the existing sources in the vicinity of the GTLF as well as additional emissions that are expected to be emitted from the new sources that will be associated with the ISWMS facility.

The AAMP was initiated on October 24, 2021 and lasted for approximately four months, encompassing approximately one month of wet season followed by three months of dry season. The AAMP consisted of United States Environmental Protection Agency (USEPA) Federal Reference Method (FRM) and Federal Equivalent Method (FEM) non-continuous and continuous sampling as well as passive monitoring, hydrogen sulphide (H_2S) and odour assessments of existing conditions.

After the assembly of the monitoring stations and initial calibration of the monitoring equipment by GHD and VES, the AAMP was run by staff from Dart and DEH. Prior to the beginning of the Program, training was provided by GHD and VES on all aspects of the equipment being used in the AAMP. Virtual and on-site training was provided by air quality experts from GHD and VES from October 8 to October 31, 2021 on the non-continuous and continuous monitors respectively. Calibration, field, and laboratory procedures for all pieces of equipment and sampling techniques were video recorded by Dart for future reference.

2. Air Contaminants Measured and Monitored for the Program

Air contaminants that were measured and monitored included the compounds that are expected to be emitted from the ISWMS as well as compounds currently being emitted from existing sources in the vicinity of the GTLF.

2.1 Emissions Expected from the ISWMS

As noted in the Method Statement, the ISWMS will incorporate the following potential air emission sources:

- An Energy Recovery Facility (ERF) for the treatment of Municipal Solid Waste (MSW)
- A Green Waste Facility for outdoor processing (composting and mulching) of organic waste
- An End-of-Life Vehicle (ELV) and Scrap Metal Processing Facility
- A Construction and Demolition (C&D) Waste Facility
- A Bottom Ash Processing Facility
- A Medical Waste Processing Facility

- A Landfill Gas Facility and
- A Residual Waste Landfill

Based on guidance such as the **EU Industrial Emissions Directive (IED – 2010/75/EU)** which stipulates acceptable emission values to atmosphere for industry, including waste incineration processes such as the ERF, as well as the parameters that should be monitored from these processes. These parameters are as follows:

- Dioxins and Furans (PCDD/PCDF)
- Polycyclic Aromatic Hydrocarbons (PAHs)
- Dust (particulate matter < 10 microns [PM10])
- Gaseous and volatile organic compounds (VOC)
- Hydrogen Chloride (HCl)
- Hydrogen Fluoride (HF)
- Sulphur Dioxide (SO_2)
- Oxides of Nitrogen (NOx)
- Carbon Monoxide (CO)
- Heavy Metals:
  - Cadmium (Cd)
  - Thallium (Tl)
  - Mercury (Hg)
  - Antimony (Sb)
  - Arsenic (As)
  - Lead (Pb)
  - Chromium (Cr)
  - Cobalt (Co)
  - Copper (Cu)
  - Manganese (Mn)
  - Nickel (Ni)
  - Vanadium (V)

2.2 Existing Local Air Contaminants

Current emissions from local sources were considered for the monitoring program. These emission sources were inventoried and include the following sources and the primary compounds they are likely to be emitting:

- Esterley Tibbetts Highway (NOx, CO, particulate matter<2.5 microns (PM2.5))
- GTLF (PM10, hydrogen sulphide (H_2S), metals from car dismantling, odour, bioaerosols))
- Wastewater Treatment Plant (WWTP) (Total Reduced Sulphur (TRS), H_2S, odour)
- Current Medical Waste Incinerator at GTLF (emissions profile similar to the proposed ERF in Section 2.1, odour)
- Asphalt Plant (NOx, SO_2, CO, PM10, PAH, odour)
- Cement, Concrete and Concrete Batching Plants (NOx, SO_2, CO, PM10)
- Cayman Spirits Company (VOC)
- Cayman Utilities (CUC) Diesel Fueled Power Plant (NOx, SO_2, CO, PM2.5, odour)
- New Airport Connector Road Construction (PM10, metals)
- Existing shoreline and mangroves near the GTLF (odour, H_2S)

– Owen Roberts International Airport
– Cruise ships and port

The existing sources of air contaminants in the vicinity of the ISWMS are indicated in Figure 1.

2.3 Final List of Parameters, Sample Methodology, Sampling Duration and QA/QC

As noted in the Method Statement, the finalized and agreed-upon list of parameters and locations for monitoring the baseline conditions of the existing and expected emissions from the ISWMS are provided in Table 1 and Figure 2. Table 1 summarizes the parameters, monitoring methodology and monitoring frequencies for each monitoring station. Monitoring methods were continuous, non-continuous and/or passive. Figure 2 shows the seven air monitoring station locations and the parameters that were sampled at each station.

The final decisions for the sampling locations and sampling methodology were based on a hybrid approach of United Kingdom/European Union (UK/EU) ambient air monitoring methods, USEPA ambient air monitoring methods and Ontario (Canada) monitoring methods and sample analyses. This was decided because although the Cayman Islands are a British territory, the geographical proximity to North America meant that US/Canadian environmental labs were better suited for shipping and analysis of the samples and sourcing of specific ambient air monitoring equipment, such as continuous emission monitors (CEMs). The UK/EU, USEPA and Ontario approaches to sample collection and analysis, and continuous/passive monitoring of ambient air are generally very similar. For the purposes of this report, CEMs refers to FEM continuous analyzers that measure ambient air concentrations of specific parameters in the part per billion (ppb) range and not specifically source emissions from stacks at a facility that measure in the part per million (ppm) and percent range of concentrations.

2.3.1 Air Quality Standards and Averaging Periods

The standards that were used for the determination of compliance with ambient air criteria was taken from the **UK National Air Quality Objectives** (NAQO). These applicable air quality standards and associated time averaging periods are provided in Table 2.

There are no ambient air quality limits for H_2S in the NAQO. For reference, the Ontario (Canada) limits for H_2S have been used (a 10-minute 13 µg/m^3 for odour).

There are no limits for dioxins and furans in the NAQO. For reference, the Ontario limits have been used which is based on World Health Organization (WHO) guidance. The standard for dioxins and furans is 0.1 pgTEQ/m^3.

In cases where the sample durations differ from the averaging period of the standard, it was agreed in the Method Statement that a conversion factor based on the Ontario Ministry of the Environment guidance document entitled **Procedure for Preparing an Emission Summary and Dispersion Modelling Report**, dated March 2018 (ESDM Procedure Document) be used. Using this guidance, the sample results from a specific averaging period can be converted to the averaging times of the air quality standards. This guidance was applied to the following instances:

– For the VOCs monitored at Station 1, to convert from a 24-hour averaging period to 1-hour averaging period.
– For HF and HCl monitored at Station 1, to convert from a 24-hour averaging period to 1-hour averaging period.
– For SO_2 monitored using passive samplers at Stations 1 through 6, to convert from a 2-week averaging period to a 15-min averaging period.

In the case of the passive samples that were deployed for 2 weeks, a conversion to 1-hour and 24-hour averaging periods was based on a factor by comparing the 1-hour average CEMS data over two-week periods for NO_2 and SO_2. In the case of NO_2, to convert the Passive Samplers 2-week averaging period to a 1-hour averaging period, the ratio of CEMS's 90th percentile to CEMS's average for that corresponding period was multiplied with the Passive Samplers 2-week averaging period values. The ratio of CEMS's 90th percentile to CEMS's average for each sampling period is listed under Table B-15. A similar approach was followed for SO_2 o convert the Passive Samplers 2-week averaging period to a 1-hour averaging period; and the ratios used for SO_2 are listed under Table B-16. For SO_2 to convert the Passive Samplers 2-week averaging period to a 24-hour averaging period, the ratio of CEMS's (24-hour rolling average) 90th percentile to CEMS's (24-hour rolling average) average for that corresponding period was multiplied with the Passive Samplers 2-week averaging period values. The ratio of CEMS's (24-hour rolling average) 90th percentile to CEMS's (24-hour rolling average) average for each sampling period is listed under Table B-16.

The annual average for the passive, continuous and non-continuous samples were the average of the applicable sample data set for the monitoring period.

2.3.2 Quality Assurance/Quality Control (QA/QC)

A comprehensive Quality Assurance/Quality Control (QA/QC) program was completed for the AAMP that included, but was not limited to the following requirements:

- Equipment calibrations according to the Methods
- USEPA Protocol 1 calibration gases
- Data editing and data reduction according to standardized procedures and methods
- Data recorded on standardized field forms including all information required
- Transportation of samples by chain of custody procedures
- Standardized sample identification system
- Provision of sample media and analyses performed by of accredited environmental air quality laboratories
- Observe sample storage requirements and holding times for each parameter
- Clean, dedicated sample recovery area with sample refrigeration (4 degrees C)
- Climate control for dedicated air quality analyzers

The QA/QC procedures for each parameter are detailed in Appendix B.

2.4 Greenhouse Gas Emissions (GHG)

Certain sources noted in Sections 2.1 and 2.2 above may also produce greenhouse gases such as carbon dioxide (CO2) and/or methane (CH4). The baseline concentrations for these parameters were not measured during the AAMP but were estimated using information from the the Cayman Islands Department of Environment (DOE). According to the DOE’s Carbon Footprint Statement (**https://doe.ky/sustainable-development/carbon-footprint/**), the UK is a signatory to both the Kyoto Protocol and the United Nations Framework Convention on Climate Change (UNFCCC). Through the UK, the UNFCCC and Kyoto Protocol were extended to the Cayman Islands in March 2007. As a result, statistics for the Cayman Islands were incorporated into the UK's overall emissions figure presented to the UNFCCC. Aether Consulting in the UK used raw data to calculate the equivalent greenhouse gas emissions produced based on assumed emissions factors for the electricity generated by CUC and fuel used in road transport. The Department of Environment (Cayman Island Government) gathers data on electricity generation and fuel consumption. Additionally, information is gathered and provided on the use of solvents, waste management, mobile equipment, aviation and air travel, shipping, agriculture, and forestry. According to the DOE, carbon dioxide (CO_2) the major greenhouse gas produced by the Cayman Islands, with methane and other greenhouse gases being negligible in contrast. The Cayman Islands released 726,000 tonnes of CO_2 equivalent in 2007 and about 714,000 tonnes of CO_2 equivalent in 2014. Power generation accounts for most of the greenhouse gas emissions, accounting for 65% of all CO_2 emissions since 2007. As per the Cayman Islands 2020 Compendium of Statistics **https://www.eso.ky/UserFiles/right_page_docums/files/uploads/the_cayman_islands_compendium_of_statist-14.pdf**), it reports that 718,000 tonnes of CO_2 equivalent was released in 2011. Based on the data from 2007, 2011 and 2014, and an assumption of marginal growth in greenhouse gas emissions since 2014, it is estimated that the current annual greenhouse gas emissions from the Cayman Islands is approximately 720,000 tonnes of CO_2 equivalent.

2.5 Odour

Odour was identified as an air emission by-product from certain sources noted in Sections 2.1 and 2.2 above. As per Section 2.1 of the Method Statement, an odour assessment survey was conducted by GHD during the daytime and early evening hours of October 28, 2021. This is further discussed in Section 4.14.

Odour assessment surveys are guided by EN 264086 Parts 1 and 2. A combination of odour assessment tools were used for determining the existing conditions as follows:

1. Sensory Assessment using field olfactometry (Nasal Ranger™) to measure the concentrations of existing odours from upwind sources (mangroves, stagnant pond and WWTP) and existing onsite sources. The Nasal Ranger is a portable field olfactometer that is used to quantify odour intensity in ambient air. Prior to the field work the user of the olfactometer is ‘calibrated’ to ensure their sense of smell is neither hyperosmic (overly sensitive) nor anosmic (under sensitive). With the calibrated user, the Nasal Ranger determines ambient odour Dilution-to-Threshold (D/T) concentration objectively by diluting the odour with carbon filtered air at various ratios (2, 4, 7, 15, 30 and 60. The dilution ratio tjerhat corresponds when the odour is no longer detected is the D/T of the odour in ambient air. Photos of the Nasal Ranger being used in the field are provided in Appendix D.
2. Compound analysis of existing upwind and downwind H_2S readings using a Jerome 631X portable H_2S analyzer that uses gold-film sensor technology to measure low-level (0.003 to 50 ppm).

During the assessment, special consideration was given to Section 3 of the UK **Guidance on the Assessment of Odour for Planning** (Institute of Air Quality Management, July 2018) (UK Planning) as noted in Section 2.4.1 of the Method Statement and discussed further in Section 4.14.

The ‘complaints’ criterion for the assessment of sewage odours from UK Planning is the 98th percentile 1-hour concentration of 5 OU/m^3 at the receptor.

2.6 Bioaerosols

Bioaerosols were considered as part of the determination of existing conditions for the project. In consideration of the potential effect of bioaerosols at sensitive receptors the following UK guidance documents were referenced:

1. *Technical Guidance Note (Monitoring) M9 Environmental Monitoring of Bioaerosols at Regulated Facilities, Environmental Agency, July 2018*
2. *Occupational and Environmental Exposure to Bioaerosols from Composts and Potential Health Effects - A Critical Review of Published Data, 2003*
3. *Guidance on the Evaluation of Bioaerosol Risk Assessments for Composting Facilities; Leeds University, 2008*
4. *Site Specific Bioaerosol Risk Assessment, WRM, 2020*

Bioaerosols are found naturally within the environment. They consist of airborne particles that contain living organisms, such as bacteria, fungi and viruses or parts of living organisms, such as plant pollen, spores and endotoxins from bacterial cells or mycotoxins from fungi. The components of a bioaerosol range in size from around 0.02 to 100 micrometres (μm) in diameter. The size, density and shape of a bioaerosol will affect its behaviour, survivability and ultimately its dispersion in the atmosphere.

Composting and anerobic digestion appear to be the largest sources of bioaerosols. The dependence on microorganisms to degrade the organic material, and the way in which the material is processed make biological treatment facilities a source of bioaerosols.

Bioaerosols degrade and disperse in the air a short distance away from the source. This distance appears to be within 200 m to 250 m depending on the meteorological conditions. Because of the nature of bioaerosols, their impact is largely on the workers who are exposed to them daily at close proximity and therefore can be a worker exposure issue.

The UK Environment Agency’s policy position on composting and potential health effects from bioaerosols (2007) is that they will:

> "take into account the potential effects of bioaerosols on human health when authorizing new waste composting facilities or changes to existing facilities. To do this, applicants will have to provide us with a site-specific bioaerosol risk assessment if there is a workplace or dwelling within 250 metres of the composting site boundary. The assessment must be based on clear scientific evidence and show that bioaerosols can and will be maintained at appropriate levels at any workplace or boundary of a dwelling"

Neither composting nor anerobic digestion are currently occurring at the GTLF. Composting of green waste will be a component of the proposed ISWMS which will be well within a 250 m buffer separating the nearest offsite sensitive receptors. The ISWMS facility will conform to an Environmental Management Plan to adopt operations and mitigation measures to control activities that may generate and affect the release of bioaerosols.

Therefore, an assessment of the existing conditions of bioaerosols was not undertaken. The ISWMS will be designed such that the potential health affects to workers are minimized.

3. Description of Baseline Monitoring Station Locations

This section summarizes the basis for the selection of the main monitoring station (Station 1) and the six (6) supporting monitoring stations used in the Program as well as their specific roles in determining the overall baseline values for the EIA.

3.1 Existing Meteorological Data

A review of the existing meteorological data that was available to GHD from Owen Roberts International Airport (2011 to 2020) at the onset of the Program, which was presented in the Method Statement, showed that the prevailing wind directions are well defined and are almost exclusively blowing in an east to west direction with slight deviations.

3.2 UK Guidance

As per the UK Department of Environment, Food and Rural Affairs (DEFRA) at **https://uk-air.defra.gov.uk/networks/site-types**, a background monitoring station should be located as follows:

> *Located such that its pollution level is not influenced significantly by any single source or street, but rather by the integrated contribution from all sources upwind of the station e.g., by all traffic, combustion sources etc. upwind of the station in a city, or by all upwind source areas (cities, industrial areas) in a rural area. These sampling points shall, generally, be representative for several square kilometres.*

Based on this guidance the main, fully equipped baseline monitoring station was located, to the extent possible, downwind of the proposed ISWMS facility based on prevailing wind conditions, but also downwind of other existing significant sources of emissions including all the emissions sources noted in Section 2.2. This station location is identified as Station 1 on Table 1 and Figure 2.

Six other monitoring stations were located throughout Georgetown to specifically measure concentrations of dust (PM10) and/or H_2S and/or NOx and SO_2 compounds at sensitive receptors such as schools, residential areas and the downtown core located closer to existing sources such as highways, the WWTP, and the industrial areas of Georgetown including the CUC, and asphalt plant sources. The six other stations, are identified as Stations 2 through 7 on Table 1 and Figure 2.

3.3 General Description and Purpose of Each Monitoring Station

3.3.1 Station 1 Cox Lumber

Station 1 was the primary monitoring station, consisting of an air-conditioned container that housed the following FRM/FEM and associated equipment:

1. Teledyne API (TAPI) T200 NOx Chemiluminescence analyzer
2. TAPI T300 CO Gas Filter Correlation analyzer
3. TAPI T100 SO_2 UV Fluorescence analyzer
4. MetOne Bata Attenuation Monitor (BAM) 1020 Continuous PM2.5 Monitor
5. Zero Air Generator
6. EPA Protocol 1 Calibration Gases (NO, SO_2 and CO)
7. HF and HCl impinger samplers
8. A 20ft meteorological tower (above the roof of the container) with an RM Young wind speed (WS) and wind direction (WD) monitor including relative humidity (RH), and ambient temperature (AT)
9. A dedicated sample recovery area including a refrigerator for interim storage of samples requiring cool storage

A rooftop area with a railing also housed non-continuous samplers such as:

1. FRM high volume PM10 sampler for the collection of PM10 and metals in the PM10 fraction for 24 hours every six days according to the National Air Pollution Surveillance (NAPS) schedule
2. FRM medium volume (PUF) sampler for the collection of semi-volatiles including PCDD/PCDF and PAH compounds for 24 hours every six days according to the NAPS schedule
3. Summa canister for the collection of VOCs for 24 hours every six days according to the NAPS schedule
4. Passive monitors for NO_2 and SO_2 for correlation purposes

This station was located according to the criteria for the location of a background monitoring station away from major roads and trees and was not influenced significantly by any specific emissions source. The station was located downwind of the future site of the ISWMS and the ERF and other significant emissions sources in the area.

Pictures of Station 1 are provided in Appendix D.

3.3.2 Station 2 Paddington Place

Station 2 was used for passive monitoring of NO_2 and SO_2 from industrial areas, the CUC, and road traffic emissions. Paddington Place was located close to the Esterly Tibbetts highway and a major roundabout.

3.3.3 Station 3 George Town Primary School

Station 3 was used for passive monitoring of NO_2 and SO_2 for sensitive receptors at the George Town Primary school.

3.3.4 Station 4 OPY 20

Station 4 was used for passive monitoring of NO_2 and SO_2 and continuous monitoring of PM10 and WS/WD from the downtown core.

3.3.5 Station 5 Lakeside

Station 5 was used for passive monitoring of NO_2 and SO_2, continuous monitoring of PM10 and H_2S, and WS/WD near sensitive receptors at this residential complex located directly downwind of the GTLF. The Lakeside monitors are also located very close to the edge of Esterly Tibbetts highway and will therefore show impacts from road traffic. Pictures of Station 5 are provided in Appendix D.

3.3.6 Station 6 Cayman International School (CIS)

Station 6 was used for passive monitoring of NO_2 and SO_2 for the sensitive receptors at CIS.

3.3.7 Station 7 Laundry

Station 7 was used for continuous monitoring of H_2S from the WWTP and other H_2S sources upwind of the GTLF, as well as continuous monitoring of WS/WD.

3.4 Summary of Issues and/or Changes to the AAMP

The following is a list of technical issues and/or changes to methods and approaches that were proposed in the Method Statement to those that occurred during the AAMP.

3.4.1 HCl/HF Method Change

The approach was changed from the USEPA OTM-40 as proposed in the Method Statement to a modified USEPA Method 26. The change occurred due to lack of equipment and laboratory availability for OTM-40. The change caused no issues for data quality and/or availability.

3.4.2 Passive Sampling

The passive sampling program started approximately 3 weeks after the AAMP due to logistics and supply chain issues. The passive program was shorted from 10 proposed samples total to 9 samples total.

3.4.3 Wind Speed and Wind Direction

Three proposed sites for WS, WD and ambient temperature (AT) at Stations 4, 5 and 7 were unavailable due to equipment issues. GHD instead acquired WS and WD data from Owen Roberts Airport to supplement the meteorological data from Station 1.

3.4.4 H_2S

The continuous H_2S data collected upwind and downwind of the GTLF during the AAMP had considerable data gaps due to power issues and saturation/regeneration of the gold-film sensors. H_2S data collected at Station 5 was likely influenced by a large holding tank containing sewage located close to the instrument although it is not known the extent this influence may have had on the values collected at this location.

4. Results and Discussion

The background concentrations for the air contaminants measured at each Station are summarized in Table 3. For the various air contaminants and their averaging periods (except for the annual averaging period), the 90th percentile value was used to represent the background concentration. For the air contaminants for which the annual averaging period is applicable, the average of the sampling data set at the applicable Station was used.

4.1 NO_2

The NO_2 concentrations were measured at Station 1 with CEMS. Passive samples for NO_2 were monitored at six Stations (1 through 6), including a co-located passive sampler at Station 1. The 1-hour and annual background concentrations are provided in Table 3. The continuous data for NO_2 is provided in Tables A-1 and A-2 in Appendix A.

Combustion gas emissions were relatively stable with low concentrations measured throughout the monitoring period. Station 1 was impacted by combustion gas emissions from CUC when the winds were blowing from the facility toward the NO_2 monitors at Station 1 at approximately the 101-to-110-degree wind direction.

4.2 CO

The TAPI CEM located at Station 1 was used for the baseline concentrations for CO. The 8-hour background concentration for CO is provided in Table 3. The continuous data for CO is provided in Tables A-1 and A-2 and A-4 in Appendix A.

Combustion gas emissions were relatively stable with low concentrations measured throughout the monitoring period. Station 1 was impacted by combustion gas emissions from CUC when the winds were blowing from the facility toward the CO monitors at Station 1 at approximately the 101-to-110-degree wind direction.

4.3 SO_2

Continuous samples for SO_2 were monitored at Station 1 and passive samples were collected at six Stations (1 through 6), including a co-located passive sampler at Station 1. The 1-hour, 24-hour and 15-minute background concentrations are provided in Table 3. The continuous data for SO_2 is provided in Tables A-1, A-2, A-3 and A-4 in Appendix A.

Combustion gas emissions were relatively stable with low concentrations measured throughout the monitoring period. Station 1 was impacted by combustion gas emissions from CUC when the winds were blowing from the facility toward the SO_2 monitors at Station 1 at approximately the 101-to-110-degree wind direction.

4.4 PM2.5

The BAM 1020 CEM with the PM2.5 cut cyclone located at Station 1 was used for the baseline concentrations for PM2.5. The PM2.5 annual background concentration is provided in Table 3. The annual PM 2.5 background concentration was approximately 5.1 µg/m3, which is 26% of the limit annual limit of 20 µg/m3. The edited continuous data for PM2.5 is provided in Tables A-1 and A-2 in Appendix A.

4.5 WS/WD, RH and Temperature

The wind speed and wind direction results collected during the AAMP at Station 1 are provided graphically in Figure 3. The windrose in Figure 3 shows that the predominant wind directions are blowing from the easterly direction with lower percentages from the south, southeast, northeast, and northerly directions and negligible winds blowing from the southwest, west and northwest. Wind speed and wind direction data was also obtained from the Owen Roberts Airport in George Town during the monitoring period. Note that WS/WD data is not collected at Owen Roberts Airport for 6 hours per day from approximately 4am to 10 am. The Owen Roberts Airport windrose is provided in Figure 4. The wind directions shown in Figures 3 and 4 are comparable. The percentage of higher wind speeds in Figure 4 compared to Figure 3 is due to the 6 hours of data missing between 4 am and 10 am at the airport, data that would be generally lower wind speeds than the rest of the day. The data for WS/WD from Station 1 is provided in Table A-1 in Appendix A.

4.6 H_2S

H_2S was monitored continuously upwind and downwind of the GTLF at Station 7 and Station 5 respectively. These stations were located to monitor specific sources of H_2S, namely the WWTP and the GTLF, so they may not be representative of true background concentrations of areas outside of the influence of these two specific sources. In addition, the H_2S values reported in Table 3, Table A-7, Table A-8 and Table A-9 are based on data collected during the monitoring period with some considerable data gaps as noted in Section 3.4.4 and the tables noted above in Appendix A. H_2S data collected at Station 5 was likely influenced by a large holding tank containing sewage located close to the instrument although it is not known the extent this influence may have had on the values collected at this location.

GHD could not locate a corresponding EU or UK ambient air quality limit for H_2S. For reference, a 10-minute limit was used from the Ontario guidance 0f 13 $\mu g/m^3$. The comparison of this limit to H_2S concentrations measured at Lakeside Station 5 produced the only air quality limit exceedance during the program. This exceedance was likely influenced by the location of the monitor as noted above. It should also be noted that H_2S is not considered as a by-product of the emissions from the ERF, so ambient concentrations should be lower after construction of the ISWMS.

4.7 PM10

PM10 was measured non-continuously from Station 1 every 6 days for a 24-hour period for the monitoring duration, for a total of 20 samples.

PM10 was also measured continuously from Stations 4 and 5. The continuous PM10 concentrations from these two stations show the impacts of vehicle traffic in the downtown areas and the Esterly Tibbetts highway.

The 24-hour and annual PM10 background concentrations from the continuous and non-continuous samplers are provided in Table 3. The continuous data statistical summaries for PM10 are provided in Table A-5 and A-6 in Appendix A. The laboratory results for the non-continuous PM10 samples are provided in Appendix B and summarized in Table B-1 and Table B-2. The field sampling forms for non-continuous sample collection are provided in Appendix C.

4.8 Metals

Metals were measured non-continuously from the PM10 fraction at Station 1 every 6 days for a 24-hour period for the monitoring duration for a total of 20 samples. As noted in Table 2, cadmium, arsenic, lead and nickel are the only metals with applicable limits in the UK Air Quality Objectives. The annual background concentrations for cadmium, arsenic, lead, and nickel are provided in Table 3. The laboratory results for the non-continuous metals samples are provided in Appendix B and are summarized in Table B-3 and Table B-4. The field sampling forms for non-continuous sample collection are provided in Appendix C.

The annual background concentrations measured for cadmium, arsenic, lead and nickel are all well below 1% of their applicable annual limits in the guidance.

4.9 PCDD/PCDF

Dioxins and furans were measured non-continuously at Station 1 every 6 days for a 24-hour period for the monitoring duration for a total of 20 samples. The 24-hour dioxin and furan background concentrations are provided in Table 3. The laboratory results for the non-continuous dioxin and furan samples are provided in Appendix B and summarized in Table B-5 and Table B-6. The field sampling forms for non-continuous sample collection are provided in Appendix C.

A representative annual and 24 hour ambient air quality limit for dioxins and furans is not available from the **UK** NAQO**.** For the purposes of this study, a dioxin and furan limit of 0.1 $pgTEQ/m^3$ was used from the Ontario (Canada) Ambient Air Quality Criteria (AAQC). The dioxins and furans background values was calculated by using the 90th percentile of the midpoint between upper bound and lower bound TEQ/m^3 lab results.

The 24 hour background concentration of dioxins and furans is 0.013 pgTEQ/m^3 which is 13% of the standard of 0.1 pgTEQ/m^3.

4.10 PAHs

PAHs were measured non-continuously at Station 1 every 6 days for a 24-hour period for the monitoring duration, for a total of 20 samples. The surrogate PAH standard in the NAQO is based on the benzo(a)pyrene (BaP) concentration as noted in Table 2. The annual BaP background concentration is provided in Table 3. The laboratory results for the non-continuous PAH samples are provided in Appendix B and summarized in Table B-7 and Table B-8. The field sampling forms for non-continuous sample collection are provided in Appendix C.

The background concentration of BaP is approximately 0.08 ng/m^3 which is 31% of the annual standard of 0.25 ng/m^3 from the NAQO.

4.11 VOC

VOCs were measured non-continuously at Station 1 every 6 days for a 24-hour period for the monitoring duration, for a total of 20 samples. The NAQO air quality standard for VOCs is based on the benzene concentration as noted in Table 2. The hourly and annual benzene background concentrations are provided in Table 3. The laboratory results for the non-continuous VOC samples are provided in Appendix B, and summarized in Table B-9, Table B-10, and Table B-11. The field sampling forms for non-continuous sample collection are provided in Appendix C

The annual and 1-hour background concentrations of benzene are approximately 0.5 and 1.6 µg/m^3 respectively which are 3% and 1% of the respective NAQO standards.

4.12 HF/HCl

HCl/HF were measured non-continuously at Station 1 every 6 days for a 24-hour period for the monitoring duration, for a total of 20 samples. The hourly background HCl concentration and the hourly and annual background HF concentrations are provided in Table 3. The laboratory results for the non-continuous HF/HCl samples are provided in Appendix B, and summarized in Table B-12, Table B-13, and Table B-14. The field sampling forms for non-continuous sample collection are provided in Appendix C.

The HCl and HF background concentrations are well below their respective NAQO standards.

4.13 Passive Monitoring for NO_2 and SO_2

Passive samples for NO_2 and SO_2 were deployed at Stations 1, 2, 3, 4, 5 and 6 for nine (9) two-week periods. The hourly and annual NO_2 concentrations from each Station are provided in Table 3. The two-week concentrations were converted to hourly and annual concentrations as per the method outlined in Section 2.3.1.

The 15 minute, 1-hour, and 24-hour SO_2 concentrations from each Station are provided in Table 3. The two-week concentrations were converted to 15 minute, 1-hour and 24-hour concentrations as per the method outlined in Section 2.3.1. The laboratory results for the passive samples are provided in Appendix B and summarized in Table B-15 and Table B-16.

The background concentrations of the passively monitored NO_2 and SO_2 are in the same range as the concentrations measured continuously at Station 1 with minor locational variations based on proximity to sources of these products of combustion.

4.14 Odour Assessment Survey

As discussed in Section 2.5, an odour assessment survey was undertaken on October 28, 2021, by representatives from GHD, Dart and DEH during the mid-afternoon and again in the evening hours as it was communicated to GHD by local representatives, that in some cases, odour can increase at night. The odour assessment took place downwind of the identified odour sources and at sensitive receptors close to the GTLF. The odour assessment locations are shown on Figure 5.

A complaints history was not retrieved or compiled for the assessment survey.

During the day and evening of October 28, the wind was blowing mildly from the south to the north at an average of 2.4 m/s and 178 degrees respectively. The meteorological data from Station 1 during the odour sampling is provided in Table A-1 in Appendix A from 10:59 to 20:59 on October 28, 2021.

During the odour monitoring period, the following point and area sources were assessed qualitatively and/or quantitatively for odour and H_2S concentrations if applicable:

– CUC
– WWTP
– GTLF
– Mangroves and shoreline areas
– Medical Waste Incinerator (MWI)
– Asphalt Plant

In addition, the following sensitive receptor locations were assessed qualitatively for odour and/or quantitatively for odour and H_2S concentrations if applicable:

– Cayman International School
– Lakeside Condominiums

4.14.1 CUC

A slight odour of diesel exhaust was detected by GHD directly downwind of the CUC at the location shown on Figure 5. A measurement using the Nasal Ranger showed this odour was not detected at a 4:1 dilution.

4.14.2 WWTP

During normal WWTP operations, sewage is stored in settling ponds that are open to atmosphere. These ponds normally produce baseline sewage odour and can regularly emit H_2S emissions resulting in part per billion (ppb) range downwind concentrations. H_2S data has been collected by H_2S monitors operated by Dart located upwind and downwind of the WWTP since 2016.

During the odour assessment survey, the baseline odour condition was measured directly downwind of the WWTP settling ponds at the locations shown in Figure 5. GHD used a Nasal Ranger to quantify the odour concentrations at these locations in conjunction with portable Jerome gold-film analyzer H_2S measurements, taken at the same time and location. At the location which was approximately 50 m downwind of the WWTP settling ponds, the odour was detected from the Nasal Ranger at a dilution of 15:1 but was not detected at 30:1. The H_2S concentration associated with this odour was measured simultaneously and was recorded at between 177 to 233 ppb.

As noted in Section 2.5 the ‘complaints’ criterion for the assessment of sewage odours from UK Planning is the 98^{th} percentile 1-hour concentration of 5 OU/m^3 at a receptor. For context, an instantaneous measurement of between 15 and 30 OU at the WWTP property boundary noted above could have the potential to cause odour complaints at the nearest receptor (CIS) depending on the meteorological conditions and the duration of the event.

At intermittent periods, raw sewage water is pumped into the settling ponds if the WWTP capacity is exceeded. This activity produces intermittent spikes in odour and H_2S concentrations as witnessed by local representatives of Dart and DEH. This activity was not witnessed or recorded by GHD during the odour assessment survey.

4.14.3 GTLF

The active face of the GTLF was assessed for odour as was the covered landfill mound. While standing downwind of the mound, a distinctive odour of landfill gas was detected with no dilution, but not by the Nasal Ranger at a 4:1 dilution. H2S concentrations from downwind of the mound were </=5ppb.

The distinctive odour from the active landfill face was detected downwind at the entrance to the CIS as shown on Figure 5 with no dilution, at approximately 460 m from the active tipping area. The odour was not detected by the Nasal Ranger at a 4:1 dilution. H_2S was not detected at this location.

4.14.4 Upwind Mangroves and Shoreline Areas

As part of the odour assessment survey, mangroves and shoreline locations were assessed for odour and H_2S concentrations. Close to the shoreline and directly east of the GTLF and the WWTP as shown on Figure 5 is a stagnant pond. The pond is a former mosquito trench that was cut off by the expansion of the GTLF and now contains stagnant water.

Odour assessment measurements did not show this pond as being a significant source of odour in either daytime or evening measurements. Nasal Ranger measurements did not detect the odour at a 4:1 dilution and H_2S measurements were </=5ppb. For comparison, on the shoreline the odour was similarly not detected by the Nasal Ranger at 4:1 and the H_2S measurements were </=5ppb. The detection limit of the Jerome gold film analyzer is 1 ppb.

As part of the construction of the new Airport Connector Road currently being completed, the stagnant pond will be drained and remediated by the placement of culverts to connect it to existing sources of drainage. As such the area should be re-assessed at that time.

4.14.5 Medical Waste Incinerator

The medical waste incinerator (MWI) is currently located adjacent to the WWTP and the GTLF. The MWI burns small individual bins of medical waste three days per week with daily cool-down periods in between. Due to COVID and the increased amounts of personal protective equipment (PPE) waste in 2021 and 2022, the MWI was burning more waste than it was before COVID. Pollution control consists of an afterburner on the incinerator stack. Odour from the MWI was assessed during the survey by standing downwind of the visible plume. The odour can be characterized as similar to burned plastic. The Odour Ranger did not detect the odour at a dilution above 15:1 at a location approximately 50 m from the MWI from the visible plume. The current MWI will be replaced by a new MWI in the proposed ISWMS development with best available control technology (BACT).

4.14.6 Asphalt Plant

The asphalt plant was not producing asphalt during the odour assessment survey. The odour from the asphalt-making process was therefore not evaluated. However, asphalt plants are known to produce a distinct asphalt odour.

4.14.7 Lakeside Condominiums

During the odour assessment survey, the Lakeside Condominiums were not directly located downwind of the GTLF, however it was noted that a sewage odour was present in the condominium parking lot adjacent to the Esterly Tibbetts Highway. The odour was identified to be coming from an onsite sewage holding tank located there. During the odour assessment survey, H_2S was not detected downwind of the holding tank. However, H_2S data collected from Station 5 (Lakeside) showed elevated H_2S readings approximately an order of magnitude above the background values collected at Station 7. It is therefore reasonable that the H2S monitor at Station 5 is being impacted by the Lakeside sewage holding tank located approximately 15m from the monitor.

4.14.8 Central Laundry Facility

At the time of the odour assessment a new facility called the Central Laundry was being built adjacent to the WWTP. The Facility will be the central laundry service for many hotels in the area and will have many emissions sources associated with the processing of commercial laundry. The main sources of emissions will be products of the combustion of LPG and water vapour. The presence or absence of odour from this facility should be included in any future odour assessment survey.

4.14.9 Conclusions of the Odour Assessment Survey

Many current odour sources in the vicinity of the GTLF will change with the construction of the ISWMS Facilities and the New Airport Connector Road. These changes are summarized as follows:

GTLF

The active face of the landfill will remain until the ERF facility has been commissioned at which time it is reasonable that odours will be significantly reduced as organics will be moved to outdoor composting windrows and combustible waste will be brought to the ERF. Landfill gas will be captured and flared until gas quality for other uses is examined. This will reduce the landfill gas odour from the mound and capped areas.

Upwind Mangroves and Shoreline Areas

As part of the construction of the new Airport Connector Road currently being completed, the stagnant pond will be drained and remediated by the placement of culverts to connect it to existing sources of drainage.

Medical Waste Incinerator

The MWI will be moved and operate with BACT systems for pollution control that will reduce odour.

Central Laundry Facility

The Central Laundry facility may be a new source of odour through combustion of LPG and emissions of water vapour. However, the facility is not expected to be a noticeable odour source, particularly at the closest sensitive receptors located more than 500 m from the facility.

5. Conclusions

The AAMP was undertaken in general accordance with the Method Statement. If and where changes occurred, they were documented in Section 3.4.

The specified measurement principles and QA/QC program ensured that reliable data was collected for each measured parameter for the duration of the monitoring program.

All recorded baseline concentrations are shown in Table 3 and are below the applicable UK, EU, WHO or Ontario AAQC limits with the exception of H_2S at Station 5 (Lakeside). As noted in Sections 4.6 and 4.14.7 above, Station 5 was likely impacted by a local H_2S source located adjacent to the monitor.

In all cases, with the exception of annual averaging periods, 90th percentile values were used to represent the background concentrations and are therefore conservative.

0 500 1000 1500m

1:50000

Coordinate System: UTM, Nad83, Zone 17F

N

GHD

DART
GEORGE TOWN, GRAND CAYMAN ISLAND

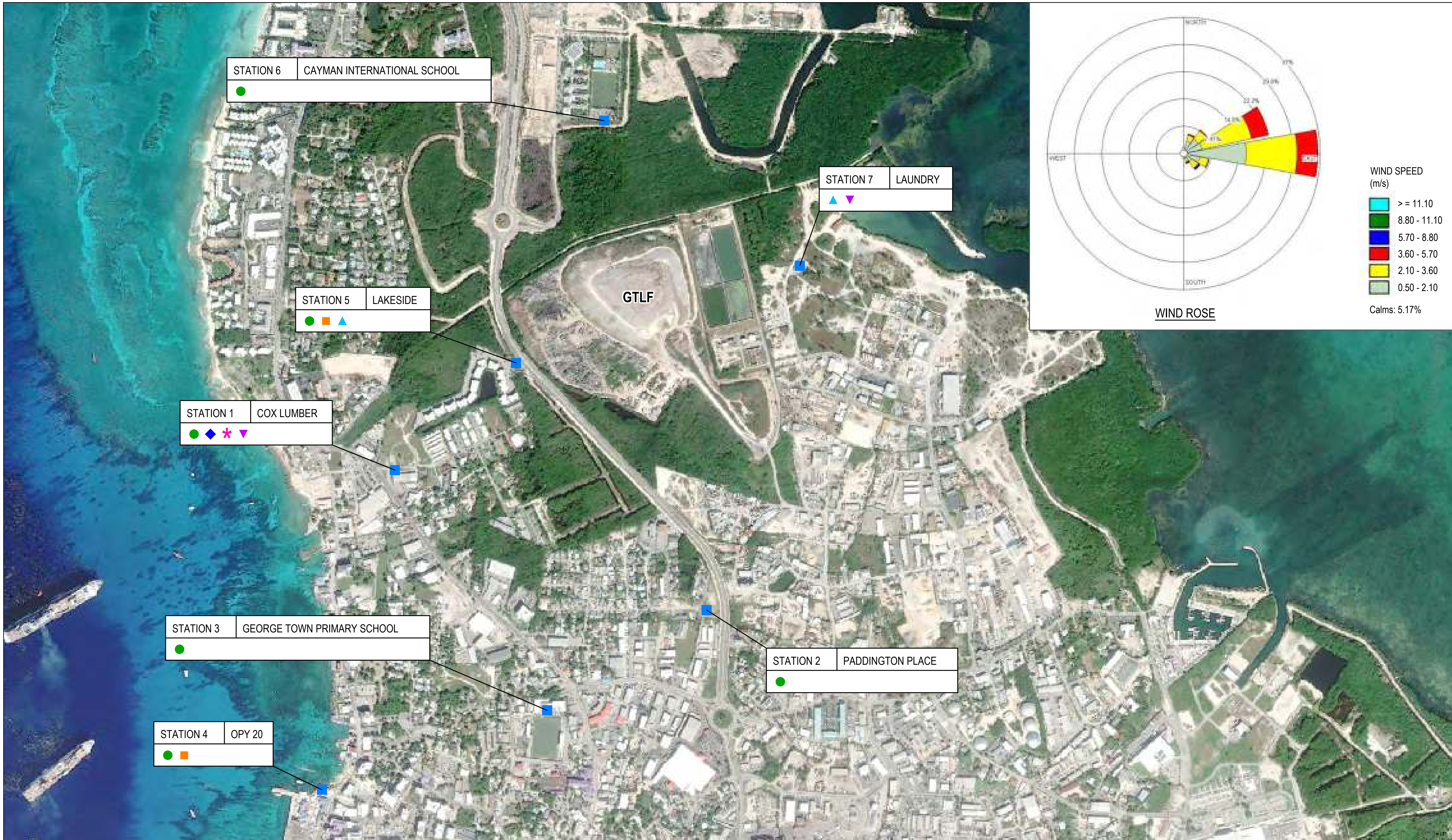
POTENTIAL EMISSION SOURCES

Project No. 11201588
Date December 2022

FIGURE 1

Filename: N:\CA\Whitby\Projects\401\12563972\11201588\Digital_Design\ACAD\Figures\MEM002\11201588-GHD-0000-MEM-EN-0101_WA-002.dwg
Plot Date: 22 December 2022 10:35 AM

Source: Microsoft Product Screen Shot(s) Reprinted with permission from Microsoft Corporation, Accessed: 2021



LEGEND

AIR MONITORING STATION LOCATION

SAMPLES

- PASSIVE (NO_2, SO_2)
- CONTINUOUS (PM10)
- CONTINUOUS (H_2S)
- CONTINUOUS (NO_X, SO_2, CO, PM2.5)
- NON-CONTINUOUS (PM10, METALS, HCl/HF, DIOXINS AND FURANS, PAH, VOC)
- METEOROLOGY

0 350 700 1050m

1:35000

Coordinate System: UTM, Nad83, Zone 17F

N

GHD

DART
GEORGE TOWN, GRAND CAYMAN ISLAND

PARAMETERS AND LOCATIONS FOR MONITORING

Project No. 11201588
Date October 2022

FIGURE 2

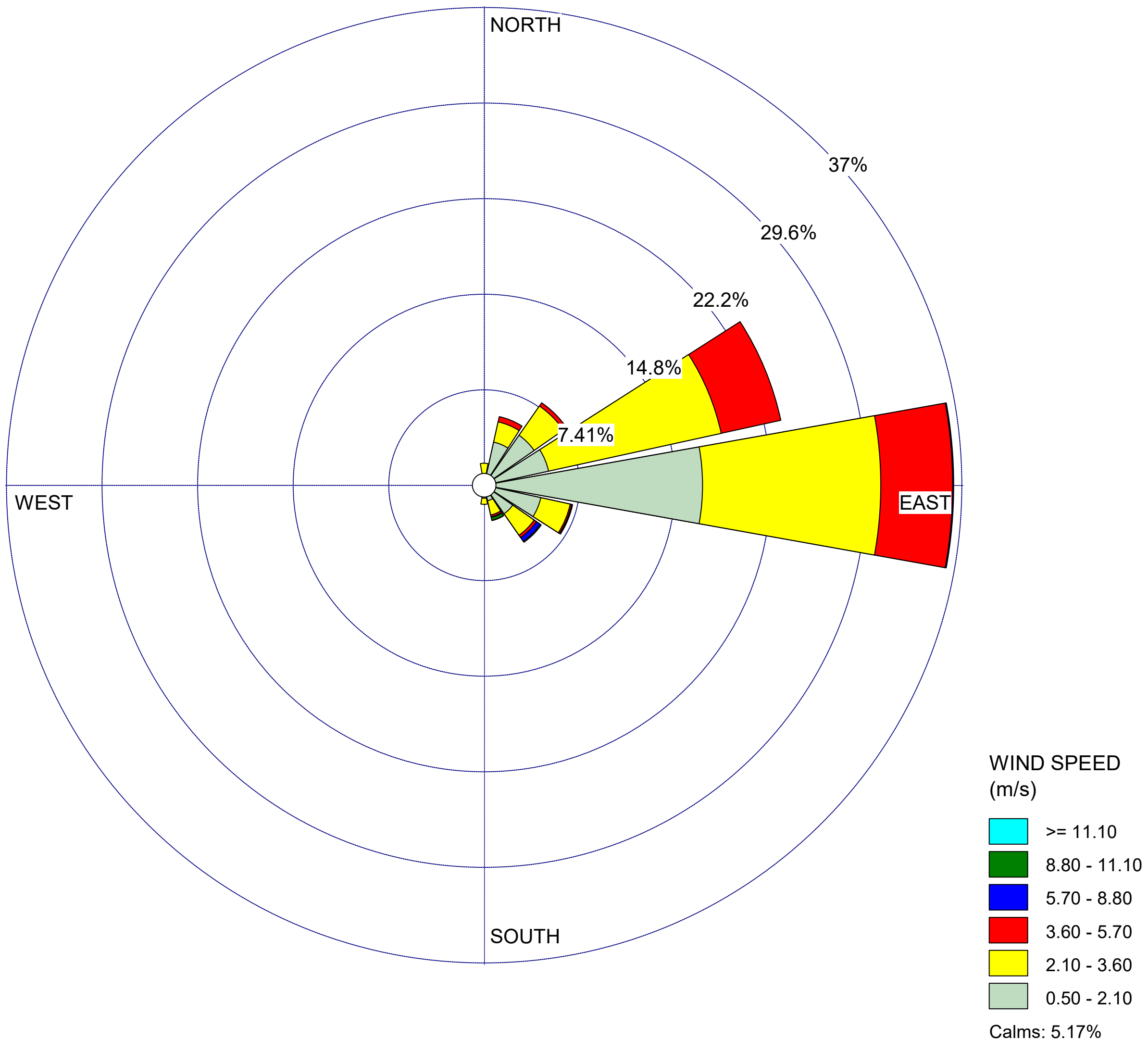
Filename: N:\CA\Whitby\Projects\662\11201588\Digital_Design\ACAD\Figures\MEM002\11201588-GHD-0000-MEM-EN-0102_WA-002.dwg
Plot Date: 25 October 2022 4:36 PM

Source: Microsoft Product Screen Shot(s) Reprinted with permission from Microsoft Corporation, Accessed: 2021

Figure 3

WIND ROSE PLOT:
Wind Rose Plot - Cayman Islands

DISPLAY:
Wind Speed
Direction (blowing from)



COMMENTS:

DATA PERIOD:
Start Date: 10/24/2021 - 00:00
End Date: 3/24/2022 - 04:00

COMPANY NAME:

MODELER:
GHD

CALM WINDS:
5.17%

TOTAL COUNT:
3619 hrs.

AVG. WIND SPEED:
2.22 m/s

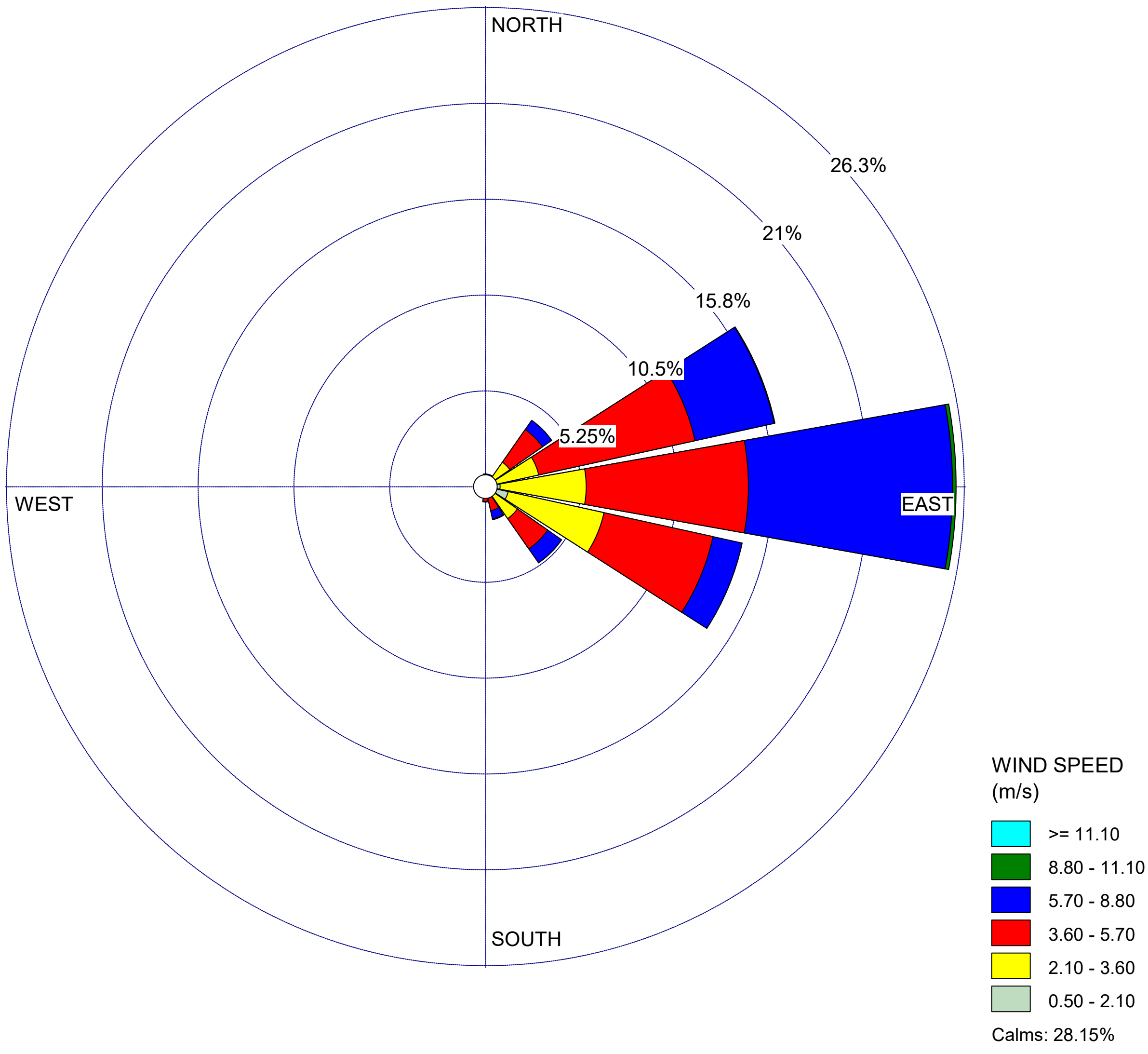
DATE:
9/13/2022

PROJECT NO.:
12563972

WRPLOT View - Lakes Environmental Software

Figure 4

WIND ROSE PLOT:	DISPLAY:
Wind Rose - Owen Roberts International AP **October 24, 2021 - March 23, 2022**	**Wind Speed** **Direction (blowing from)**



COMMENTS:	DATA PERIOD: **Start Date: 10/24/2021 - 00:00** **End Date: 3/24/2022 - 00:00**	COMPANY NAME:	
		MODELER: **GHD**	GHD
	CALM WINDS: **28.15%**	TOTAL COUNT: **2571 hrs.**	
	AVG. WIND SPEED: **3.16 m/s**	DATE: **10/20/2022**	PROJECT NO.: **12563972**

WRPLOT View - Lakes Environmental Software

LEGEND

● ODOUR ASSESSMENT LOCATION

0 350 700 1050m

1:35000

Coordinate System:
UTM, Nad83, Zone 17F

N

GHD

DART
GEORGE TOWN, GRAND CAYMAN ISLAND

ODOUR ASSESSMENT LOCATIONS

Project No. 11201588
Date January 2023

FIGURE 5

Filename: N:\CA\Whitby\Projects\401\12563972\11201588\Digital_Design\ACAD\Figures\MEM002\11201588-GHD-0000-MEM-EN-0104_WA-002.dwg
Plot Date: 19 January 2023 11:40 AM

Table 1

Summary of Ambient Air Monitoring Stations and Principles of Measurement

Station #	Station Name	Parameters	Type	Equipment	Reference Method	Analytical Method	Interval/Frequency
1	Cox Lumber	NO_x	Continuous	Teledyne API T200 (or equivalent)	EN14211:2012	Chemiluminescence	One-hour Average
		NO_2	Passive	NO2 Passive Diffusion Sampler	BVC-00148	IC	Two Weeks
		SO_2	Continuous	Teledyne API T100U (or equivalent)	EN14212:2012	UV Fluorescence	One-hour Average
		SO_2	Passive	SO2 Passive Diffusion Sampler	BVC-00149	IC	Two Weeks
		CO	Continuous	Teledyne API T300U (or equivalent)	EN14626:2012	Gas Filter Correlation	One-hour Average
		$PM_{2.5}$	Continuous	Met-One BAM-1020	EN16450:2017	Beta Attenuation	One-hour Average
		PM_{10}	Non-Continuous	PM10 High Volume Sampler	USEPA IO-2.1	Gravimetric	24-hour Average/6 day
		Metals	Non-Continuous	PM10 High Volume Sampler	EN 14902:2005	ICP/MS	24-hour Average/6 day
		HCl/HF	Non-Continuous	Sorbent Trap	USEPA M26 (Modified)	IC	24-hour Average/6 day
		Dioxins and Furans	Non-Continuous	Medium Volume Sampler/PUF/XAD Trap	USEPA TO-9A	HR/MS	24-hour Average/6 day
		PAH	Non-Continuous	Medium Volume Sampler/PUF/XAD Trap	USEPA TO-9A	HR/MS	24-hour Average/6 day
		VOC	Non-Continuous	Summa Canister	USEPA TO-15	GC/MS	24-hour Average/6 day
		WS, WD, AT, BP	Continuous	Met-One (or equivalent)	OMAQO	NA	One-hour Average
2	Paddington Place	NO_2	Passive	NO2 Passive Diffusion Sampler	BVC-00148	IC	Two Weeks
		SO_2	Passive	SO2 Passive Diffusion Sampler	BVC-00149	IC	Two Weeks
3	George Town Primary School	NO_2	Passive	NO2 Passive Diffusion Sampler	BVC-00148	IC	Two Weeks
		SO_2	Passive	SO2 Passive Diffusion Sampler	BVC-00149	IC	Two Weeks
4	OPY 20	NO_2	Passive	NO2 Passive Diffusion Sampler	BVC-00148	IC	Two Weeks
		SO_2	Passive	SO2 Passive Diffusion Sampler	BVC-00149	IC	Two Weeks
		PM_{10}	Continuous	Met-One E-sampler	EN16450:2017	Optical Light Scattering	One-hour Average
5	Lakeside	NO_2	Passive	NO2 Passive Diffusion Sampler	BVC-00148	IC	Two Weeks
		SO_2	Passive	SO2 Passive Diffusion Sampler	BVC-00149	IC	Two Weeks
		PM_{10}	Continuous	Met-One E-sampler	EN16450:2017	Optical Light Scattering	One-hour Average
		H_2S	Continuous	Jerome 631	NA	Gold film sensing	One-hour Average
6	Cayman International School	NO_2	Passive	NO2 Passive Diffusion Sampler	BVC-00148	IC	Two Weeks
		SO_2	Passive	SO2 Passive Diffusion Sampler	BVC-00149	IC	Two Weeks
7	Laundry	H_2S	Continuous	Jerome 631		Gold film sensing	One-hour Average

Notes:

PAH	Polycylclic Aromatic Hydrocarbons
PUF	Polyurethane Foam
XAD	XAD Sorbent
B(a)P	Benzo-a-Pyrene
VOC	Volatile Organic Compounds
GC/MS	Gas Chromatography/Mass Spectrometry
ICP/MS	Inductively Coupled Plasma Mass Spectrometry
HR/MS	High Resolution Mass Spectroscopy
WS	Wind Speed
WD	Wind Direction
AT	Ambient Temperature
BP	Barometric Pressure
OMAQO	Operations Manual for Air Quality Monitoring in Ontario
IC	Ion Chromatography

Table 2

Summary of Applicable Air Quality Standards and Averaging Periods

Parameters	CAS#	Averaging Period	Limit Time Average	Standard
Carbon Monoxide (CO)	630-08-0	8 Hour running average across a 24 hour period	10 mg/m^3	AAD Limit Value and AQS Objective
Nitrogen Dioxide (NO_2)	11104-93-1	1 Hour	200 $\mu g/m^3$ (2)	AAD Limit Value
Nitrogen Dioxide (NO_2)	11104-93-1	Annual	40 $\mu g/m^3$	AAD Limit Value
Particulates (PM10)	NA - M09	24 Hour	50 $\mu g/m^3$ (3)	AAD Limit Value
Particulates (PM10)	NA - M09	Annual	40 $\mu g/m^3$	AAD Limit Value
Particulates (PM2.5)	NA - M10	Annual	20 $\mu g/m^3$	AAD Limit Value
Sulphur Dioxide (SO_2)	7446-09-5	1 Hour	350 $\mu g/m^3$(4)	AAD Limit Value
Sulphur Dioxide (SO_2)	7446-09-5	24 hour	125 $\mu g/m^3$(5)	AAD Limit Value
Sulphur Dioxide (SO_2)	7446-09-5	15-Minute Mean	266 $\mu g/m^3$(6)	AAD Limit Value
Hydrogen Chloride (HCl)	7647-01-0	Hourly Limit in µg/m3	750 $\mu g/m^3$	EAL
Hydrogen Flouride (HF)	7664-39-3	Annual Limit	16 $\mu g/m^3$ (monthly average)	EAL
Hydrogen Flouride (HF)	7664-39-3	Hourly Limit in $\mu g/m^3$	160 $\mu g/m^3$	EAL
Cadmium (Cd)	NA-03	Annual	5 ng/m^3	AAD Target Value
Arsenic (As)	NA-02	Annual	6 ng/m^3	AAD Target Value
Lead (Pb)	NA-08	Annual	0.25 $\mu g/m^3$	UK AQS Objective
Nickel (Ni)	NA-11	Annual	20 ng/m^3	AAD Target Value
Polycyclic Aromatic Hydrocarbons (PAHs)	50-32-8	Annual	0.25 ng/m^3 of benzo(a)pyrene (BaP) total content within the PM10 fraction	AAD Target Value
Volatile Organic Carbon (VOCs) (Benzene)	71-43-2	Annual-Running Mean	16.25 $\mu g/m^3$	EAL
Volatile Organic Carbon (VOCs) (Benzene)	71-43-2	Hourly Limit in $\mu g/m^3$	195 $\mu g/m^3$	EAL
Hydrogen Sulphide	6/4/7783	10 Minute	13 $\mu g/m^3$	AAQC
Dioxins and Furans	-	24 Hour	0.1 $pgTEQ/m^3$	AAQC

Notes:

(1) Reporting Standards sourced from National Air Quality objectives and European Directive limit and target values
for the protection of human health (applicable to the UK).
https://uk-air.defra.gov.uk/assets/documents/Air_Quality_Objectives_Update.pdf
(2) Not to be exceeded more than 18 times a year.
(3) Not to be exceeded more than 35 times a year.
(4) Not to be exceeded more than 24 times a year.
(5) Not to be exceeded more than 4 times a year.
(6) Not to be exceeded more than 35 times a year.
(7) Reporting Standards for Hydrogen Sulphide, Dioxins and Furans were sourced from "The Ministry of the Environment, Conservation and Parks" of Ontario, Canada.
https://www.ontario.ca/page/ontarios-ambient-air-quality-criteria#section-4

EAL - Environmental Assessment Levels
AAD - Ambient Air Quality Directive
AQS - Air Quality Strategy Value
AAQC - Ambient Air Quality Criteria

Table 3

Monitored Background Air Concentrations and Averaging Periods

Parameters	Station #	Station Name	CAS#	Averaging Period	Units	Background Concentration	Standard	% of the Standard
Carbon Monoxide 8 Hour Background Concentrations								
Carbon Monoxide (CO)	1	COX Lumber	630-08-0	8 Hour running average across a 24 hour period	(mg/m^3)	2.258	10	23%
Nitrogen Dioxide 1 Hour Background Concentrations								
Nitrogen Dioxide (NO_2) - CEMS	1	COX Lumber	11104-93-1	1 Hour	$\mu g/m^3$	14.340	200	7%
Nitrogen Dioxide (NO_2) - Passive	1	COX Lumber	11104-93-1	1 Hour	$\mu g/m^3$	20.559	200	10%
Nitrogen Dioxide (NO_2) - Passive	2	Paddington Place	11104-93-1	1 Hour	$\mu g/m^3$	82.805	200	41%
Nitrogen Dioxide (NO_2) - Passive	3	George Town Primary School	11104-93-1	1 Hour	$\mu g/m^3$	103.160	200	52%
Nitrogen Dioxide (NO_2) - Passive	4	OPY 20	11104-93-1	1 Hour	$\mu g/m^3$	68.625	200	34%
Nitrogen Dioxide (NO_2) - Passive	5	Lakeside	11104-93-1	1 Hour	$\mu g/m^3$	50.395	200	25%
Nitrogen Dioxide (NO_2) - Passive	6	Cayman International School	11104-93-1	1 Hour	$\mu g/m^3$	11.222	200	6%
Nitrogen Dioxide Annual Background Concentrations								
Nitrogen Dioxide (NO_2) - CEMS	1	COX Lumber	11104-93-1	Annual	$\mu g/m^3$	5.796	40	14%
Nitrogen Dioxide (NO_2) - Passive	1	COX Lumber	11104-93-1	Annual	$\mu g/m^3$	5.499	40	14%
Nitrogen Dioxide (NO_2) - Passive	2	Paddington Place	11104-93-1	Annual	$\mu g/m^3$	21.641	40	54%
Nitrogen Dioxide (NO_2) - Passive	3	George Town Primary School	11104-93-1	Annual	$\mu g/m^3$	25.990	40	65%
Nitrogen Dioxide (NO_2) - Passive	4	OPY 20	11104-93-1	Annual	$\mu g/m^3$	16.016	40	40%
Nitrogen Dioxide (NO_2) - Passive	5	Lakeside	11104-93-1	Annual	$\mu g/m^3$	11.228	40	28%
Nitrogen Dioxide (NO_2) - Passive	6	Cayman International School	11104-93-1	Annual	$\mu g/m^3$	2.509	40	6%
Particulates (PM10) 24 hour Background Concentrations								
Particulates (PM10) - Non-Continuous	1	COX Lumber	NA - M09	24 Hour	$\mu g/m^3$	31.215	50	62%
Particulates (PM10) - Continuous	4	OPY 20	NA - M09	24 Hour	$\mu g/m^3$	6.965	50	14%
Particulates (PM10) - Continuous	5	Lakeside	NA - M09	24 Hour	$\mu g/m^3$	8.915	50	18%
Particulates (PM10) Annual Background Concentrations								
Particulates (PM10) - Non-Continuous	1	COX Lumber	NA - M09	Annual	$\mu g/m^3$	25.768	40	64%
Particulates (PM10) - Continuous	4	OPY 20	NA - M09	Annual	$\mu g/m^3$	14.948	40	37%
Particulates (PM10) - Continuous	5	Lakeside	NA - M09	Annual	$\mu g/m^3$	16.525	40	41%
Particulates (PM2.5) Annual Background Concentrations								
Particulates (PM2.5)	1	COX Lumber	NA - M10	Annual	$\mu g/m^3$	5.117	20	26%
Sulphur Dioxide 1 Hour Background Concentrations								
Sulphur Dioxide (SO_2) - CEMS	1	COX Lumber	7446-09-5	1 Hour	$\mu g/m^3$	3.087	350	1%
Sulphur Dioxide (SO_2) - Passive	1	COX Lumber	7446-09-5	1 Hour	$\mu g/m^3$	17.932	350	5%
Sulphur Dioxide (SO_2) - Passive	2	Paddington Place	7446-09-5	1 Hour	$\mu g/m^3$	8.450	350	2%
Sulphur Dioxide (SO_2) - Passive	3	George Town Primary School	7446-09-5	1 Hour	$\mu g/m^3$	5.742	350	2%
Sulphur Dioxide (SO_2) - Passive	4	OPY 20	7446-09-5	1 Hour	$\mu g/m^3$	5.144	350	1%
Sulphur Dioxide (SO_2) - Passive	5	Lakeside	7446-09-5	1 Hour	$\mu g/m^3$	38.610	350	11%
Sulphur Dioxide (SO_2) - Passive	6	Cayman International School	7446-09-5	1 Hour	$\mu g/m^3$	15.960	350	5%
Sulphur Dioxide 24 Hour Background Concentrations								
Sulphur Dioxide (SO_2) - CEMS	1	COX Lumber	7446-09-5	24 hour	$\mu g/m^3$	1.268	125	1%
Sulphur Dioxide (SO_2) - Passive	1	COX Lumber	7446-09-5	24 hour	$\mu g/m^3$	17.515	125	14%
Sulphur Dioxide (SO_2) - Passive	2	Paddington Place	7446-09-5	24 hour	$\mu g/m^3$	7.423	125	6%
Sulphur Dioxide (SO_2) - Passive	3	George Town Primary School	7446-09-5	24 hour	$\mu g/m^3$	5.339	125	4%
Sulphur Dioxide (SO_2) - Passive	4	OPY 20	7446-09-5	24 hour	$\mu g/m^3$	3.795	125	3%
Sulphur Dioxide (SO_2) - Passive	5	Lakeside	7446-09-5	24 hour	$\mu g/m^3$	37.038	125	30%
Sulphur Dioxide (SO_2) - Passive	6	Cayman International School	7446-09-5	24 hour	$\mu g/m^3$	11.039	125	9%

Table 3

Monitored Background Air Concentrations and Averaging Periods

Parameters	Station #	Station Name	CAS#	Averaging Period	Units	Background Concentration	Standard	% of the Standard
Sulphur Dioxide 15 Min Background Concentrations								
Sulphur Dioxide (SO_2) - CEMS	1	COX Lumber	7446-09-5	15-Minute	$\mu g/m^3$	4.551	266	2%
Sulphur Dioxide (SO_2) - Passive	1	COX Lumber	7446-09-5	15-Minute	$\mu g/m^3$	119.325	266	45%
Sulphur Dioxide (SO_2) - Passive	2	Paddington Place	7446-09-5	15-Minute	$\mu g/m^3$	47.258	266	18%
Sulphur Dioxide (SO_2) - Passive	3	George Town Primary School	7446-09-5	15-Minute	$\mu g/m^3$	30.717	266	12%
Sulphur Dioxide (SO_2) - Passive	4	OPY 20	7446-09-5	15-Minute	$\mu g/m^3$	22.447	266	8%
Sulphur Dioxide (SO_2) - Passive	5	Lakeside	7446-09-5	15-Minute	$\mu g/m^3$	251.646	266	95%
Sulphur Dioxide (SO_2) - Passive	6	Cayman International School	7446-09-5	15-Minute	$\mu g/m^3$	64.979	266	24%
Hydrogen Chloride 1 Hour Background Concentrations								
Hydrogen Chloride (HCl)	1	COX Lumber	7647-01-0	1 Hour	$\mu g/m^3$	32.279	750	4%
Hydrogen Flouride Annual Background Concentrations								
Hydrogen Flouride (HF)	1	COX Lumber	7664-39-3	Annual	$\mu g/m^3$	6.971	16	44%
Hydrogen Flouride 1 Hour Background Concentrations								
Hydrogen Flouride (HF)	1	COX Lumber	7664-39-3	1 Hour	$\mu g/m^3$	22.888	160	14%
Metals Annual Background Concentrations								
Cadmium (Cd)	1	COX Lumber	NA-03	Annual	$\mu g/m^3$	0.0002	5	0.003%
Arsenic (As)	1	COX Lumber	NA-02	Annual	$\mu g/m^3$	0.0018	6	0.031%
Lead (Pb)	1	COX Lumber	NA-08	Annual	$\mu g/m^3$	0.0020	0.25	0.816%
Nickel (Ni)	1	COX Lumber	NA-11	Annual	$\mu g/m^3$	0.0022	20	0.011%
Polycyclic Aromatic Hydrocarbons (PAHs) Annual Background Concentrations								
PAHs (Benzo(a)Pyrene)	1	COX Lumber	50-32-8	Annual	ng/m^3	0.0765	0.25	31%
Volatile Organic Compounds Annual Background Concentrations								
VOCs (Benzene)	1	COX Lumber	71-43-2	Annual	$\mu g/m^3$	0.503	16	3%
Volatile Organic Compounds 1 Hour Background Concentrations								
VOCs (Benzene)	1	COX Lumber	71-43-2	1 Hour	$\mu g/m^3$	1.587	195	1%
Hydrogen Sulphide 10 Min Background Concentrations								
Hydrogen Sulphide	5	Lakeside	7783-06-4	10 Min	$\mu g/m^3$	34.847	13	268%
Hydrogen Sulphide	7	Laundry	7783-06-4	10 Min	$\mu g/m^3$	2.788	13	21%
Dioxin and Furans 24 Hour Background Concentrations								
Mid Point PCDD/F TEQ (WHO 2005)	1	COX Lumber	-	24	$pgTEQ/m^3$	0.013	0.1	13%

Notes:

(1) For the various parameters and their averaging periods (except for the annual averaging period), the 90 th percentile value was used to represent the background concentration.
(2) For the various parameters for which the annual averaging period is applicable, the average of the entire sampling duration was used.
(3) PCDD/F - Polychlorinated Dibenzo-p-dioxins (PCDDs, Dioxins) and Polychlorinated Dibenzofurans (PCDFs, Furans),
(4) TEQ - Toxic equivalency of a dioxin or furan homologue to that of 2,3,7,8 PCDD.

Appendices

Appendix A

Continuous Raw Data and Working Tables

Table A-1

Edited Raw Data from CEMS
Station 1 - Cox Lumber

TIMESTAMP TS	RECORD RN #	Batt_Volt_Min Volts Min	WS_kph_S_WVT m/s WVc	WindDir_D1_WVT Deg WVc	Ambient_Temp_Avg Deg C Avg	NO_X ppb Avg	NO ppb Avg	NO_2 ppb Avg	SO_2 ppb Avg	CO ppm Avg	PM_{25} µg/m3 Avg	RH % Avg
10/24/2021 8:59	0	13.62	7.539	118	30.17							67.24
10/24/2021 9:59	1	13.65	9.92	121.3	30.94							61.88
10/24/2021 10:59	2	13.65	10.45	121.7	31.47							59.23
10/24/2021 11:59	3	13.65	10.74	145.7	32.73							55.24
10/24/2021 12:59	4	13.65	10.18	151.2	33.4							53.09
10/24/2021 13:59	5	13.65	11.19	149	33.26							53.95
10/24/2021 14:59	6	13.65	10.31	152.8	31.99							58.34
10/24/2021 15:59	7	13.65	10.96	146.4	32.02							59.92
10/24/2021 16:59	8	13.65	9.99	140.1	31.58							62.15
10/24/2021 17:59	9	13.65	8.14	133.7	30.21							65.21
10/24/2021 18:59	10	13.65	6.893	128.9	29.36							68.4
10/24/2021 19:59	11	13.65	6.753	131.3	29.21							70.11
10/24/2021 20:59	12	13.65	6.592	125.1	28.99							70.21
10/24/2021 21:59	13	13.65	5.352	128.8	28.83							70.79
10/24/2021 22:59	14	13.65	6.179	127.1	28.53							73.69
10/24/2021 23:59	15	13.65	6.18	125.9	28.45							72.35
10/25/2021 0:59	16	13.65	5.105	128.1	28.25							72.33
10/25/2021 1:59	17	13.65	6.053	129.6	28.1							73.88
10/25/2021 2:59	18	13.65	5.406	135.3	27.97							74.46
10/25/2021 3:59												
10/25/2021 4:59	20	13.65	4.109	137.9	27.99						9.43	74.96
10/25/2021 5:59	21	13.65	5.544	144.3	27.96						7.51	75.07
10/25/2021 6:59	22	13.65	5.487	146	28.16	5.532	3.42	2.277		0.452	8.34	72.19
10/25/2021 7:59	23	13.65	7.577	144.5	29.45	10.18	7.477	2.943		0.583	8.87	70.14
10/25/2021 8:59	24	13.65	8.74	142.7	30.73	4.953	3.972	1.12		0.468	12.58	65.52
10/25/2021 9:59	25	13.62	7.327	140.6	31.62	1.601	2.033			0.548	14.23	62.48
10/25/2021 10:59	26	13.59	9.1	148.4	32.35	2.274	2.698			0.497	10.53	57.87
10/25/2021 11:59	27	13.56	8.78	167.5	33.63	4.57	4.45			0.601	6.481	53.99
10/25/2021 12:59	28	13.56	9.48	162	33.76	3.316	3.758			0.492	7.37	52.65
10/25/2021 13:59	29	13.56	9.48	152.2	33.76	1.363	2.302			0.429	22.67	52.42
10/25/2021 14:59	30	13.56	9.28	153.1	33.76	1.898	2.419			0.471		53.64
10/25/2021 15:59	31	13.59	9.62	154.2	33.23	2.512	3.159			0.453		56.19
10/25/2021 16:59	32	13.62	8.16	151.1	32.52	5.164	4.328	0.894		0.471	4.675	58.42
10/25/2021 17:59	33	13.65	8.3	137.5	30.46	8.24	6.171	2.033		0.453	8.5	65.17
10/25/2021 18:59	34	13.65	6.913	136.4	29.32	35.85	27.54	8.53		0.42	6.476	69.37
10/25/2021 19:59	35	13.65	6.549	131.5	29.12	24.83	18.51	6.487		0.447	4.141	71.05
10/25/2021 20:59	36	13.65	4.215	116.9	28.94	13.32	9.3	4.24		0.423	4.654	72.21
10/25/2021 21:59	37	13.65	4.616	100.1	28.56	2.749	2.364	0.619		0.482	3.046	75.32
10/25/2021 22:59	38	13.65	4.318	111.2	28.4	76.89	63.91	13.31		0.557	3.612	74.15
10/25/2021 23:59	39	13.65	3.831	105.3	28.08		0.983			0.408	6.006	76.28
10/26/2021 0:59	40	13.65	3.364	123.4	27.83	14.57	10.23	4.52		0.413	9.42	76.32
10/26/2021 1:59	41	13.65	2.284	107.5	27.64	35.78	27.5	8.44		0.402	7.182	76.34
10/26/2021 2:59	42	13.65	1.874	95.2	27.37	11.39	5.899	5.756		0.571	8.18	79.08
10/26/2021 3:59												
10/26/2021 4:59	44	13.65	1.082	106	27.18	0.789	0.777	0.233		0.389	29.81	79.88
10/26/2021 5:59	45	13.65	1.359	97.3	26.9	1.583	1.597	0.188		0.456	14.6	81.1
10/26/2021 6:59	46	13.65	1.785	113.3	27.14	14.67	10.65	4.191		0.62	2.348	79.81
10/26/2021 7:59	47	13.65	4.475	94.4	28.76	12.75	9.66	3.324		0.59	4.664	73.14
10/26/2021 8:59	48	13.65	6.349	87.8	29.64	20.98	17.6	3.558		0.573	8.29	68.47
10/26/2021 9:59	49	13.65	5.855	89.4	30.62	10.74	8.94	1.928		0.514	9.79	64.25
10/26/2021 10:59	50	13.65	5.469	124.1	32.39	1.69	2.528			0.517	11.16	54.59
10/26/2021 11:59	51	13.68	6.564	88.2	31.35	1.522	2.284			0.537	12.87	62.15
10/26/2021 12:59	52	13.62	7.43	162.3	33.98	3.034	3.561			0.745	8.67	49.39
10/26/2021 13:59	53	13.56	2.171	179.7	34.46	3.37	3.444	0.083		0.555		49.28
10/26/2021 14:59	54	13.59	1.956	161.4	33.8	4.032	4.012	0.1		0.479		51.73
10/26/2021 15:59	55	13.62	1.871	167.1	32.94	6.319	5.469	0.873		0.486	2.748	54.4
10/26/2021 16:59	56	13.66	1.65	167.6	32.22	12.93	10.14	2.772		1.245	6.994	57.59
10/26/2021 17:59	57	13.65	1.186	146.6	30.71	6.551	5.241	1.337		0.525	12.15	63.14
10/26/2021 18:59	58	13.65	1.062	148.8	29.22	5.814	4.066	1.829		0.535	6.081	66.93
10/26/2021 19:59	59	13.66	1.025	136.4	28.76	1.292	1.363	0.111		0.435	2.209	69.75
10/26/2021 20:59	60	13.66	0.635	99	28.47	10.89	7.095	3.993		0.493	7.545	71.48
10/26/2021 21:59	61	13.65	0.517	86.8	28.16	4.006	3.657	0.526		0.435	4.52	72.41
10/26/2021 22:59	62	13.66	0.413	128.2	27.7	2.883	1.467	1.562		0.494	1.567	72.01
10/26/2021 23:59	63	13.66	0.184	124.8	27.4	4.694	2.257	2.648		0.458	3.012	75.19
10/27/2021 0:59	64	13.66	0.183	160.4	27.06	6.119	3.239	3.062		0.443	2.549	78.03
10/27/2021 1:59	65	13.65	0.406	151.8	26.82	1.753	1.308	0.663		0.435	3.279	79.26
10/27/2021 2:59	66	13.62	0.144	117.4	26.45	1.391	0.906	0.682		0.418	3.377	80.4
10/27/2021 3:59												
10/27/2021 4:59	68	13.65	0.337	117.7	26.09	11.14	7.715	3.631	0.046	0.438	6.366	81.5
10/27/2021 5:59	69	13.63	0.581	126.5	26.39	4.271	3.452	1.061		0.502	3.34	79.57
10/27/2021 6:59	70	13.63	0.192	121	26.17	60.35	53.9	6.629	0.678	0.975	5.23	81.6
10/27/2021 7:59	71	13.66	0.75	125.3	28.57	42.16	36.33	5.946	0.506	0.901	10.69	72.7
10/27/2021 8:59	72	13.52	1.546	127	30.3	19.94	12.35	1.137		0.336	7.384	63.73
10/27/2021 9:59	73	13.05	1.973	142.1	31.16							60.21
10/27/2021 10:59	74	13.02	2.377	152.4	32.19							58.49
10/27/2021 11:59	75	12.99	2.491	161.8	32.61							57.04
10/27/2021 12:59	76	13	2.337	173.1	33.3							54.85
10/27/2021 13:59	77	13	2.45	171.5	33.31							53.98

Full Appendix A table set removed to reduce Report size. See original documentation of Air Monitoring Report for full data set.

Appendix B

Non-Continuous Raw Data, Working Tables and Lab Results

Dart
ATTN: John MacRae
455 Philip Street
Waterloo ON -

Date Received: 07-DEC-21
Report Date: 29-DEC-21 15:05 (MT)
Version: FINAL

Client Phone: 519-340-4312

Certificate of Analysis

Lab Work Order #: L2670121

Project P.O. #: NOT SUBMITTED
Job Reference: 11201588
C of C Numbers:
Legal Site Desc:

Lynne Wrona, M.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2670121-1 JM-01							
Sampled By: Client on 25-OCT-21							
Matrix: Hi Vol Filter							
Miscellaneous Parameters							
Air volume	1627			m3		16-DEC-21	R5681407
Particulate on High Volume Filter							
Total particulate	42.8		0.061	ug/m3		20-DEC-21	R5682100
Total particulate	69700		100	ug		20-DEC-21	R5682100
Mercury on High Volume Filter by CVAA							
Mercury (Hg)	0.0000282		0.0000061	ug/m3	22-DEC-21	29-DEC-21	R5683675
Mercury (Hg)	0.046		0.010	ug	22-DEC-21	29-DEC-21	R5683675
Metals on High Volume Filter by ICPMS							
Silver (Ag)	<0.000055		0.000055	ug/m3	22-DEC-21	23-DEC-21	R5683661
Silver (Ag)	<0.090		0.090	ug	22-DEC-21	23-DEC-21	R5683661
Aluminum (Al)	0.351		0.0055	ug/m3	22-DEC-21	23-DEC-21	R5683661
Aluminum (Al)	572		9.0	ug	22-DEC-21	23-DEC-21	R5683661
Arsenic (As)	<0.0018		0.0018	ug/m3	22-DEC-21	23-DEC-21	R5683661
Arsenic (As)	<3.0		3.0	ug	22-DEC-21	23-DEC-21	R5683661
Barium (Ba)	0.00608		0.00031	ug/m3	22-DEC-21	23-DEC-21	R5683661
Barium (Ba)	9.90		0.50	ug	22-DEC-21	23-DEC-21	R5683661
Beryllium (Be)	<0.000031		0.000031	ug/m3	22-DEC-21	23-DEC-21	R5683661
Beryllium (Be)	<0.050		0.050	ug	22-DEC-21	23-DEC-21	R5683661
Cadmium (Cd)	0.000070		0.000017	ug/m3	22-DEC-21	23-DEC-21	R5683661
Cadmium (Cd)	0.114		0.027	ug	22-DEC-21	23-DEC-21	R5683661
Cobalt (Co)	0.000204		0.000018	ug/m3	22-DEC-21	23-DEC-21	R5683661
Cobalt (Co)	0.333		0.030	ug	22-DEC-21	23-DEC-21	R5683661
Chromium (Cr)	0.0024		0.0021	ug/m3	22-DEC-21	23-DEC-21	R5683661
Chromium (Cr)	3.9		3.4	ug	22-DEC-21	23-DEC-21	R5683661
Copper (Cu)	0.0755		0.00061	ug/m3	22-DEC-21	23-DEC-21	R5683661
Copper (Cu)	123		1.0	ug	22-DEC-21	23-DEC-21	R5683661
Iron (Fe)	0.470		0.0074	ug/m3	22-DEC-21	23-DEC-21	R5683661
Iron (Fe)	765		12	ug	22-DEC-21	23-DEC-21	R5683661
Magnesium (Mg)	1.20		0.037	ug/m3	22-DEC-21	23-DEC-21	R5683661
Magnesium (Mg)	1950		60	ug	22-DEC-21	23-DEC-21	R5683661
Manganese (Mn)	0.00813		0.00028	ug/m3	22-DEC-21	23-DEC-21	R5683661
Manganese (Mn)	13.2		0.45	ug	22-DEC-21	23-DEC-21	R5683661
Molybdenum (Mo)	0.00135		0.00022	ug/m3	22-DEC-21	23-DEC-21	R5683661
Molybdenum (Mo)	2.20		0.36	ug	22-DEC-21	23-DEC-21	R5683661
Nickel (Ni)	0.00335		0.00015	ug/m3	22-DEC-21	23-DEC-21	R5683661
Nickel (Ni)	5.45		0.25	ug	22-DEC-21	23-DEC-21	R5683661
Lead (Pb)	0.00270		0.000074	ug/m3	22-DEC-21	23-DEC-21	R5683661
Lead (Pb)	4.40		0.12	ug	22-DEC-21	23-DEC-21	R5683661
Antimony (Sb)	0.00065		0.00015	ug/m3	22-DEC-21	23-DEC-21	R5683661
Antimony (Sb)	1.06		0.25	ug	22-DEC-21	23-DEC-21	R5683661
Selenium (Se)	<0.00080		0.00080	ug/m3	22-DEC-21	23-DEC-21	R5683661
Selenium (Se)	<1.3		1.3	ug	22-DEC-21	23-DEC-21	R5683661
Thallium (Tl)	<0.000055		0.000055	ug/m3	22-DEC-21	23-DEC-21	R5683661
Thallium (Tl)	<0.090		0.090	ug	22-DEC-21	23-DEC-21	R5683661
Uranium (U)	0.0000625		0.0000037	ug/m3	22-DEC-21	23-DEC-21	R5683661
Uranium (U)	0.102		0.0060	ug	22-DEC-21	23-DEC-21	R5683661
Vanadium (V)	<0.0031		0.0031	ug/m3	22-DEC-21	23-DEC-21	R5683661
Vanadium (V)	<5.0		5.0	ug	22-DEC-21	23-DEC-21	R5683661
Zinc (Zn)	0.0256		0.0028	ug/m3	22-DEC-21	23-DEC-21	R5683661
Zinc (Zn)	41.6		4.5	ug	22-DEC-21	23-DEC-21	R5683661
Bismuth (Bi)	<0.0011		0.0011	ug/m3	22-DEC-21	23-DEC-21	R5683661

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Full Appendix B table set removed to reduce Report size. See original documentation of Air Monitoring Report for full data set.

Appendix C

Field Files and Calibration Files

Appendix C QA/QC Plan Cayman AAMP

1. Quality Assurance/Quality Control

1.1 CEMS

The CEMs were purchased specifically for this project. They were installed brand new out of the crate into the container racking. The following sections discuss the QA/QC program that was utilized for the CEMs.

1.1.1 NOx

The NOx CEM was calibrated prior to the start of the Program with EPA Protocol 1 calibration gases. The CEMs were spanned and zeroed nightly with the zero air generator and internal permeation tubes. After installation calibration was performed monthly using the calibration gases.

1.1.2 CO

The CO CEM was calibrated prior to the start of the Program with EPA Protocol 1 calibration gases. After installation calibration was performed monthly using the calibration gases.

1.1.3 SO_2

The SO_2 CEM was calibrated prior to the start of the Program with EPA Protocol 1 calibration gases. The CEMs were spanned and zeroed nightly with the zero air generator and internal permeation tubes. After installation calibration was performed monthly using the calibration gases.

1.1.4 BAM 1020 PM2.5

The BAM 1020 was leak tested and calibrated by VES upon installation. A PM2.5 cut cyclone was placed on the top of the sample inlet. Flow checks were completed every month as per the operator manual using a MetOne calibration orifice. The BAM 1020 calibrates itself before each reading by analyzing a blank portion of the tape prior to collecting and analyzing the sample using the principle of beta attenuation.

1.1.5 H_2S

The Jerome gold-film analyzers were calibrated on an annual basis at the AMETEK facility in the US.

The functionality of the analyzers were checked regularly using a Functional Test Module (FTM) at the DEH lab.

1.1.6 WS/WD

The RM Young Wind Speed and Wind direction monitor was calibrated prior to the AAMP by VES. At the beginning of the program the wind direction was confirmed using a compass and verified by calculating the magnetic declination and adjusting the direction to true north by using online maps and identifying an object that is visibly in the true north direction. In addition, the data was verified by comparing the measurements at Station 1 with the George Town Airport measurements for the same period.

1.2 FRM Non-Continuous Samplers

Prior to the sampling, the FRM equipment was leak tested and calibrated using a calibration kit specific to each unit. Each calibration kit was calibrated by the manufacturer and a calibration sheet was generated by the manufacturer with a calibration curve specific to each calibrator. GHD used a calibrated digital manometer to set the flow rate of the equipment to specifications and the flow rate was locked using set screws. Internal timing devices (chronometers) were used to record the time each FRM sampler was running in order to calculate the final volume sampled. The calibration procedures ensured the PM10 sampler was running at 40 cfm+/- 10% while the PUF sampler was running at 8 cfm+/- 10%. After initial calibration, calibration checks were performed monthly to ensure that the flow rate had not changed.

1.2.1 Chain of Custody

For each sample in the following section, chain of custody (COC) procedures were utilized from the point of transport to the laboratory. On each COC the following information was recorded at a minimum:

– Sample date
– Sample time
– Sampler name
– Required analyses
– Mode of transport
– Person who relinquished the samples for transport
– Person who received the samples by the laboratory

1.3 PM10/Metals

Each PM10 filter was weighed at ALS Labs and uniquely labelled. The filter was placed inside the filter holder by the sampler using nitrile gloves and secured in the housing. Field data sheets were used to record the unique identifier on each filter as well as all other pertinent information specific to each sample such as:

– Date
– Start time
– End time
– Chronometer starting value
– Chronometer ending value
– Laboratory sample number
– Field Sample Number with Sampler initials beginning at 01
– Weather Conditions
– Ambient temperature

At the end of the sample run, the filter was removed using nitrile gloves and placed into the unique envelope and the samples were stored in the container for shipment to ALS Labs in Burlington, Ontario, Canada. Pictures were taken of the sample prior to placing it in the envelope. Pictures were also taken of the sample data sheet. All laboratory hold times were adhered to for shipping and analysis of the samples. The field sampling and calibration forms for non-continuous sample collection are provided in Appendix C.

1.4 PUF Sampler

Each PUF/XAD cartridge and hexane rinsed filter was prepared by ALS Labs and uniquely labelled. Once received, the cartridges were placed inside a refrigerator in the container and kept cold. On the sampling day, the cartridge was placed inside the housing by the sampler using nitrile gloves and secured in the housing. Field data sheets were used to record the unique identifier on each filter as well as all other pertinent information specific to each sample such as:

– Date
– Start time
– End time
– Chronometer starting value
– Chronometer ending value
– Laboratory sample number
– Field Sample Number with Sampler initials beginning at 01
– Weather Conditions
– Ambient temperature

At the end of the sample run, the cartridge was removed using nitrile gloves and placed into the unique packaging and the samples were stored in the container inside the refrigerator for shipment to ALS Labs in Burlington, Ontario, Canada. Pictures were taken of the sample prior to placing it in the envelope. Pictures were also taken of the sample data sheet. All laboratory hold times were adhered to for shipping and analysis of the samples. The field sampling and calibration forms for non-continuous sample collection are provided in Appendix C.

1.5 TO15 VOC from Summa Canisters

Each canister and 24hr mass flow controller (MFC) was cleaned/prepared and/or evacuated by ALS Labs and uniquely labelled. Once received, the summa canisters and MFCs were stored inside the container prior to use. When ready for sampling the MFC was attached to the canister and the canister/MFC was placed on the roof of the container and securely chained to the railing. At the start of sampling, the summa canister valve was opened and the vacuum at the beginning of the sample was recorded on a field data sheet. Field data sheets were used to record the unique identifier on each canister/MFC as well as all other pertinent information specific to each sample such as:

– Date
– Start time
– End time
– Vacuum starting value
– Vacuum ending value
– Laboratory canister/MFC number
– Field Sample Number with Sampler initials beginning at 01
– Weather Conditions
– Ambient temperature

At the end of the 24-hour sample run, the canister valve was closed and disassembled from the MFC and placed into a shipping box. The samples were stored in the container for shipment to ALS Labs in Burlington, Ontario, Canada. All laboratory hold times were adhered to for shipping and analysis of the samples by GC/MS. The field sampling and calibration forms for non-continuous sample collection are provided in Appendix C.

1.6 HCl/HF

The HCl/HF samples were collected from the exhaust of the CO monitor at approximately 800 ml/min using a mini-impinger and 0.1N H_2SO_4 reagent solution to capture the chloride and fluoride ions. Prior to sampling the impinger was rinsed with de-ionized water. After the rinse and prior to sampling, approximately 30 ml of the 0.1N H_2SO_4 reagent solution was added to the impinger and the impinger was placed in a holder. Teflon tubing was placed between the exhaust of the CO monitor and the flow rate of the CO monitor was recorded on a field data sheet.

Samples were allowed to run for 24-hours and the ending flow rate on the CO monitor was recorded. After the completion of the sample period, the samples were recovered by placing the reagent inside an amber glass sample jar. The impinger was rinsed with DI water and added to the sample jar and uniquely identified. Field data sheets were used to record the unique identifier on each impinger as well as all other pertinent information specific to each sample such as:

- Date
- Start time
- End time
- Flow rate starting value
- Flow rate ending value
- Field Sample Number with Sampler initials beginning at 01

The samples were stored in the container for shipment to ALS Labs in Burlington, Ontario, Canada. All laboratory hold times were adhered to for analysis of the samples.

1.7 Passive Samples

Passive sample media was prepared and shipped to the site on ice by Bureau Veritas (BV) labs. The following protocols were used on-site during the sampling at each location:

Deployment:

- The sample media was inspected for damage prior to use
- The sample media was deployed to their respective shelters
- The storage caps were replaced with the diffusive caps
- Sample information was recorded on field data sheet
- The media was exposed for required sampling period

Retrieval:

- Inspect the sample media for damage
- Replace the diffusive caps with the storage caps
- Record Sample information on the field data sheet
- Package exposed samples packs for shipment
- Send to the lab for analysis

The samples were stored in the refrigerator in the container for shipment on ice to BV Labs in Edmonton, Alberta, Canada. All laboratory hold times were adhered to for shipping and analysis of the samples.

1.8 Odour

The odour assessment specialist that completed the odour assessment survey has over 20 years experience at completing odour assessment surveys. Prior to the assessment survey the specialist was calibrated according to ASTM Special Technical Publication - STP 758 and EN 13725 using a triangular forced-choice olfactometer. The calibration ensured the assessment specialist was neither insensitive or oversensitive to the control odour (n-butanol).

Prior to odour assessment, the activated carbon and batteries in the Nasal Ranger were replaced. During the assessment the specialist ensured that the proper flow rate was being used to properly measure the field odour concentration.

1.9 Data Editing and Data Reduction

1.9.1 CEMs Results

Data editing and reduction was completed on the continuous data retrieved from Station 1 for NOx, NO, NO_2, SO_2 and PM2.5 data. The hourly data used to calculate the baseline concentrations for these parameters was edited by a person experienced with the workings of the analyzers and the calibration process. The edited data included deleting erroneous values created by the following reasons:

- Daily calibrations
- Monthly calibrations
- Analyzer zero drift
- Erroneous recorded data

Where values were edited for these reasons, the data was replaced by a blank cell and was not included in the calculation of the hourly baseline concentrations for these parameters.

1.9.2 Laboratory Results

Laboratory analytical data was edited to replace values that were not detected at the laboratory detection limits (DL) with the value of the detection limit for the purposes of this report. This is a conservative approach as the DL is generally substituted with half the DL for monitoring reports. In some cases, if a specific compound was not detected at the DL in any of the monitoring events, such as specific VOCs, they were not included in the reported results for calculation of baseline concentrations.

Analyzer Calibration Data - SO_2

Location:	Dart AQ Container	Date of Calibration / Calibration Check:	12/30/2021
Serial #:	6039	Technician	Sai Nidval

Sl No	Test Parameter	Observed For Zero Cal	Observed For Span Cal	Nominal Range		Unit
1	Range	1000	1000	50 - 20,000		PPB
2	Stability	0.4	0.3	< 1	0.09	PPB
3	Sample pressure	26.6	26.6	Amb ± 1	26.8	In-Hg-A
4	Sample flow	697	698	650 ± 50	685	CCM
5	PMT	9	1585	0 - 4000	9.1	mV
6	UV Lamp	3375.2	3375.2	1000 - 4800	2462.2	mV
7	Lamp Ratio	83.40%	83.40%	35 - 120	60.8	%
8	Str.Light	5.6	5.6	< 60	5.6	PPB
9	DRK PMT	4.8	4.8	< 100	6	mV
10	DRK LMP	9.9	9.9	< 50	9.3	mV
11	Slope	0.997	0.997	1.0 ± 0.3	0.997	
12	Offset	0.045	0.045	< 250	0.045	mV
13	HVPS	497	497	450 - 900	497	V
14	DCPS	na	na	2500 ± 200	na	mV
15	Recell Temp	50	50	50 ± 1	50	°C
16	Box Temp	30.1	30.1	Amb ± 5	33.6	°C
17	PMT Temp	8.3	8.3	7 ± 1	8.3	°C

Cylinder Concentration Details :

SO2 Concentration	24.8	PPM
Serial #	200009866744.00	
Certification Date	9/14/2021	
Cal Gas Cylinder Output Press.@ Calibrator :	20	PSI
Diluent Press at Calibrator:	23	PSI
OutPut Concentration set from Calibrator:	784	PPB

List of Warning Messages if any:

Failure Symptoms if any:

ELECTRICAL TEST RESULT, If Performed :

Parameter	Nominal Range	Unit	Observed During Diagnosis /adjusted
a. PMT VOLTS	2000 + / - 1000	mV	9.1
b. Conc.Reading	1000 + / - 500	PPB	

OPTICAL TEST RESULT, If performed:

Parameter	Nominal Range	Unit	Observed During Diagnosis / adjusted
a. PMT VOLTS	2000 + / - 1000	mV	
b. Conc.Reading	1000 + / - 500	PPB	

Analayzer Concentration Readings:		UNIT	Reading at Analyzer	Analyzer Adjusted to
a.Before Zero Cal / Cal Check		PPM	0.235	0
b.Before Span Cal / Cal Check		PPM	772	784
c.After Span Cal. Zero Check if Any		PPM	0	0

Calibration Time

Full Appendix C table set removed to reduce Report size. See original documentation of Air Monitoring Report for full data set.

Appendix D

Pictures

Appendix D removed to reduce Report size. See original documentation of Air Monitoring Report for full data set.

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Appendix C

Background NOx Emission Estimate

Appendix C Background NOx Emission Estimates Cayman Air Quality Assessment

1. Nearby Road Traffic

Motor vehicle tailpipe emissions are one of the major contributors to NO_x within an airshed. The following roads were identified as possible major contributors to NO_x, whose impact would have been captured at the background air monitoring stations:

- Godfrey Nixon Way
- Esterly Tibetts Hwy
- North Sound Road
- West Bay Road
- Lawerence Blvd
- Eastern Ave.

The US EPAs Latest Version of Motor Vehicle Emission Simulator (MOVES3) was used to generate the NO_x emission rates in terms of grams per vehicle kilometre travelled (g/VKT) for each vehicle category such as motorcycle, passenger car, transit bus, and single unit short-haul truck. MOVES3 is also capable of generating the emission rates for various vehicle speed bins under each vehicle category. Since MOVES3 is mainly designed for counties in the United States of America, the Monroe County of Florida was used as a representative for the Cayman Islands.

Based on their 2016 and 2019 study, the National Roads Authority (Cayman Islands) provided the Yearly Average Daily Traffic. According to Appendix 1 of the National Roads Authority of Cayman Islands' 2016–17 Annual Report, the primary arterial roads (Esterly Tibetts Highway, North Sound Road), secondary arterial roads (West Bay Road, Eastern Avenue), and Collector Roadways (Godfrey Nixon Way, Lawrence Blvd) experience an annual average growth rate of traffic of 4.46%, -1.04%, and 3.35%, respectively. The Traffic Speed Limits in Grand Cayman, available in the Regulations, 2016, Supplement No. 1, which was published in Extraordinary Gazette No. 15 on March 4, 2016, was used to determine the speed limit for each road.

The estimated road traffic emission rates for the year 2022, are summarized under Table A.1, and the roads were modelled as Line Area sources in AERMOD.

2. Caribbean Utilities Company

The Caribbean Utilities Company (CUC) is the major power utility in the vicinity of the Site. They have several heavy duty diesel generators, that are used to supply electricity to the local power grid. The list of generators used along with their location were provided in response to a ISWMS request for information by CUC to Dart.

According to Appendix A of the Caribbean Utilities Company, Ltd. 2022 Sustainability Report, the NO_x emissions in ktonnes for the years 2021, 2020, and 2019 were 8.47, 8.35, and 8.59, respectively. Assuming worst-case annual emissions of 8.59 ktonnes, the NO_x emission were distributed proportionately among the generators based on their power output. Note that this is a rough approximation as GHD did not have the utilization factors for the various generators used at CUC. The generators and their capacity along with the estimated NO_x emission rates are listed under Table A.2a. The location of the stacks associated with each generator, and their modelling parameters were estimated and summarized under Table A.2b.

3. Port activities – Cruise Ships

The Cayman Islands is considered as a great destination holiday spot by tourists, and Grand Cayman welcomes about 1.8 million cruise tourists per annum, bringing in revenue through tourism. The Port Authority of the Cayman Islands (Port) has four anchoring locations for Cruise Ships in the vicinity. Two of the anchoring positions are used for Dream Class Cruise ships, and the other two for Oasis Class Cruise ships. Based on the information provided in "Air Quality Report for EIA of The Cayman Islands Berthing Facility", June 1, 2015, the NO_x emission rates for these Cruise ships were determined. These Cruise Ships consume common residual oil as fuel for their main propulsion and auxiliary engines. The emissions from the ship maneuvering and hotelling activities were considered.

Emission estimation methodology for these ships is sourced from the "Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories" Final Report - April 2009, prepared for US EPA by ICF International. The details of which are summarized in Table A.3a and Table A.3b. The stack parameters as suggested in "Generating an Hour-By-Hour Model-Ready Marine Emission Inventory" by Boulton et al, June 2008, US EPA 17th International Emission Inventory Conference were used in AERMOD.

4. Airport

The Owen Roberts International Airport (Airport) which is in the vicinity of the Site is considered to be a major source of NO_x as well. The Owen Roberts International Airport provided information on the 2019 Aircraft Movement. The Airline Movement Prediction from 2017 to 2022 was predicted to increase by 33% based on the Cayman Islands Airports Airport Master Plan 2032. Aircraft landing, taxing and idling, and takeoff make up a normal Landing Take Off (LTO) Cycle. A reasonable assumption that 75% of LTO emissions happen at ground level was assumed. As per the Owen Roberts International Airport Flight Schedule, aircraft activity in a day is between 6:00 AM And 11:00 PM, which leads to about 17-hours of aircraft emissions in a day.

The US EPA's Emission Factor for Aircraft was used to generate the emission rates, details of which are summarized in Table A.4. The Airport was modelled as a Polygon Area Source in AERMOD.

5. Medical Waste Incinerator

A medical waste incinerator is currently operating near the northern fenceline of the Site. The incinerator processes about 6,400 pounds of waste in one batch and the burn and cooldown cycle lasts about 24 hours. The site operates 2 batches per week to process the current inflow of medical waste. Reasonable estimates were made regarding the stack's height, diameter, and gas exit temperature. The estimated emission rate along with the modelling parameters are shown in Table A.5.

6. Cayman Spirits

There is a small-batch distillery, the Cayman Spirits that operate a boiler at its facility NO_x emissions from this boiler were estimated using emission factors for Small Boilers from Table 1.4-1 of the AP-42. Details of the boiler and estimated emission rates are summarized in Table A.6.

7. Central Laundry

A laundry facility, Central Laundry, operates one boiler at its facility. NO_x emissions from this boiler were estimated using emission factors for Small Boilers from Table 1.4-1 of the AP-42. Details of the boiler and estimated emission rates are summarized in Table A.6.

8. Asphalt and Cement Plants

A hot mix asphalt (HMA) plant is located west of the Site. Two main sources of NO_x emissions from this facility are estimated. The HMA baghouse estimates NO_x emissions using the maximum asphalt production capacity and the emission factors from AP-42 Table 11.1-5 for a No. 2 fuel iol-fired dryer, hot screens, and mixer. The second emission source is a hot oil heater for the asphalt storage tanks. AP-42 Table 1.3-1 is used to estimate the NO_x emission s from No. 4 fuel oil fired boilers. Details of the estimated emission rates and parameters are summarized in Table A.7.

9. Cement Plants

Three cement batching plants operate south of the Site. These plants are identified as Supermix, National Concrete, and Kirk Concrete. The NO_x emissions from diesel-fired generators are estimated using Table 3.3-1 of AP-42. Details of the generators and estimated emission rates are summarized in Table A.8.

Table C.1

Estimated NOx Emission Rates - Major Roads by ISWMS

Name of Road	Length (km)	Direction of Traffic	Annual Average Daily Traffic (2016)	Annual Average Daily Traffic (2019)	Annual Average Daily Traffic (2022)	Speed Limit (mph)	Motorcycle (%)	Motorcycle Count	Passenger Car (%)	Passenger Car Count	Transit Bus (%)	Transit Bus Count	Single Unit Short-haul Truck (%)	Single Unit Short-haul Truck Count	2022 NOx ER (g/s)
Godfrey Nixon Way	0.433	Both		20163	22258	30	0.44%	98	91.84%	20441	0.65%	145	7.07%	1574	0.026
Esterly Tibetts Hwy	2.577	Northbound		15763	17968	40	0.73%	130	81.71%	14682	0.30%	55	17.26%	3101	0.157
Esterly Tibetts Hwy	2.583	Southbound		14948	17039	40	0.99%	169	88.87%	15141	0.23%	38	9.92%	1690	0.114
North Sound Road	0.237	Northbound		17892	20394	35	1.11%	227	70.62%	14402	2.07%	422	26.20%	5344	0.024
North Sound Road	0.227	Southbound		18495	21082	35	0.47%	100	90.38%	19054	0.35%	74	8.80%	1854	0.012
North Sound Road	0.506	Both		36387	41476	35	0.79%	328	80.60%	33428	1.20%	498	17.41%	7221	0.078
West Bay Road	1.486	Both		22255	21568	25	1.32%	285	81.34%	17543	2.01%	433	15.33%	3307	0.138
Lawerence Blvd	0.339	Eastbound	5764	-	7024	25	0.00%	0	95.27%	6692	0.22%	15	4.51%	317	0.006
Lawerence Blvd	0.326	Westbound	4565	-	5563	25	0.00%	0	98.87%	5500	0.09%	5	1.04%	58	0.003
Eastern Ave	1.071	Both	15433	-	14495	25	0.00%	0	98.56%	14286	0.35%	51	1.09%	158	0.029

Vehicle Type	NOx Emission Factors by Speed Limits (g/VKT)			
	25 mph	30 mph	35 mph	40 mph
Motorcycle	0.144	0.153	0.178	0.201
Passenger Car	0.140	0.132	0.131	0.130
Transit Bus	2.213	2.076	1.867	1.784
Single Unit Short-haul Truck	1.382	1.314	1.107	1.037

Notes:

(1) The Annual Average Daily Traffic was obtained from National Roads Authority (Cayman Islands), through their 2016 and 2019 study.
(2) As per Appendix 1 of the 2016/17 Annual Report for National Roads Authority of Cayman Islands, the Annual average growth rate of traffic for Primary Arterial Roadways (Esterly Tibetts Hwy, North Sound Road) is 4.46%, Secondary Arterial Roadways (West Bay Road, Eastern Ave) is -1.04%, and 3.35% for Collector Roadways (Godfrey Nixon Way, Lawrence Blvd).
(3) NOx emission factors were obtained from US EPA's software MOVES3.
(4) The Speed limit for each roadway was obtained from The Traffic (Speed Limits in Grand Cayman) Regulations, 2016. Supplement No. 1 published with Extraordinary Gazette No.15 dated 4th March, 2016.

Table C.2a

Estimated NOx Emission Rates
Generators within Caribbean Utilities Company, Ltd. (CUC)

Make and Model	Unit #	Unit Size (MW)	NOx Emission Rate (ktonne/year)	NOx Emission Rate (g/s)
Caterpillar 3616	19	4	0.21	6.77
Caterpillar 3616	20	4	0.21	6.77
Mak 8M601C	1	9	0.48	15.23
Mak 8M601C	2	9	0.48	15.23
Man B&W 12V 48/60	35	12.25	0.65	20.73
Man B&W 12V 48/60	36	12.25	0.65	20.73
Solar Centar 50 G Turbine	25	3.5	0.19	5.92
Caterpillar 3616	3	4.4	0.23	7.45
Caterpillar 3616	4	4.4	0.23	7.45
Man B&W 12V 48/60	34	12.25	0.65	20.73
Man B&W 12V 48/60	33	16	0.85	27.08
MAN Gas Turbine	26	8.4	0.45	14.22
Man B&W 12V 48/60	32	16	0.85	27.08
Caterpillar	41	1.45	0.08	2.45
Caterpillar	42	1.45	0.08	2.45
Caterpillar 3516C	43	1.5	0.08	2.54
Caterpillar 3516C	44	1.5	0.08	2.54
Man B&W 18V 48/60	30	18.5	0.99	31.31
Man B&W 18V 48/60	31	18.5	0.99	31.31
Steam Turbine	28	2.6	0.14	4.40

Notes:

(1) The Make and Model, Unit number, and Unit Size were provided through correspondance with Caribbean Utilities Company, Ltd.
(2) As per the Caribbean Utilities Company, Ltd. 2022 Sustainability Report, Appendix A,
for the years 2021, 2020, and 2019 the installed generation capacity was 160.95 MW.
(3) As per the Caribbean Utilities Company, Ltd. 2022 Sustainability Report, Appendix A,
for the years 2021, 2020, and 2019 the NOx emissions in ktonnes were 8.47, 8.35, and 8.59 respectively.
(4) Assuming worst case emisisons of 8.59 ktonnes per year, and dividing the emissions proportionally
between the generators based on their capacity.
(5) Unit 19 and 20, are not currently operational, hence not considered for the dispersion model.

Table C.2b

CUC Generators and their Associated Stack Parameters used for Dispersion Modelling

Generators Make and Model	Generator Unit #	Stack ID	Stack UTM X Coordinate (m)	Stack UTM Y Coordinate (m)	Exhaust Flow rate 6 (m^3/s)	Gas Exit Temperature 6 (°C)	Stack Tip Inside Diameter (m)	Stack Tip Release Height (m)
Caterpillar 3616	3, 4	CUC1	461726.59	2134237.44	40.49	381.40	2.00	42.40
Mak 8M601C	1, 2	CUC4	461734.27	2134365.47	82.82 (4)	480.00 (5)	2.00	42.40
Man B&W 12V 48/60	34, 35, 36	CUC5	461793.17	2134568.78	169.09 (4)	480.00	3.00	42.40
Man B&W 12V 48/60	32	CUC6a	461804.58	2134546.4	73.62 (4)	480.00	1.50	42.40
Man B&W 12V 48/60	33	CUC6b	461809.01	2134535.26	73.62 (4)	480.00	1.50	42.40
Man B&W 18V 48/60, Steam Turbine	28, 30, 31	CUC7	461821.84	2134500.75	182.21 (4)	480.00	3.80	42.40
Solar Centar 50 G Turbine	25	CUC8	461763.98	2134313.24	16.10 (4)	480.00 (5)	1.50	42.40
MAN Gas Turbine	26	CUC9	461770.63	2134301.46	38.65 (4)	480.00 (5)	2.00	42.40
Caterpillar 3516C, Caterpillar	41, 42, 43, 44	CUC10	461797.26	2134277.39	31.83	490.70	2.00	42.40

Notes:

(1) The location of the Generators were provided through correspondance with Caribbean Utilities Company, Ltd.
(2) The location of stacks associated with the generators, along with their stack tip inside diamter was approximately determined using Google Earth satelite imagery.
(3) The stack tip release height was assumed to be 42.4 m for all the stacks considered within CUC, based on the technical data from a brochure created by Burmeister & Wain Scandinavian Contractor for CUC as part of their ten Year Starategic Alliance Success.
(4) For generators that did not have the Exhaust Flow rate provided in their technical spec sheets, the exhaust flow rate was extrapolated based on generator capacity.
(5) For generators that did not have gas exit temperature, it was assumed to be 480 °C.
(6) The Exhaust Flow rate and Gas Exit temperature were obtained from technical spec sheets of the Generator.

Table C.3a

Estimated NOx Emission Rates
Cruise Ships (Dream Class) Hoteling by the Port

Formulas:

E(g) = P(kW)*LF(%)*A(hour)*EF(g/kWh)

Where,	E	= Emissions (grams)
	P	= Maximum Continuous Rating Power (kW)
	LF	= Load Factor (percent of vessel's total power)
	A	= Activity Duration (hour)
	EF	= Emission Factor (g/kWh)

LF = (AS/MS)^3

Where,	LF	= Load Factor (percent of vessel's total power)
	AS	= Actual Speed (knots)
	MS	= Maximum Speed (knots)

Based on "Air Quality Report For EIA of The Cayman Islands Berthing Facility", June 1, 2015:

Example Cruise ship (Dream Class Vessel):

The Carnival Dream

Maximum Continuous Power Rating

75,600 kW

Fuel used my main propulsion engine:

Common Residual Oil

Main propulsion engine were assumed to be medium speed, with a range of 130 RPM to 1,400 RPM.

It is assumed that the onboard garbage incinerators do not operate while the ships are hoteling by the port.

The following duration for each Cruise ship activity is assumed within a 24 hour period:

Maneuvering	1 hour
Hoteling	8 hour

No "cold ironing" (ship powered from shore) nor over-nighting of Cruise ships were assumed.

The engine load factor while hoteling is assumed to be same was while the cruise ship is maneuvering.

Within the ports domain (25 nautical miles), the Maneuvering speed of each Cruise ship is 8 knots.

An adjustment factor of 0.7565 was used for NOx emission factors, as suggested in Table 2-12 of reference document cited under Note 1.

NOx emission factors begin to increase due to inefficient engine operations when engine load falls below 20% (1). The following adjustment factors were used for these load factors from Table 2-15 of reference document cited under Note 1.

Load factor of 19%	1.01
Load factor of 6%	1.60

Cruise Ship Activity	Load Factor (%)	Activity Duration (hour)	Emission Factor (g/kWh)	Adjustment Factor	Adjusted Emission Factor (g/kWh)	NOx Emissions (g)
Maneuvering	6%	1	14	1.60	22.400	93622.86
Hoteling	6%	8	14	1.60	22.400	748982.86

Total NOx emisisons per Cruise Ship over a 9 hour period (g) = 842605.71

NOx emission rate per cruise ship (g/s) = 26.006

Stack Parameters[2]	Value	Units
Stack Diameter	0.8	m
Gas Exit Velocity	25	m/s
Gas Exit Temp	282	° C
Stack Height	20	m

Notes:

(1) Emission estimation methodology for these ships is sourced from the "Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories" Final Report - April 2009, prepared for US EPA by ICF International.
(2) "Generating an Hour-By-Hour Model-Ready Marine Emission Inventory" by Boulton et al, June 2008, US EPA 17th International Emission Inventory Conference.
https://www3.epa.gov/ttnchie1/conference/ei17/session6/boulton_pres.pdf

Table C.3b

Estimated NOx Emission Rates
Cruise Ships (Oasis Class) Hoteling by the Port

Formulas:
*E(g) = P(kW)*LF(%)*A(hour)*EF(g/kWh)*

Where,	E	= Emissions (grams)
	P	= Maximum Continuous Rating Power (kW)
	LF	= Load Factor (percent of vessel's total power)
	A	= Activity Duration (hour)
	EF	= Emission Factor (g/kWh)

LF = (AS/MS)^3

Where,	LF	= Load Factor (percent of vessel's total power)
	AS	= Actual Speed (knots)
	MS	= Maximum Speed (knots)

Based on "Air Quality Report For EIA of The Cayman Islands Berthing Facility", June 1, 2015:
Example Cruise ship (Oasis Class Vessel):
Oasis of the Seas
Maximum Continuous Power Rating:

Main Propulsion Engine	82,000	kW
Auxilary Engine	115920	kW

Fuel used my main propulsion engine:
Common Residual Oil
Main propulsion enginer were assumed to be medium speed, with a range of 130 RPM to 1,400 RPM.

It is assumed that the onboard garbage incinerators do not operate while the ships are hoteling by the port.

Within the ports domain (25 nautical miles), the following duration for each Cruise ship activity is assumed within a 24 hour period:

Maneuvering	1	hour
Hoteling	8	hour

No "cold ironing" (ship powered from shore) nor over-nighting of Cruise ships were assumed.

The engine load factor while hoteling is assumed to be same was while the cruise ship is maneuvering.

Within the ports domain (25 nautical miles), the Maneuvering speed of each Cruise ship is 8 knots.

An adjustment factor of 0.7478 was used for NOx emission factors, as suggested in Table 2-12 of reference document cited under Note 1.

NOx emission factors begin to increase due to inefficient engine operations when engine load falls below 20% (1).
The following adjustment factors were used for these load factors:

Load factor of 19%	1.01
Load factor of 6%	1.60

Propulsion Engine Emissions

Cruise Ship Activity	Load Factor (%)	Activity Duration (hour)	Emission Factor (g/kWh)	Adjustment Factor	Adjusted Emission Factor (g/kWh)	NOx Emissions (g)
Maneuvering	6%	1	14	1.60	22.400	101548.60
Hoteling	6%	8	14	1.60	22.400	812388.81

Auxilary Engine Emissions

Cruise Ship Activity	Load Factor (%)	Activity Duration (hour)	Emission Factor (g/kWh)	Adjustment Factor	Adjusted Emission Factor (g/kWh)	NOx Emissions (g)
Maneuvering	80%	1	14.7	0.7478	10.993	1019415.32
Hoteling	64%	8	14.7	0.7478	10.993	6524258.03

Total NOx emisisons per Cruise Ship over a 9 hour period (g) = 8457610.77

NOx emission rate per cruise ship (g/s) = 261.037

Stack Parameters[3]	Value	Units
Stack Diameter	0.8	m
Gas Exit Velocity	25	m/s
Gas Exit Temp	282	° C
Stack Height	20	m

Notes:

(1) Emission estimate formula is sourced from the "Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories" Final Report - April 2009, prepared for US EPA by ICF International.
(2) Oasis of the Seas onboard engine details were acquired from the vessel register
https://vesselregister.dnv.com/vesselregister/details/27091
(3) "Generating an Hour-By-Hour Model-Ready Marine Emission Inventory" by Boulton et al, June 2008, US EPA 17th International Emission Inventory Conference.
https://www3.epa.gov/ttnchie1/conference/ei17/session6/boulton_pres.pdf

Table C.4

Estimated NOx Emission Rates
Aircraft Activity at the Owen Roberts International Airport

Aircraft Type	Aircraft Movement		NOx Emission Factor	NOx Emission Rate			
	2019	2022	(Tons/LTO)	(Tons/year)	(Tonne/Year)	(g/year)	(g/s)
Jet	17571	23370	9.29E-03	1.63E+02	1.48E+02	1.48E+08	6.61E+00
Piston	484	644	3.25E-05	1.57E-02	1.42E-02	1.42E+04	6.38E-04
Turbine	8988	11955	1.62E-04	1.45E+00	1.32E+00	1.32E+06	5.90E-02

Notes:

(1) The 2019 Aircraft Movement was obtained from Owen Roberts International Airport.
(2) Based on the Cayman Islands Airports Airport Master Plan 2032, the Aircraft Movement Forecast was estimated to be an increase of 33% from the year 2017 to 2022.
(3) A typical Landing Take Off (LTO) Cycle consists of Aircraft Landing, Taxing and Idling, and finally Take Off.
(4) Conservatively assuming 75% of LTO emission occur at ground level.
(5) The Emission Factor for Aircrafts was obtained from US EPA in the link provided below
https://www.epa.gov/sites/default/files/2016-04/documents/nei2014_genericef_table.pdf
(6) As per the Owen Roberts International Airport Flight Schedule, aircraft activity in a day is between 6:00 AM and 11:00PM. Aircraft emissions occur 17 hours in a day.
https://www.caymanairports.com/upimages/commonfile/1449917851FLIGHT_SCHEDULE_Updated_on_Jun_24_2013.pdf

Table C.5

Estimated Emission Rates - Medical Waste Incinerator of ISWMS

Medical Waste Incinerated per Batch (Mg)	NOx Emission Factor (kg/Mg)	CO Emission Factor (kg/Mg)	NOxCO (kg)	Daily CO Emission Rate (g/s)	NOx Emission Per Batch (kg)	Daily NOx Emission Rate (g/s)
2.90	1.58	0.15	0.435	0.012	4.587	0.127

Stack Parameters

	Stack UTM X Coordinate (m)	Stack UTM Y Coordinate (m)	Exhaust Flow rate (m^3/s)	Gas Exit Temperature (°C)	Stack Tip Inside Diameter (m)	Stack Tip Release Height (m)
Existing Location	460795.11	2135424.3	0.6	1000	0.75	10
Future Location	460752.73	2135046.5	0.6	1000	0.75	10

Notes:

(1) As per information received by DART from DEH on 2 Nov 2022, the Medical Waste Incinerator, handles 6,400 lb of medical waste per batch. There are two batch handled a week, and each batch lasts 10 hours. The Secondary chamber operates at 1038 °C.
(2) Reasonable assumptions were made for stack height, stack diameter, stack gas exit temperature since there was no available information.
(4) The stack flow rate is assumed to be 0.6 m^3/s, which is the ideal design consideration as per a guidance document by Central Pollution Control Board of India for medical waste incinerators.
(5) Emission factors for Modular Starved Air Combustors from Table 2.1-9 of the AP-42 was used.

Table C.6

Estimated NOx Emission Rates - Boiler at Cayman Spirits and Central Laundry

Make and Model of boiler	Boiler Heat Input (Btu/hr)	Natural Gas Consumption (Scf/hr)	NOx Emission Factor (lb/10^6 scf)	NOx Emission Rate (lb/hr)	NOx Emission Rate (g/s)
Columbia 50 MPH (Cayman Spirits)	2,100,000	2058.824	100	0.206	0.026
Cleaver Brooks CBLE.700.300 (Central Laundry)	10,045,000	9848.039	100	0.985	0.124

Stack Parameters

Location	Stack UTM X Coordinate (m)	Stack UTM Y Coordinate (m)	Exhaust Flow rate (m^3/s)	Gas Exit Temperature (°C)	Stack Tip Inside Diameter (m)	Stack Tip Release Height (m)
Cayman Spirits	461008.88	2134244.49	0.176	200	0.5	11
Central Laundry	461046.99	2135176.54	0.843	200	0.5	7

Notes:

(1) Emission factors for Small Boilers from Table 1.4-1 of the AP-42 was used.
(2) Reasonable assumptions were made for the exhaust flow rate, stack diameter, and stack temperature since there was no available information.

Table C.7

Estimated NOx Emission Rates - Hot Mix Asphalt (HMA) Plant

Oil Fired Dryer emission rates throught HMA Baghouse

HMA Manufactured per Day (Mg)	NOx Emission Factor[1] (kg/Mg)	NOx Emission (kg/day)	NOx Emission Rate (g/s)
725.75	0.06	43.545	1.008

Emission rates of Hot Oil Heater for Asphalt storage tanks

Fuel Consumption (MMBTU/hr)	NOx Emission Factor[2] ($lb/10^3$ gal)	NOx Emission (lb/hr)	NOx Emission Rate (g/s)
3.00	20	0.405	0.051

Stack Parameters

Equipment	Stack UTM X Coordinate (m)	Stack UTM Y Coordinate (m)	Exhaust Flow rate (m^3/s)	Gas Exit Temperature (°C)	Stack Tip Inside Diameter (m)	Stack Tip Release Height (m)
Baghouse	461193.25	2134903.93	31.00	110	1.3	9
Asphalt Tank Heater	461172.86	2134899.34	0.60	200	0.3	3

Notes:

(1) Emission factors from Table 11.1-5 of AP-42 for Batch Mix Hot Asphalt Plant, using No.2 fuel oil-fired dryer, hot screens, and mixer was used.
(2) Emission factors from Table 1.3-1 of AP-42 for No. 4 oil fired boilers <100 MMBtu/hr.
(3) A heating value of 148100 Btu/gal was used for No. 4 Fuel Oil.
(4) A 12 hour operational period per day was assumed.
(5) The heater for the Asphalt storage tanks are expected to run 24 hours a day.
(6) A production capacity of 725.75 tonne per day was used for the Hot Mix Asphalt plant as conveyed by Dart in their email dated April 12, 2023.
(7) Reasonable assumptions were made for the Crusher Engine power rating, and fuel consumption rate for the hot oil heater of Asphalt Storage tanks.
(8) Stack parameters were extracted from similar Hot Asphalt Mix sites.

Table C.8

Estimated NOx Emission Rates - Concrete Batch Mixer Plants

Main Diesel-fired Generator

Location	Power Rating of Engine Used [1] (kW)	NOx Emission Factor[2] (kg/kW-hr)	NOx Emission (kg/hr)	NOx Emission Rate (g/s)
National Concrete	150.00	0.019	2.827	0.065
Supermix	150.00	0.019	2.827	0.065
Kirk Concrete	150.00	0.019	2.827	0.065

Stack Parameters

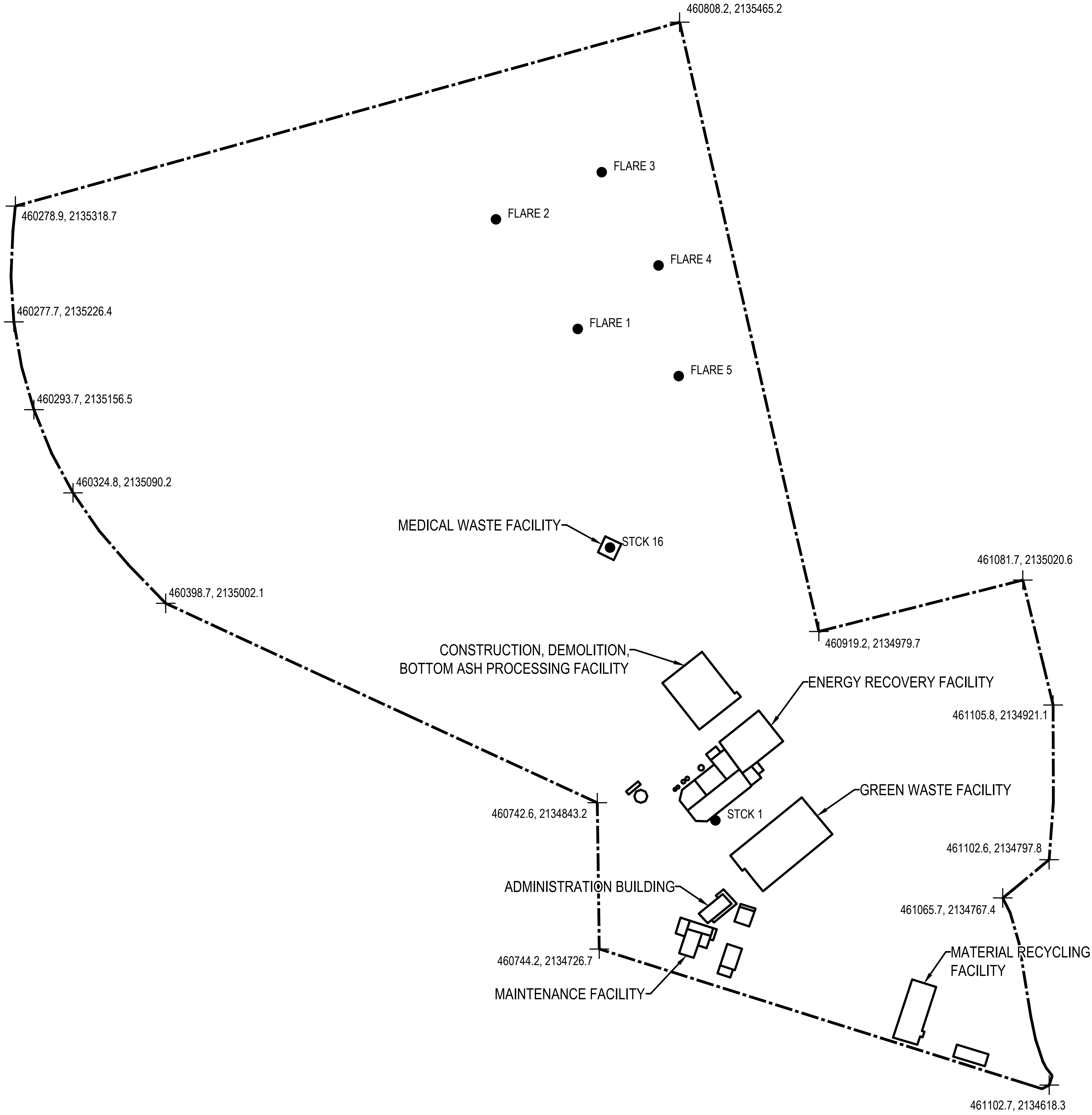
Location	Stack UTM X Coordinate (m)	Stack UTM Y Coordinate (m)	Exhaust Flow rate (m^3/s)	Gas Exit Temperature (°C)	Stack Tip Inside Diameter (m)	Stack Tip Release Height (m)
National Concrete	461610.87	2134392.4	0.5	455	0.13	6
Supermix	461164.03	2134557.94	0.5	455	0.13	6
Kirk Concrete	461180.98	2134375.93	0.5	455	0.13	6

Notes:

(1) Engine power ratings are engineering estimates
(2) Emission factors from Table 3.3-1 of AP-42 for diesel industrial engines.

Appendix D

Layout and Building Plans



LEGEND

PROPERTY BOUNDARY

POINT SOURCE LOCATION

0 35 70 105m

1:3500

Coordinate System: UTM, NAD83, ZONE 17F

N

GHD

DART
GEORGE TOWN, GRAND CAYMAN ISLAND
AIR QUALITY ASSESSMENT REPORT

ISWMS BUILDING AND POINT SOURCE LOCATIONS

Project No. **12563972**
Date **March 2023**

FIGURE D.1

Filename: \\ghdnet\ghd\CA\Whitby\Projects\401\12563972\Digital_Design\ACAD\Figures\RPT001\12563972-GHD-00-00-RPT-EN-D102_WB-001.dwg
Plot Date: 06 March 2023 3:50 PM

Appendix E

Waste Incinerator Manufacturer In-stack Concentration Guarantees

Substance	Base unit	Daily average	Half-hourly avg. 100%	Half-hourly avg. 97%	10 min. average	Sampling period *1
Total dust	mg/m^3 STP, dry, 11% O2	5	30	10	-	-
Hydrogen chloride (HCl)	mg/m^3 STP, dry, 11% O2	6	60	10	-	-
Hydrogen fluoride (HF)	mg/m^3 STP, dry, 11% O2	1 *2	4	2	-	1 *2
Sulphur dioxide (SO_2)	mg/m^3 STP, dry, 11% O2	30	200	50	-	-
Gaseous + vaporous organic substances, expressed as total organic carbon (TOC)	mg/m^3 STP, dry, 11% O2	10	20	10	-	-
Carbon monoxide (CO)	mg/m^3 STP, dry, 11% O2	50	100	-	150	-
Nitrogen monoxide (NO) + nitrogen dioxide (NO_2) expressed as NO_2	mg/m^3 STP, dry, 11% O2	120	400	200	-	-
Ammonia (NH_3)	mg/m^3 STP, dry, 11% O2	10	-	-	-	-
Cadmium + Thallium (Cd + Tl)	$\mu g/m^3$ STP, dry, 11% O2	-	-	-	-	20
Mercury (Hg) + its compounds	$\mu g/m^3$ STP, dry, 11% O2	20 *2	35	-	-	20 *2
Σ heavy metals incl. comp. (Sb + As + Pb + Cr + Co + Cu + Mn + Ni + V)	$\mu g/m^3$ STP, dry, 11% O2	-	-	-	-	300
Dioxins and furans (PCDD/F)	ng/m^3 STP, dry, 11% O2	-	-	-	-	0.04
PCDD/F and dioxin-like PCB's	ng/m^3 STP, dry, 11% O2	-	-	-	-	0.06

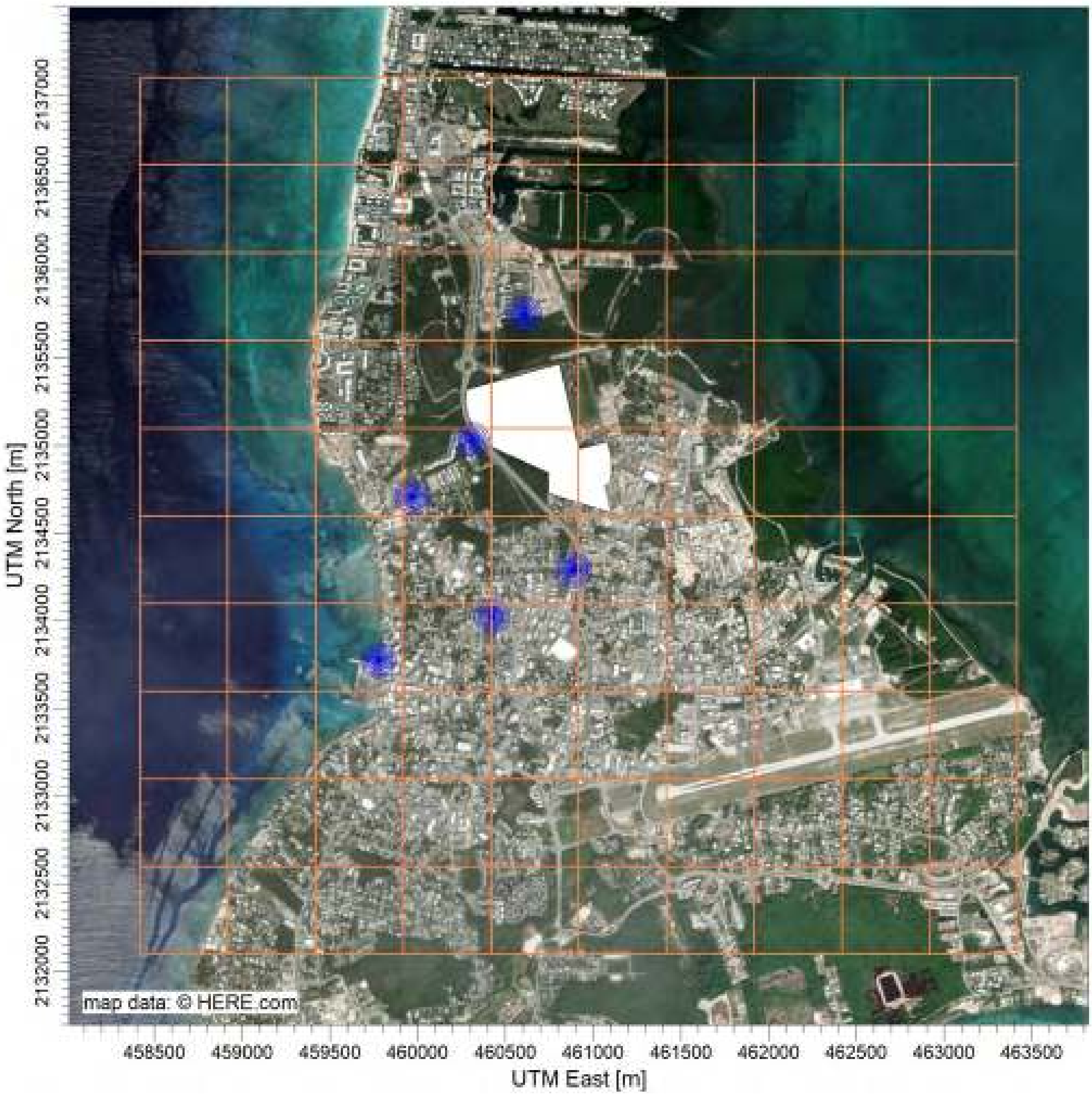
*1 The following sampling periods shall be applied to all substances which are only measured during a specific period:
a) For PCDD/F and PCB's: Sampling period = 6 - 8 hours
b) For all other pollutants: Sampling period = min. 30 min. ➝ Average value of 3 consecutive measurements

*2 According to the new BREF regulation (published 03.12.2019), emission limit values for hydrogen fluoride (HF) and mercury (Hg) can be defined either as daily average values or as average values over a sampling period.

Appendix F

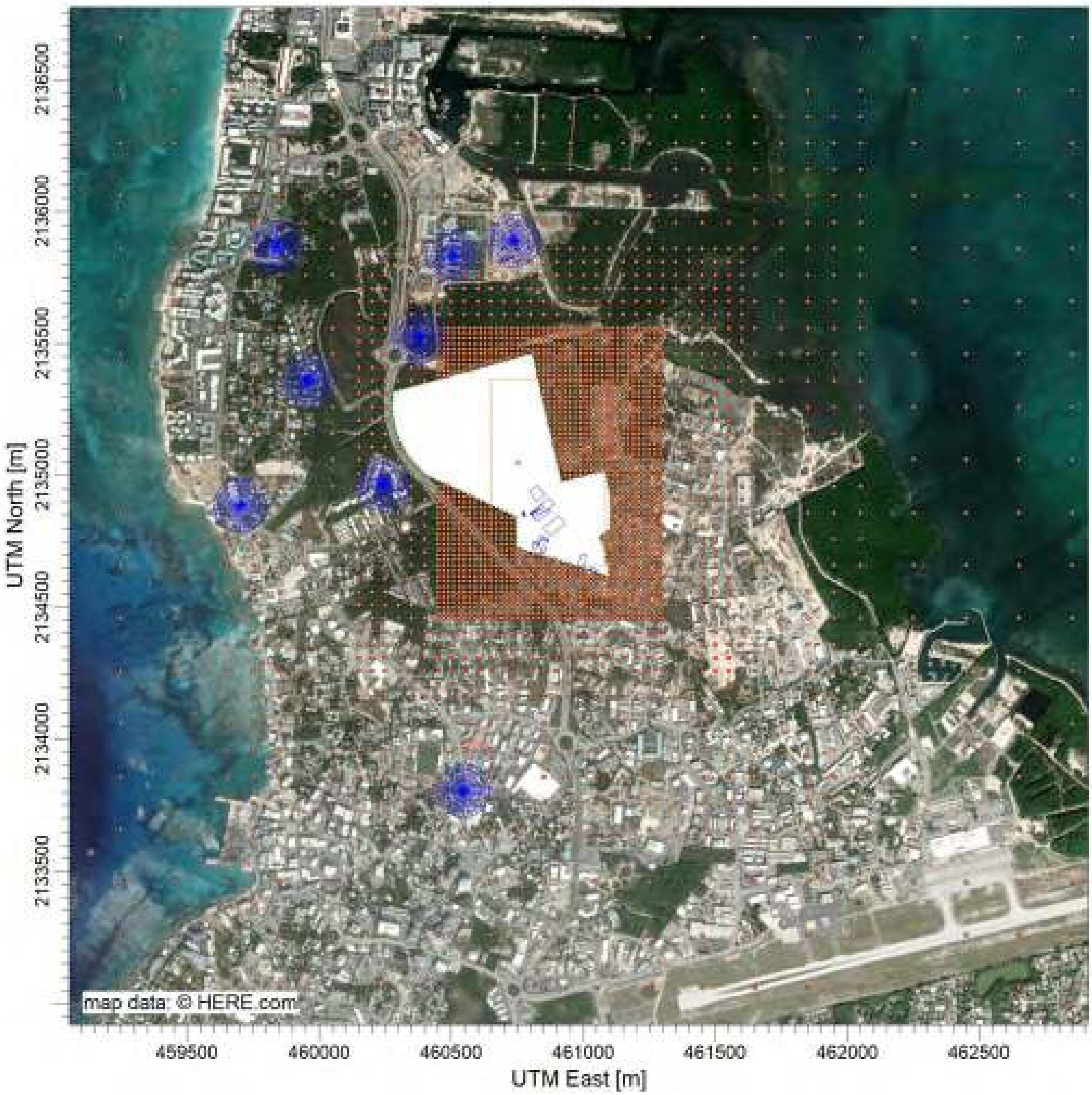
AERMOD Inputs and Modelling Grids

Figure F.1
Receptors for Modelling Baseline Conditions



COMMENTS:	SOURCES:	COMPANY NAME:	
Orange lines - 5km x 5k Uniform grid Blue web - Polar Grid receptors at Background Monitoring Stations Fenceline of Project - Receptors placed every 20 m	**29**	**GHD**	
	RECEPTORS: **1367**		
		SCALE: 1:36,500 0 — 1 km	
		DATE: **3/30/2023**	PROJECT NO.: **12563972**

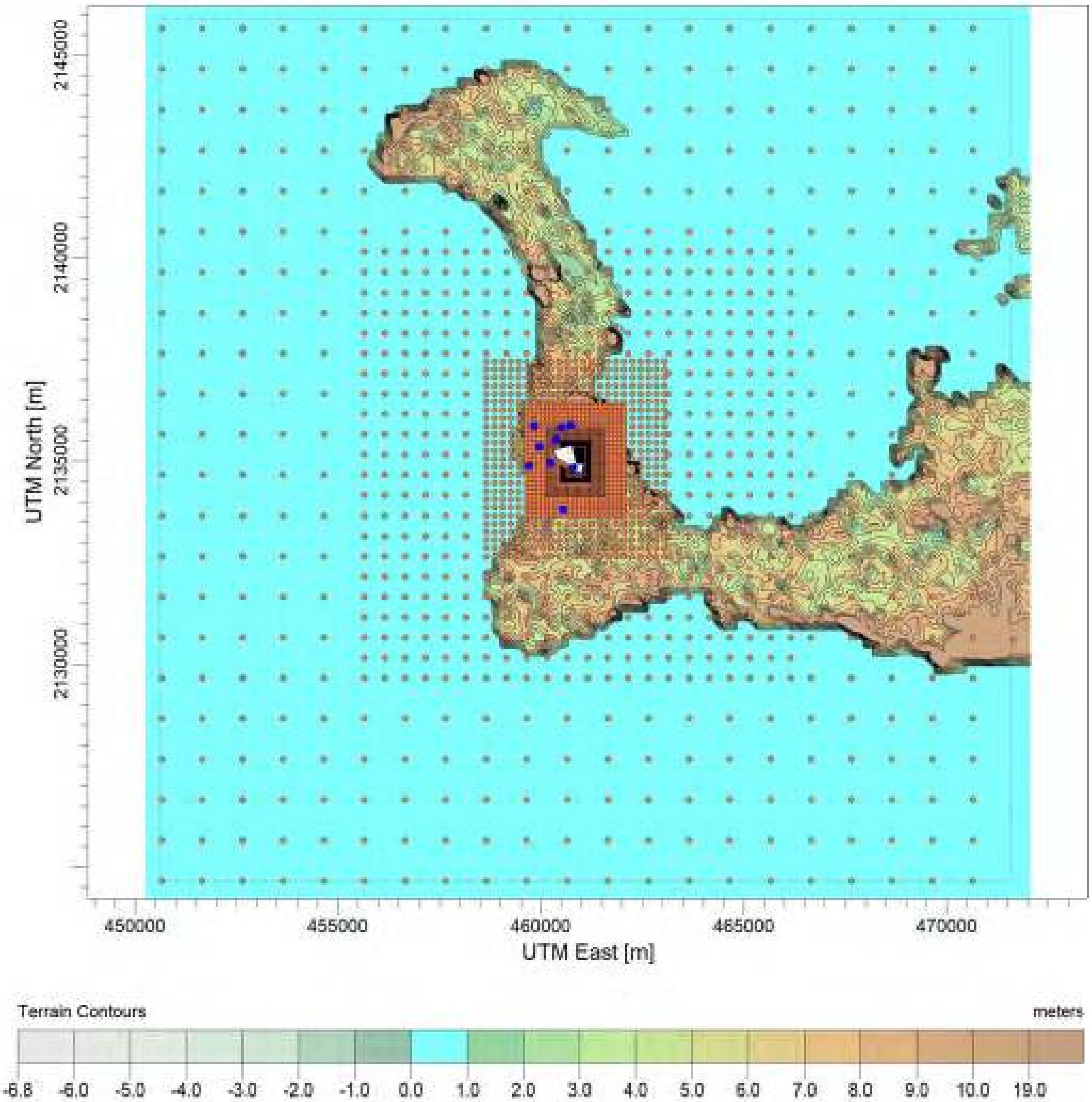
Figure F.2
Nested Grid Receptors along with Uniform Polar Grid receptors for Modelling Future Operational Conditions



COMMENTS: - Zoomed in to show nested receptors (orange) near the fenceline. - Uniform polar grid receptors (blue) placed at sensitive receptors.	SOURCES: **9**	COMPANY NAME: **GHD**	
	RECEPTORS: **5418**		GHD
		SCALE: 1:24,249 0 0.5 km	
		DATE: **3/30/2023**	PROJECT NO.: **12563972**

AERMOD View - Lakes Environmental Software C:\AM\12563972_Cayman\12563972_ISWMS_Base_Future_22Mar2023.isc

Figure D.3
Entire Nested Grid Receptors along with Uniform Polar Grid receptors for Modelling Future Operational Conditions



COMMENTS: - Zoomed out to show entire nested grid receptors (orange) used. - Uniform polar grid receptors (blue) placed at sensitive receptors.	SOURCES: **9**	COMPANY NAME: **GHD**	
	RECEPTORS: **5418**		GHD
		SCALE: 1:155,030 0 — 5 km	
		DATE: **3/30/2023**	PROJECT NO.: **12563972**

AERMOD View - Lakes Environmental Software C:\AM\12563972_Cayman\12563972_ISWMS_Base_Future_22Mar2023.isc

Table F.1

AERMOD Source Inputs for Background NOx Modelling

Point Sources

Source ID	Description	Release Orientation	UTM Coordinates X (m)	UTM Coordinates Y (m)	Release Height (m)	Exit Diameter (m)	Gas Exit Velocity (m/s)	Gas Exit Temperature (K)
STCK2	Cruise Ship 1	vertical	458,948.48	2,133,510.44	20.0	0.80	25.00	555
STCK3	Cruise Ship 2	vertical	458,948.93	2,133,992.21	20.0	0.80	25.00	555
STCK4	Cruise Ship 3	vertical	458,969.97	2,134,585.24	20.0	0.80	25.00	555
STCK5	Cruise Ship 4	vertical	458,615.51	2,134,903.59	20.0	0.80	25.00	555
STCK6	CUC 1	vertical	461,726.59	2,134,237.44	40.0	2.00	12.89	655
STCK7	CUC 4	vertical	461,734.27	2,134,365.47	40.0	2.00	26.36	773
STCK8	CUC 5	vertical	461,793.17	2,134,568.78	40.0	3.00	23.92	753
STCK9	CUC 6a	vertical	461,804.58	2,134,546.40	40.0	1.50	41.66	753
STCK15	CUC 6b	vertical	461,809.01	2,134,535.26	40.0	1.50	41.66	753
STCK10	CUC 7	vertical	461,821.84	2,134,500.75	40.0	3.80	16.07	753
STCK11	CUC 8	vertical	461,763.98	2,134,313.24	40.0	1.50	9.11	773
STCK12	CUC 9	vertical	461,770.63	2,134,301.46	40.0	2.00	12.30	773
STCK13	CUC 10	vertical	461,797.26	2,134,277.39	40.0	2.00	10.13	764
STCK14	Cyman Spirits	vertical	461,008.88	2,134,244.49	11.0	0.50	0.90	473
STCK16	Medical Waste Incinirator	vertical	460,795.11	2,135,424.31	10.0	0.75	1.36	1273
STCK17	Central Laundry	vertical	461,046.99	2,135,176.54	7.0	0.50	4.29	473
STCK18	HMA Baghouse	vertical	461,193.25	2,134,903.93	9.0	1.30	23.36	383
STCK19	Asphalt tank heater	vertical	461,172.86	2,134,899.34	3.0	0.30	8.49	473
STCK20	Supermix Generator	vertical	461,164.03	2,134,557.94	6.0	0.13	37.67	728
STCK21	National Concrete Generator	vertical	461,610.87	2,134,392.40	6.0	0.13	37.67	728
KIRKCONC	Kirk Concrete Generator	vertical	461,180.98	2,134,375.93	6.0	0.13	37.67	728

Line Area Sources

Source ID	Description	UTM Coordinates X1 (m)	UTM Coordinates Y1 (m)	Release Height (m)	Length X (m)	Line Area Ratio (m)	Number of Coordinates
ARLN1	Esterly Tibbetts HWY Southbound	460,193.89	2,136,273.57	0.0	13.00	10.00	50
ARLN2	Esterly Tibbetts HWY Northbound	460,909.52	2,134,017.64	0.0	13.00	10.00	43
ARLN3	Lawrence Bl Eastbound	460,153.61	2,136,246.37	0.0	8.50	10.00	12
ARLN4	Lawrence Bl Westbound	460,121.22	2,136,272.71	0.0	8.50	10.00	18
ARLN5	Westbay Road	459,728.22	2,134,785.80	0.0	13.00	10.00	24
ARLN6	Eastern Avenue	459,731.91	2,134,784.02	0.0	13.00	10.00	23
ARLN7	Godfrey Nixon Way	460,497.14	2,134,070.97	0.0	13.00	10.00	20
ARLN8	N Sound Road South (northbound)	460,904.35	2,134,005.78	0.0	9.50	10.00	13
ARLN9	N Sound Road South (southbound)	460,984.43	2,133,793.30	0.0	9.50	10.00	13
ARLN10	N Sound Road South (combined)	460,980.46	2,133,791.28	0.0	18.00	10.00	11

Polygon Area Sources

Source ID	Description	UTM Coordinates X1 (m)	UTM Coordinates Y1 (m)	Release Height (m)	Number of Coordinates
PAREA1	Airport POT	462,276.08	2,133,516.61	3	16

Table F.2

AERMOD Source Inputs for Project Modelling

Point Sources

Source ID	Description	Release Orientation	UTM Coordinates X (m)	UTM Coordinates Y (m)	Release Height (m)	Exit Diameter (m)	Gas Exit Velocity (m/s)	Gas Exit Temperature (K)
STCK1	EFW Stack	vertical	460,836.68	2,134,829.23	35.8	1.30	18.82	414
STCK16	Medical Waste Incinirator	vertical	460,752.73	2,135,046.53	12.8	0.75	1.36	1311
STCK17	Landfill Gas Enclosed Flare	vertical	460,932.21	2,134,956.19	10.0	1.00	0.18	1148

Flare Sources

Source ID	Description	Release Orientation	UTM Coordinates X (m)	UTM Coordinates Y (m)	Release Height (m)	Exit Diameter (m)	Gas Exit Velocity (m/s)	Gas Exit Temperature (K)
FLARE1	Land Fill Flare 1	vertical	460,726.97	2,135,220.77	3.6	0.04	37.26	623
FLARE2	Land Fill Flare 2	vertical	460,661.81	2,135,308.15	3.6	0.04	37.26	623
FLARE3	Land Fill Flare 3	vertical	460,746.13	2,135,345.71	3.6	0.04	37.26	623
FLARE4	Land Fill Flare 4	vertical	460,791.35	2,135,271.36	3.6	0.04	37.26	623
FLARE5	Land Fill Flare 5	vertical	460,807.44	2,135,183.22	3.6	0.04	37.26	623

Line Volume Sources

Source ID	Description	Line Volume Type	UTM Coordinates X1 (m)	UTM Coordinates Y1 (m)	Release Height (m)	Plume Width (m)	Line Volume Height (m)	Number of Coordinates
SLINE1	Entrance to Offloading point	Surface-Based	461112.5463	2134621.644	3.4	11	6.8	15

Appendix G

AERMET Surface Characteristics

Table G.1

AERMET Output Surface Characteristics

Wind Sector	Start	End	Month	Albedo	Bowen Ratio	Surface Roughness
1	0	30	1	0.12	0.14	0.002
			2	0.12	0.14	0.002
			3	0.11	0.13	0.002
			4	0.11	0.13	0.002
			5	0.11	0.13	0.002
			6	0.12	0.14	0.002
			7	0.12	0.14	0.002
			8	0.12	0.14	0.002
			9	0.12	0.14	0.002
			10	0.12	0.14	0.002
			11	0.12	0.14	0.002
			12	0.12	0.14	0.002
2	30	60	1	0.12	0.14	0.004
			2	0.12	0.14	0.004
			3	0.11	0.13	0.004
			4	0.11	0.13	0.004
			5	0.11	0.13	0.004
			6	0.12	0.14	0.004
			7	0.12	0.14	0.004
			8	0.12	0.14	0.004
			9	0.12	0.14	0.004
			10	0.12	0.14	0.004
			11	0.12	0.14	0.004
			12	0.12	0.14	0.004
3	60	90	1	0.12	0.14	0.009
			2	0.12	0.14	0.009
			3	0.11	0.13	0.009
			4	0.11	0.13	0.009
			5	0.11	0.13	0.009
			6	0.12	0.14	0.009
			7	0.12	0.14	0.009
			8	0.12	0.14	0.009
			9	0.12	0.14	0.009
			10	0.12	0.14	0.009
			11	0.12	0.14	0.009
			12	0.12	0.14	0.009
4	90	120	1	0.12	0.14	0.354
			2	0.12	0.14	0.354
			3	0.11	0.13	0.44

Table G.1

AERMET Output Surface Characteristics

Wind Sector	Start	End	Month	Albedo	Bowen Ratio	Surface Roughness
			4	0.11	0.13	0.44
			5	0.11	0.13	0.44
			6	0.12	0.14	0.44
			7	0.12	0.14	0.44
			8	0.12	0.14	0.44
			9	0.12	0.14	0.44
			10	0.12	0.14	0.44
			11	0.12	0.14	0.44
			12	0.12	0.14	0.354
5	120	150	1	0.12	0.14	0.4
			2	0.12	0.14	0.4
			3	0.11	0.13	0.5
			4	0.11	0.13	0.5
			5	0.11	0.13	0.5
			6	0.12	0.14	0.5
			7	0.12	0.14	0.5
			8	0.12	0.14	0.5
			9	0.12	0.14	0.5
			10	0.12	0.14	0.5
			11	0.12	0.14	0.5
			12	0.12	0.14	0.4
6	150	180	1	0.12	0.14	0.4
			2	0.12	0.14	0.4
			3	0.11	0.13	0.5
			4	0.11	0.13	0.5
			5	0.11	0.13	0.5
			6	0.12	0.14	0.5
			7	0.12	0.14	0.5
			8	0.12	0.14	0.5
			9	0.12	0.14	0.5
			10	0.12	0.14	0.5
			11	0.12	0.14	0.5
			12	0.12	0.14	0.4
7	180	210	1	0.12	0.14	0.4
			2	0.12	0.14	0.4
			3	0.11	0.13	0.5
			4	0.11	0.13	0.5
			5	0.11	0.13	0.5
			6	0.12	0.14	0.5

Table G.1

AERMET Output Surface Characteristics

Wind Sector	Start	End	Month	Albedo	Bowen Ratio	Surface Roughness
			7	0.12	0.14	0.5
			8	0.12	0.14	0.5
			9	0.12	0.14	0.5
			10	0.12	0.14	0.5
			11	0.12	0.14	0.5
			12	0.12	0.14	0.4
8	210	240	1	0.12	0.14	0.4
			2	0.12	0.14	0.4
			3	0.11	0.13	0.5
			4	0.11	0.13	0.5
			5	0.11	0.13	0.5
			6	0.12	0.14	0.5
			7	0.12	0.14	0.5
			8	0.12	0.14	0.5
			9	0.12	0.14	0.5
			10	0.12	0.14	0.5
			11	0.12	0.14	0.5
			12	0.12	0.14	0.4
9	240	270	1	0.12	0.14	0.4
			2	0.12	0.14	0.4
			3	0.11	0.13	0.5
			4	0.11	0.13	0.5
			5	0.11	0.13	0.5
			6	0.12	0.14	0.5
			7	0.12	0.14	0.5
			8	0.12	0.14	0.5
			9	0.12	0.14	0.5
			10	0.12	0.14	0.5
			11	0.12	0.14	0.5
			12	0.12	0.14	0.4
10	270	300	1	0.12	0.14	0.287
			2	0.12	0.14	0.287
			3	0.11	0.13	0.354
			4	0.11	0.13	0.354
			5	0.11	0.13	0.354
			6	0.12	0.14	0.354
			7	0.12	0.14	0.354
			8	0.12	0.14	0.354
			9	0.12	0.14	0.354

Table G.1

AERMET Output Surface Characteristics

Wind Sector	Start	End	Month	Albedo	Bowen Ratio	Surface Roughness
			10	0.12	0.14	0.354
			11	0.12	0.14	0.354
			12	0.12	0.14	0.287
11	300	330	1	0.12	0.14	0.007
			2	0.12	0.14	0.007
			3	0.11	0.13	0.007
			4	0.11	0.13	0.007
			5	0.11	0.13	0.007
			6	0.12	0.14	0.007
			7	0.12	0.14	0.007
			8	0.12	0.14	0.007
			9	0.12	0.14	0.007
			10	0.12	0.14	0.007
			11	0.12	0.14	0.007
			12	0.12	0.14	0.007
12	330	0	1	0.12	0.14	0.005
			2	0.12	0.14	0.005
			3	0.11	0.13	0.005
			4	0.11	0.13	0.005
			5	0.11	0.13	0.005
			6	0.12	0.14	0.005
			7	0.12	0.14	0.005
			8	0.12	0.14	0.005
			9	0.12	0.14	0.005
			10	0.12	0.14	0.005
			11	0.12	0.14	0.005
			12	0.12	0.14	0.005

Appendix 12.A

Noise and Vibration Assessment

Integrated Solid Waste Management System for the Cayman Islands

Noise and Vibration Assessment

Dart

19 June 2023

→ The Power of Commitment

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The Power of Commitment

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Appendices

1. Introduction

1.1 Purpose of this Report

ReGen (‘the proponent') is seeking approval for the development of a proposed Integrated Solid Waste Management System (ISWMS) in the Cayman Islands (‘the project'). Construction and operation of the Project is proposed to allow the existing landfill in George Town to be closed, remediated, and replaced with an integrated waste management philosophy based on the core principles of the international waste hierarchy.

This report presents the Noise and Vibration Impact Assessment (NVIA) prepared to support the Environmental Impact Assessment (EIA) for the project. It has been prepared to address the noise and vibration requirements of the Final Terms of Reference (ToR) prepared by the proponent.

This NVIA reports the likely effects of the Proposed Development in terms of noise and vibration in the context of the Site and surrounding area, and whether these would be deemed to be significant. In particular it considers the likely effects of noise and vibration from the Proposed Development and its impact on nearby receptors through the construction and operational phases of the project.

In line with ToR for project, the objectives for the NVIA are to evaluate that the direct and indirect significant effects of a proposed development which are to be identified, described and assessed. Unwanted noise & vibration are known to have an adverse impact on health and quality of life. The activities proposed during the construction and operational phases of the ISWMS have the potential to result in a measurable increase to levels of noise and vibration in the vicinity of the proposed development, and therefore a potential for significant effect on health and quality of life and so these activities have been assessed in detail to confirm potential impacts as part of the EIA process.

The NVIA has been informed by the outcomes of stakeholder consultation conducted by the proponent to date, which sought input from key project-affected stakeholders and members of the broader local community. It also includes consideration of the results of other technical chapters prepared for the EIA, including Traffic and Transport (Chapter 13).

1.2 Overview of the Proposed Development

Each year, approximately 115,000 tons of solid waste is produced in the Cayman Islands, with the overwhelming majority of the material presently being managed by the George Town landfill (GTLF). This landfill capacity is, however, finite and in accordance with the provisions of both the National Solid Waste Management Strategy for the Cayman Islands (2016) and the National Planning Framework (draft for public consultation) (2018), the ToR has been prepared in relation to the proposed development of a replacement ISWMS for the Cayman Islands.

The proposed ISWMS site is located to the north of central George Town towards the western coast of Grand Cayman, immediately south-west of the existing GTLF. The proposed ISWMS is a multi-facility development, including an energy recovery facility (ERF) and supporting non-ERF waste processing, treatment, and disposal facilities. Construction and operation of the ISWMS would allow the existing landfills in George Town, Cayman Brac and Little Cayman to be closed and remediated.

Section 5.7.8 of ToR states – ‘The development also includes the construction of facilities on Grand Cayman’s Sister Islands namely, Little Cayman and Cayman Brac. This assessment includes the construction phases of these facilities – the operational phases of the Sister Island facilities will be managed by the Department of Environmental Health and therefore the assessment of this not covered in this report.’

The NVIA has been prepared considerate of the ToR and an evaluation of the operational phases of the Sister Island (SI) facilities was not included in this assessment. It is expected that a noise assessment for SI facilities will be conducted when plan of facilities in the Sister Islands is finalized with Cayman Islands Government or similar responsible agencies.

1.2.1 Key Features

The proposed ISWMS development consists of various new waste management facilities. The various components of the ISWMS subject to assessment in this NVIA are as follows:

The Study Area considered within this report is principally focussed on the entire footprint of the ISWMS. GHD understand that the ISWMS will include the following elements:

- Energy Recovery Facility (ERF)
- Non-Energy Recovery Facilities:
  - Site weighbridges
  - Green Waste Processing Facility
  - Construction and Demolition Waste Processing Facility
  - Bottom Ash Processing Facility
  - Abandoned and End-of-Life / Scrap Metal Processing Facility
  - Medical Waste Facility
  - Materials Recycling Facility
  - Household Waste Recycling Centre
  - Landfill Gas Facility
  - Residual Waste Landfill
- Ancillary Facilities:
  - Admin Building
  - Maintenance Building

The design life of the new facilities is 25 years.

A complete description of each of the project elements described above is provided in Chapter 4 (Proposed Project and Overview of Concerns and Constraints) of the EIA.

1.2.2 Timeframes

Construction for the proposed ISWMS development would commence in 2024, with completion planned in 2027 (subject to final review and confirmation).

1.3 Study Areas and Assessment Boundaries

1.3.1 Spatial Boundaries

The following spatial boundaries apply to Noise and Vibration:

1.3.1.1 Site Study Area (SSA) (or "Project Footprint")

The SSA encompasses the land area directly disturbed by Project construction activities, including associated physical works and activities. The proposed ISWMS site is located to the north of central George Town towards the western coast of Grand Cayman, immediately south-west of the existing GTLF as shown in Figure 1. Access to the site will be via Seymour Drive from the south.

1.3.1.2 Local Study Area (LSA)

The Noise and Vibration LSA encompasses all lands within a 1,000 m radius of the SSA boundaries as shown in Figure 1. The maximum noise impacts are expected to occur at the property line and within 500 m of the SSA. The LSA has been defined as double this distance to conservatively assess all likely and lessor noise impacts in **George Town**, which contains the area directly occupied by the Project infrastructure, as well as communities and landholders that may be directly affected by Project construction and operation activities.

Figure 1 Site Study Area and Local Study Area for Noise and Vibration

1.3.1.3 Regional Study Area (RSA)

The Noise and Vibration RSA encompasses all lands which may provide a source of workers, goods or services for the Project as the main noise source in the existing area is the Esterly Tibbetts Highway, the RSA would include the lands connected to the Esterly Tibbetts Highway as depicted in Figure 2. The RSA has been defined conservatively to assess all likely sources of potential noise impacts to the sensitive areas surrounding the ISWMS Facility.

The maximum distance recommended for assessment is not stipulated in the United Kingdom's (UK) Institute of Environmental Management and Assessment Guidelines for Environmental Noise Impact Assessment, 2014 (IEMA). Therefore, for the purpose of this baseline noise assessment the noise at the worst-case sensitive Noise Sensitive Receptors (NSRs) within the LSA will be evaluated. The maximum noise impacts are however expected to occur at the property line and within approximately 500 m of the SSA.

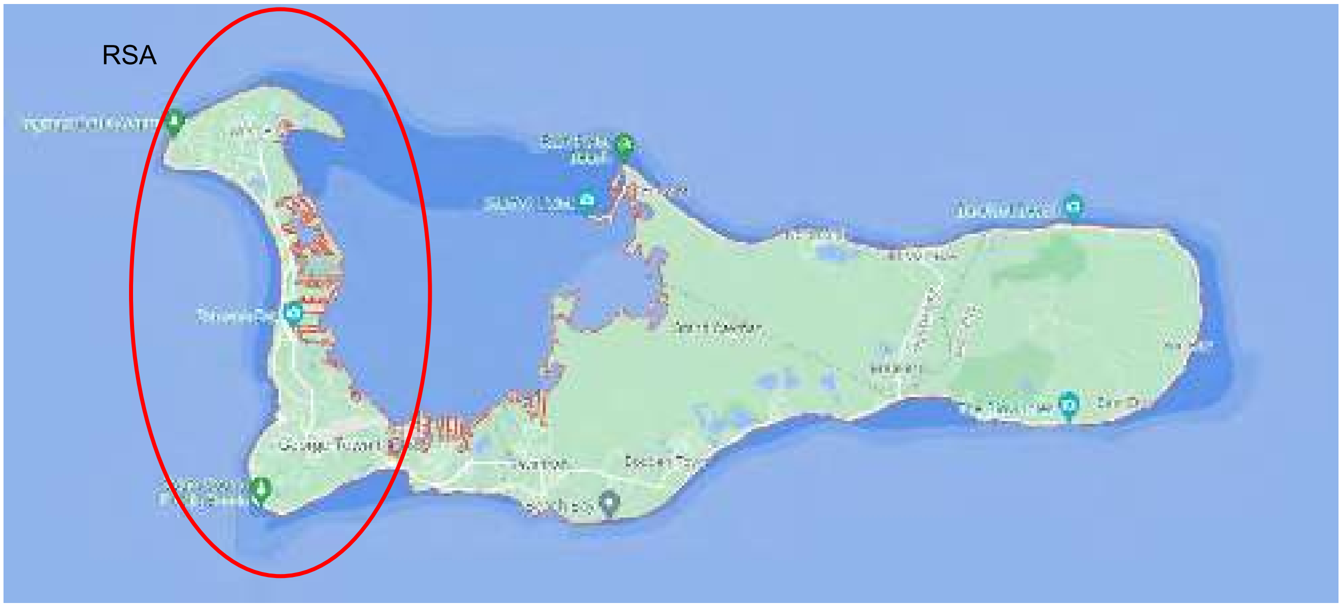


Figure 2 ***Regional Study Area for Noise and Vibration***

1.3.2 Temporal Boundaries

There are two different types of temporal boundaries to consider. The first type are the boundaries that are associated with the temporal limits of a project. They include both large scale limits: different phases of a project (construction, operation, and closure and post-closure) and small scale limits: duration of specific project activities. Generally, the temporal boundary encompasses all project phases; however, the temporal boundary can vary depending on the Valued Components (VC) being considered. The second are the temporal characteristics associated with each VC. Temporal characteristics include both the timing and duration of critical or sensitive life stages of biological VCs (e.g., nesting and spawning periods and over-wintering). Temporal characteristics also include timing and duration of human activities (e.g., heavy tourism and recreation seasons).

For the ISWMS Project the temporal boundary limits for all VCs encompass all project phases as follows:

– **Construction (C)**: Initial Site preparation and construction (approximately 3 years)
– **Operations (O)**: Waste acceptance at the Site, ongoing landfill clearing and landfill cell construction, progressive landfill cell closure, and monitoring (approximately 25 years, depending on demand for facility services)
– **Decommissioning (D)**: removal of non-essential on-site infrastructure and closure of the facility (approximately 6 months)

Relevant temporal characteristic boundaries for Noise and Vibration include:

– Seasonal fluctuations in traffic volumes and composition
– Fluctuations in weather patterns, and their corresponding effect on Noise propagation

1.3.3 Technical Boundaries

Technical boundaries reflect the limitations in the ability to predict the effects of a project, which impose potential constraints on an assessment. An example of a technical boundary is the difficulty associated with sampling certain reclusive species, resulting in a data gap for a VC. Technical limitations are also associated with modeling and the possible margin of error in the generated data.

Technical boundaries relevant to the existing conditions assessment of Noise and Vibration include:

- Accuracy of the sound level data and traffic data used in the assessment
- Modelling accuracy
- Level of detailed design

1.3.4 Sensitive Receptor Locations – ISWMS Development

The identification of appropriate sensitive receptors is necessary to conduct the NVIA. A Noise Sensitive Receptor (NSR) is any point on the premises of a person, where sound, originating from external sources other than those that premises, is received. In general, NSRs may include: permanent or seasonal residences, nursing/retirement homes, hotels/motels, rental residences, hospitals, campgrounds, parks, schools, cemeteries or places of worship.

The objective of the NVIA is to determine the predictable worst case 1-hour equivalent sound level (1-hour Leq) at the worst case NSR(s) and to prove and ensure that the construction and operation of the ISWMS does not significantly affect the acoustic environment of the worst case NSR(s). Also, this work will ensure that should future impact assessments require equipment which that needs appropriate specifications or effective noise mitigation to meet existing sound levels, there is a reference to provide effective mitigation suggestions. The worst case NSR(s) is(are) defined as the sensitive receptor(s) with the greatest potential exposure to the ISWMS noise sources due to proximity and direct line of sight exposure.

As per the Terms of Reference (ToR), this section identifies NSRs that have the potential to be significantly affected by the main ISWMS development. The NSRs considered in the assessment include the following:

- NSR1 - Locations within the Lakeside Development (residential dwelling immediately west of the ISWMS development, on the opposite side of the Esterly Tibbetts Highway)
- NSR2 - Properties on Parkside Close (residential dwelling approximately 800 m to the northwest of the ISWMS development)
- NSR3 - Properties on Seymour Road (residential dwelling approximately 300 m to the southeast of the proposed ISWMS development)
- NSR4 - Representative of The Cayman International School (educational establishment approximately 800 m to the northeast of the ISWMS development); and Locations within the OLEA residential development approximately 800 m north of the ISWMS development
- NSR5 - Properties on Woodlake Drive/Glenwood Drive (residential dwelling approximately 300 m to the southwest of the ISWMS development)
- NSR6 – Proposed New Health City Camana Bay Medical Campus (sensitive receptor approximately 700 m to the north of the ISWMS development)

All NSR locations within 1000 m of the Facility were considered; however, the noise impact at only the worst case and most exposed NSRs are presented herein.

The location of the worst case NSRs are identified on **Figure 3 below:**

Figure 3 Point of Reception Location Plan

1.4 Existing Noise & Vibration Environment

The Cayman Islands has a total population of around 65,000 people, most of whom reside on Grand Cayman. The capital city of Grand Cayman, George Town, is located in the George Town District where the project is to be located and has a population of around 30,000 people. The population of the Cayman Island's is young compared to most developed countries, with approximately 85% of the population below the age of 55.

The economy of the Cayman Islands is mainly fuelled by the tourism and financial services sectors. Various economic impact studies put the financial services sector at approximately 50 to 60% of gross domestic product (GDP), while the tourism sector contributes between 25 to 30% of GDP – the islands having received over 2 million visitors in 2016 (mainly from the USA). Other sectors include construction, property and other business activities.

The existing ambient acoustic environment and sound characteristics around the ISWMS is mainly influenced by road traffic attributed to the local and highway roads, cruise ships, airplanes supporting the local tourism industry to the north south and west, and by existing industry to the southeast, which includes various automotive shops and ready-mix cement/concrete suppliers.

1.4.1 Existing Site and Surroundings

The land usage surrounding the proposed ISWMS site is summarised as follows:

- The existing GTLF lies immediately north and east of the proposed ISWMS site. North of this is a tidal drainage channel developed for mosquito control that connects with North Sound to the east. The Cayman International School and Camana Bay development are located approximately 0.2 miles and 0.5 miles north of the GTLF respectively.
- The land east of the GTLF is owned by Water Authority Cayman (WAC), comprising four large former wastewater treatment lagoons that are still used for sludge storage. South of the lagoons is the current wastewater treatment plant including some buildings and four smaller basins. Some 0.1 to 0.2 miles east of the landfill site is land zoned for industrial use. This is mainly undeveloped or used for open storage. The Department of Environmental Health (DEH) collections depot (comprising several trailers for staff facilities and parking for staff and collection vehicles) is located on approximately 1 acre of land to the east of the wastewater treatment lagoons within the ISWMS property. A Central Laundry Facility is also located to the east of the wastewater treatment lagoons.
- The southern boundary of the proposed ISWMS site is currently mangrove, beyond which is industrial and commercial development. This land is occupied by a variety of businesses, including a concrete batching plant and a concrete block and paver stone manufacturer.
- Esterly Tibbetts Highway (the main arterial road to West Bay) lies immediately adjacent to the fence line forming the western boundary of the proposed ISWMS site. The Lakeside residential development is located west of this road. This development comprises 12 three-storey residential apartments with car parking and leisure/landscape areas (including a small lake). The North Mound of the GTLF is visible from the easternmost lakeside buildings.
- The undeveloped parcel of the ISWMS development (Block 13D Parcel 431) is predominantly zoned Heavy Industrial (HI), which designation includes all of the activities proposed at the ISWMS Site; allowing for power generation, fuel refining and storage, solid waste disposal, recycling, quarrying and mining, mechanical and other forms of manufacture. This is consistent with the existing zoning designations and activities on the land surrounding the proposed ISWMS development.

There is one major highway and two major local roads located within the Study Area including:

1. Esterly Tibbetts Highway is a 4 lane highway that carries the majority of the traffic noise in the area around the proposed ISWMS site
2. West Bay Road is a 3-lane municipal road
3. North Sound Road is a 4-lane municipal road that becomes a 2-land road between Butterfield roundabout and Seymour Road

Vehicular road traffic generates noise that consists of mechanical noise from the engine and brakes, friction noise created from the wheel contacting the road surface, and aerodynamic wind noise from the vehicle. Traffic volume, speed, road composition, gradient and surface type will affect the overall traffic noise that can be generated. Proximity and line of sight to the road corridor are most consequential for determining the noise impact exposure for an adjacent area.

Road traffic noise is generally considered atonal broadband noise, meaning that it generates a fairly even sound distribution over the frequency spectrum with little to no predominant peaks. For any broadband noise, the audibility and potential impact from a change in the overall noise level will be a function of how much it exceeds the existing ambient background sound level or baseline noise environment. The noise generated from vehicular traffic can be defined as a line type noise source, meaning that the noise generated will reduce by approximately 3 dBA for every doubling of distance from the source.

Road traffic is scoped out and not considered to be a significant source of vibration as per ToR Section 5.7.14.

As previously completed noise monitoring describes the existing acoustic environment further north on the island it is not representative of the closest sensitive receptors to the ISWMS site and as such GHD has completed additional Baseline Noise Monitoring around the LSA.

1.5 Baseline Noise Monitoring Results

Baseline noise monitoring was necessary since noise monitoring is not routinely undertaken on the Cayman Islands, and no data is publicly available on existing levels of noise levels since the previous monitoring conducted in 2014 at other locations. The monitoring data was used in conjunction with predictive dispersion modelling using the Cadna A acoustical model to determine the potential effects of the ISWMS relative to the elevated baseline noise levels.

The objective of the baseline monitoring was to accurately measure the baseline noise levels in the area from the existing potential noise emission sources in the Study Area as detailed in the preceding Section 1.4.1.

1.5.1 Baseline Noise Monitoring Systems

Baseline sound surveys were undertaken at the agreed NSRs using 4 Larson Davis LXT (Serial Number 0006587, 0006393, 0003969, 0006585) Type 1 sound level meters as defined by BS EN 61672: Part 1: 2013 (Electroacoustics, Sound Level Meters, Specifications). All sound level meters were field calibrated before and after the measurement period by applying an acoustic calibrator that conformed to the latest versions of BS EN IEC 60942:2018 (Electroacoustics - Sound Calibrators) to the microphone to check the sensitivity of the measuring equipment. Any significant drift in calibration levels were noted. The equipment used for the noise monitoring had undergone laboratory calibration within a period not exceeding two years (one year for calibrators).

The local Cayman's airport weather station data was used to monitor weather patterns over the survey period and any periods measured under unsuitable weather conditions (precipitation and/or winds greater than 20 km/hour) were excluded from the final dataset.

The instrumentation used for the sound surveys was set up to simultaneously log, at a minimum, $L_{Aeq,T}$, $L_{A90,T}$, $L_{A10,T}$, L_{ASmin} and L_{ASmax} sound levels over continuous sampling periods for 1 hour, over a total period of 5-8 days including a weekend period. All measurements were undertaken in accordance with recognised relevant methodologies such as BS 4142:2014. The baseline sound survey results were then defined against, BS4142:2014 in terms of background sound levels (defined as the L_{eq}, $L_{A90,\,T}$ parameter) in compliance with the requirements of the EAB scoping opinion, per Section 5.7.17 in the ToR. Section 5 of the scoping opinion states that "noise levels from the proposed activities should be calculated and assessed against baseline conditions and relevant standards, taking into account cumulative effects of adjacent activities and land uses".

The noise descriptors are described as the following:

– $L_{Aeq,\,T}$ – This is the A-weighted sound level of a steady sound carrying the same total energy in the time period T as the observed fluctuating sound. The time period T is given in hours. Leq without a specific time period means Leq.

– $L_{A90,T}$ – This is sound the level that is exceeded for 90% of the time and is often used to quantify the background noise levels in assessments of noise pollution and nuisance noise from industrial sources.

– $L_{A10,T}$ – This is sound the level that is exceeded for 10% of the time and takes account of any annoying peaks in noise.

– L_{ASmin} and L_{ASmax} – the minimum and maximum L_{Aeq} within a period of time.

The baseline noise monitoring program followed these standards. Unattended baseline monitoring was selected due to the variability of the sound levels in an urban environment and since the ISWMS will run year-round, a more long-term evaluation is required to best evaluate the existing conditions. The month of October was selected due to favourable weather and because local schools would be in session depicting typical traffic patterns for the area.

1.5.2 Duration of Baseline Noise Monitoring

Seasonality on the Cayman Islands consists of a wet and a dry season. The dry season usually begins in early November and lasts until April. The monitoring took place beginning in October 2021 which measured noise emissions occurring just prior to the start of the rainy season but after the summer school break so regular traffic is observed and documented with regards to ambient noise in the area.

Baseline monitoring was completed for 8 days at NSRs 1, 3, and 4. The Baseline monitoring at NSR2 however was only completed over 5 days due to difficulty obtaining permissions and access to that location. This is still within the minimum 5 day required total period for determining background sound levels. All baseline monitoring included both weekday and weekend days for evaluation. Monitoring at NSR1 is considered representative of NSR5 due to the same line of sight, exposure and separation distance (~50m) to Esterly Tibbetts Highway. Monitoring at NSR4 is considered representative of NSR6 due to similar proximity to Esterly Tibbetts Highway.

Photographs of the monitoring locations are included in Appendix D.

1.5.3 Baseline Noise Monitoring Results

Continuous one-hour L_{Aeq}s were taken with the detector in slow response over the course of the measuring period when meteorological conditions consisted of low winds (less than 15 kilometers per hour [km/hr]), and minimal precipitation or were otherwise excluded due to weather. The baseline noise monitoring was conducted from October 19, 2021 to October 27, 2021 with all statistical sound level measurements including $L_{Aeq,T}$, $L_{A90,T}$, $L_{A10,T}$, L_{ASmin} and L_{ASmax} over continuous hourly sampling periods for each monitoring location in addition to providing the average for the weekday periods of monitoring program as summarized in Tables D.1-D.4 of Appendix D.

The daytime, evening, and nighttime statistical sound levels are summarized for each monitoring location are shown below:

Table 1 Baseline Noise Monitoring Week Summary

NSR	Average Daytime (dBA) LAeq, 11 hour	Average Evening (dBA) LAeq, 5 hour	Average Night Time Level (dBA) LAeq, 8 hour	Daytime Range (dBA) LA90, 11 hour	Evening Range (dBA) LA90, 5 hour	Night time Range (dBA) LA90, 8 hour
NSR1 – Lakeside Development (7.5 metres above grade [m AG])	63	58	58	51 - 59	49 - 54	45 - 47
NSR2 – Residence on Parkside Cl. (4 m AG)	56	48	44	43 - 46	40 - 43	36 -40
NSR3 – Residence on Seymour Rd. (1.5 m AG)	65	57	57	53 - 57	52 - 54	49 - 53
NSR4 – Cayman International School (4.5 m AG)	61	54	51	43 - 52	42 - 45	38 - 41
NSR5 – Residence on Woodlake Drive (1.5 m AG)	63	58	58	51 - 59	49 - 54	45 – 47
NSR6 – Proposed New Health City Camana Bay Medical Campus (7.5 m AG)	61	54	51	43 - 52	42 - 45	38 - 41

Note that NSR1 baseline data is used to represent NSR5 and NSR4 baseline data is used to represent NSR6 due to similar proximity to Esterly Tibbetts Highway.

The average L_{90} hour for each monitoring period is typically used for comparison to the proposed operational impacts of the ISWMS, as this is the period in which the ambient environment is at its lowest and is therefore conservative criteria to evaluate potential noise impacts relative to the ambient.

2. Applicable Standards and Guidelines

Cayman Islands is an overseas British Territory. Noise and Vibration guidance regarding baseline monitoring will therefore be referenced from the current EU Directives as noted in Table 5.33 of the ToR:

– UK's Institute of Environmental Management and Assessment Guidelines for Environmental Noise Impact Assessment, 2014 (IEMA)

As stated in the ToR, emissions in the Cayman Islands are guided by the UK's Institute of Environmental Management and Assessment Guidelines for Environmental Noise Impact Assessment, 2014 (IEMA) which presents guidelines on how the assessment of noise effects should be presented within the Environmental Impact Assessment (EIA) process. The IEMA guidelines cover aspects such as; scoping, baseline, prediction and example definitions of significance criteria.

The applicable guidance is summarized as follows:

– British Standard 5228-1:2009+A1:2014 Code of Practice for noise and vibration control on construction and open sites – Part 1: Noise (BS5228-1)
– British Standard 5228-2:2009+A1:2014 Code of Practice for noise and vibration control on construction and open sites – Part 2: Vibration (BS5228-2)
– UK's Highways Agency Design Manual for Roads and Bridges, 2011 (DMRB)
– British Standard 4142+A1:2019: Methods for rating and assessing industrial and commercial sound (BS4142)
– British Standard 8233:2014 Guidance on sound Insulation and noise reduction for buildings (BS8233)
– British Standard 6472-1:2008 Guide to evaluation of human exposure to vibration in buildings. Part 1: Vibration sources other than blasting (BS6472)
– UK's Department of Transport Calculation of Road Traffic Noise, 1988 (CRTN)
– Acoustics – Attenuation of sound during propagation outdoors: Part 2 General Method of Calculation, 1996 (ISO 9613-2)
– UK's Institute of Environmental Management and Assessment Guidelines for Environmental Noise Impact Assessment, 2014 (IEMA)
– Potential noise impacts at educational facilities – Acoustic design of schools: performance standards: Building bulletin 93, 2015 (BB93)
– Cayman Islands Government Department of Environmental Health – Guidelines for Development Control (2009 Revision) - Section 4.4 - Noise Pollution Control (https://www.gov.ky/deh/publications.html)

The potential noise effects associated with the ISWMS have been assessed in accordance with the guidance detailed in the following sections to determine whether statutory objectives are exceeded or whether undesirable/desirable consequences may arise for the receiving environment. Where potential adverse impacts are identified, appropriate mitigation measures are proposed to avoid, reduce or compensate for the adverse effects. The significance of an environmental impact will be determined not only by the magnitude of the impact but also by the sensitivity of the receptor. The significance of construction noise and vibration, and operational noise, is detailed below, respectively, as well as the determination of the sensitivity of the receptor.

2.1 Assessment Criteria for Operational Noise Effects

For each NSR the ISWMS operational noise assessment methodology, as described in BS 4142:2014, comprises:

– Ascertaining a representative $L_{A90,\,T}$ background sound level at the NSR from the results of baseline sound survey.
– Calculating or modelling the free-field $L_{Aeq,Tr}$ specific sound level (due to each item of plant) at said NSR and applying a character correction (for tonality, intermittency and impulsivity, if appropriate) to obtain the free-field

$L_{Ar,\,Tr}$ rating level – for the identification of tonality, reference should be made to 1/3rd octave data if such data is available.

– Performing a decibel addition to obtain the cumulative effect (where appropriate) of all relevant $L_{Ar,\,Tr}$ rating levels on the NSR.
– Arithmetically subtracting the $L_{A90,\,T}$ background level from the cumulative $L_{Ar,\,Tr}$ rating level to obtain the excess of rating level over background level for the assessment.
– The assessment criteria for EIA magnitude of change has been derived from the assessment criteria described in section 11 of BS 4142: 2014 and is given in Table 2.

Table 2 EIA Magnitude of Change Assessment Criteria

EIA Magnitude of Change	Excess of Rating over Background Sound Level, dB	Typical BS 4142:2014 Assessment Outcome
Very High	> 12	A difference of around +10 dB or more is likely to be an indication of a significant adverse impact depending on context
High	8 – 12	A difference of around +10 dB or more is likely to be an indication of a significant adverse impact depending on context
Medium	3 – 7	A difference of around +5 dB is likely to be an indication of an adverse impact depending on context
Low	0 – 2	Less than an indication of adverse impact, depending on context
Very Low	< 0	Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on context.

For the purposes of BS4142:2014, adverse impacts include, but are not limited to, annoyance and sleep disturbance. However, it should be noted that not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact.

Table 3 Sensitivity of Receptor

Sensitivity	Receptor Type
High	**Receptor/resource has little ability to absorb change without fundamentally altering its present character or is of international or national importance. For example, hospitals, residential care homes, and internationally and nationally designated nature conservation sites which are also known to contain noise sensitive species (i.e., noise may change breeding habits or threaten species in some other way).**
Medium	**Receptors/resource has moderate capacity to absorb change without significantly altering its present character. For example, residential dwellings, offices, schools, and play areas. Locally designated nature conservation sites which are also known to contain noise sensitive species (i.e., noise may change breeding habits or threaten species in some other way).**
Low	Receptor/resource is tolerant of change without detriment to its character or is of low or local importance. For example, industrial estates.
Negligible	Receptor/ resource is not sensitive to noise.

The NSRs identified have been assessed to have medium sensitivity as noise & vibration assessments primarily apply to residential receptors in the ISWMS development area, with the exception of NSR6 and NSR4, which are assessed high sensitivity due to being a hospital and a school, respectively.

The significance of an environmental impact for on-site operational noise is determined by the interaction of magnitude and sensitivity. The Significance Evaluation Matrix used in this assessment is shown in Table 4:

Table 4 Significance Evaluation Matrix

		Magnitude of Change				
		Very High	**High**	**Medium**	**Low**	**Very Low**
Sensitivity	**Very High**	Major (Significant)	Major (Significant)	Major (Significant)	Major (Significant)	Moderate (Possibly significant)
	High	**Major (Significant)**	**Major (Significant)**	**Major (Significant)**	**Moderate (Possibly significant)**	**Minor (Not significant)**
	Medium	**Major (Significant)**	**Major (Significant)**	**Moderate (Possibly significant)**	**Minor (Not significant)**	**Negligible (Not significant)**
	Low	Major (Significant)	Moderate (Possibly significant)	Minor (Not significant)	Negligible (Not significant)	Negligible (Not significant)
	Very Low	Moderate (Possibly significant)	Minor (Not significant)	Negligible (Not significant)	Negligible (Not significant)	Negligible (Not significant)

Within the matrix that is used in most significance evaluation exercises, reference is made to:

– Major effects, which will always be determined as being significant.

– Moderate effects that are likely to be significant, although there may be circumstances where such effects are considered 'not significant' based on specific scenarios and professional judgement.

– Minor or negligible effects, which will always be determined as 'not significant'.

Additionally, Moderate impacts might be noticeable and intrusive but may cause only a small change in behaviour, while significant impacts might be noticeable and disruptive and might cause a material change in behaviour or attitude.

2.2 Assessment of Operational Traffic Noise Effects

Predictions of the relative increase in traffic noise levels will be undertaken where data indicates that there will be an increase of 25% or decrease of 20% in existing traffic levels or if there is an increase of more than 1 dBA due to heavy goods vehicle (HGV) traffic increases on the main route(s) to the development.

The Operational Traffic Roads includes the following roads: Seymour Road, North Sound Road, Thomas Russel Avenue, Elgin Avenue, Goring Avenue, Harbour Drive and Esterly Tibbets Highway. The BNL was predicted using noise emission rates in accordance with CRTN calculations using total flows, mean speed and %HGVs.

18-hour (06:00 – 24:00) traffic counts from 2017 and 2019 for all roadways were obtained from the National Roads Authority (Cayman Islands) and manual traffic counts for Seymour Road were completed in December 2022 and January 2023. Traffic data collected from automatic traffic counters between December 2 and 16, 2022 as part of a

Traffic Study by APEC Consulting Engineers Limited was also used. These counts were used to determine the minimum hourly count during the day, evening, and nighttime periods.

Table 5 Operational Roads Traffic Parameters

Road Segment	Daytime Vehicle Count (06:00 – 00:00)	Night-time Vehicle Count (00:00 – 06:00)	Speed Limit (miles/hour)	%HGVs
Seymour	4405	277	25	9%
N Sound Rd. (West of Seymour Rd.)	10125	637	35	15%
N Sound Rd. (East of Seymour Rd.)	8628	543	35	15%
Thomas Russel Ave.	34102	899	35	11%
Elgin Ave.	19629	526	25	7%
Goring Ave.	19629	526	25	7%
Harbour Dr.	23107	686	25	15%
Esterly Tibbetts Highway	31185	816	40	15%

The above road traffic data was used to calculate the Haul Road noise levels. Note that North Sound Road east of Seymour Road is not part of the Haul Route, but is included to account for traffic coming from that direction.

The rounded road traffic noise modeling results are summarized as follows:

Table 6 Existing Operational Traffic $L_{A10,\ 18hr}$ Noise Impact Levels

NSR	Existing 18 hr Daytime Operational Road Traffic $L_{A10,\ 18hr}$ (dBA)	Existing 6 hr Night-time Operational Road Traffic $L_{A10,\ 6hr}$ (dBA)
Seymour	65	58
N Sound Rd. (West of Seymour Rd.)	71	64
N Sound Rd. (East of Seymour Rd.)	71	63
Thomas Russel Ave.	76	65
Elgin Ave.	71	61
Goring Ave.	71	61
Harbour Dr.	74	64
Esterly Tibbetts Highway	77	66

Any increase will be assessed in terms of the criteria given in DMRB based on the magnitude of change for the long-term as the operation traffic will be a long-term effect and is defined in Table 7 below:

Table 7 Magnitude of Change of Operational Traffic Noise Effects –Long Term

Magnitude	Long Term Noise Change (dBA $L_{A10,18hr}$)
Major	Greater than or equal to 10.0
Moderate	5.0 to 9.9
Minor	3.0 to 4.9
Negligible	Less than 3.0

Once the magnitude of change is determined, the Significance Evaluation Matrix (Table 4) will be consulted to determine the significance of the impact. It is expected that operational traffic noise change will be considered long term noise change.

2.3 Assessment Criteria for Construction Noise Effects

The activities associated with the construction phase of the ISWMS have the potential to generate noise and create an impact on the surrounding area. The potential noise impact during the construction phase has been assessed against the BS5228-1 ABC method. The magnitude of any impacts has been established, and the significance of the construction noise impact has been determined.

In addition to the construction activities, construction vehicle movements to and from the site have the potential to generate noise at existing sensitive receptors, in the immediate vicinity of the local road network. This potential noise impact has been considered against the existing baseline noise levels and vehicle movements within the local area.

The British and International standard Construction & Operational Road Traffic Noise by the UK's Highways Agency Design Manual for Roads and Bridges (DMRB) is widely used as reference for construction noise impact assessments. The DMRB guidance scope of construction noise by first understanding if construction noise generated by the project has the potential to adversely affect any sensitive receptors. Second, the DMRB asks if the scale of the development or receptors warrant there a reasonable stakeholder expectation to undertake a noise assessment. In this case the answer to both would be yes, therefore a noise assessment must be undertaken.

The DMRB assesses areas based on the baseline noise of an area. The noise assessment will be based on GHD's baseline noise data collected from October 19, 2021 to October 27, 2021, since data from other sources was not sufficient to enable production of a proportionate construction noise assessment.

The DMRB determines significance based on the lowest observed adverse effect level (LOAEL), and the significant observed adverse effect level (SOAEL) as follows:

Table 8 Magnitude of Impact and Construction Noise Descriptions

Magnitude of Impact	Construction Noise Level
Major	Above or equal to SOAEL +5 dB
Moderate	Above or equal to SOAEL and below SOAEL +5 dB
Minor	Above or equal to LOAEL and below SOAEL
Negligible	Below LOAEL

The DMRB establishes that the LOAEL is the ambient noise level, and the SOAEL is determined by the BS5228-1 threshold value (see Table 9 on next page).

Construction noise will be predicted using the methodology indicated in BS5228-1:2009+A1:2014 for all the main phases of the construction works, including any cumulative noise associated with simultaneous operation of construction activities within different phases.

The results from these predictions will be assessed against the ABC methodology within Annex E of this Standard and will be based on the prevailing ambient noise levels measured as part of the study.

Table 9 The ABC Method of Determining the Threshold Noise Levels of Potential Significant Effect at Dwellings

Assessment Category and Threshold Value Period	Threshold Value, in decibels (dB), $L_{aeq,T}$		
	Category A[(A)]	Category B [(B)]	Category C [(C)]
Night-time (23:00 – 07:00)	45	50	55
Evenings and weekends	55	60	65
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)[(D)]	65	70	75
[A)] Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.			

Assessment Category and Threshold Value Period	Threshold Value, in decibels (dB), $L_{aeq,T}$		
	Category A[(A)]	Category B [(B)]	Category C [(C)]
B) Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values. C) Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than Category A values. D) 19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays.			

A potential significant effect is indicated if the $L_{Aeq,T}$ noise level arising from the site exceeds the threshold level for the category appropriate to the ambient noise level. If the ambient noise level exceeds Category C threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a potential significant effect is indicated if the total $L_{Aeq,T}$ noise level for the period increases by more than 3 dB due to site noise. This table applies to residential receptors only.

Chapter 4 of the Environmental Statement specifies that all construction work and ancillary operations that are audible at sensitive receptors shall be carried out between the hours of 8 am – 6 pm. Thus, the daytime values will be determined using this method.

Table 10 Threshold Limits for Noise Sensitive Receptors

Noise Sensitive Receptor	Daytime Ambient Leq (dBA) (07:00 – 19:00)	Rounded to Nearest 5 dBA	BS-5228 Category	Daytime Threshold (dBA)
NSR1 – Lakeside Development (7.5 metres above grade [m AG])	63	65	B	**70**
NSR2 – Residence on Parkside Cl. (4 m AG)	56	55	A	**65**
NSR3 – Residence on Seymour Rd. (1.5 m AG)	66	65	B	**70**
NSR4 – Cayman International School (4.5 m AG)	60	60	A	**65**
NSR5 – Residence on Woodlake Drive (1.5 m AG)	63	65	B	**70**
NSR6 - Proposed New Health City Camana Bay Medical Campus (7.5 m AG)	60	60	A	**65**

In order to rate the magnitude of potential significant effects, the modelled results are then considered against the criteria in Table 11, which specifies a magnitude of change based on the threshold values and temporal considerations.

Table 11 Construction Noise EIA Magnitude of Change Criteria

EIA Magnitude of Change	Criteria
Very High	Exceeds BS 5228 threshold values for one month or more by 10 dB or more or any of the trigger levels for more than nine days in a 15-day period by 10 dB or more.
High	Exceeds BS 5228 threshold values for one month or more by less than 10dB or any of the trigger levels for more than 9 days in a 15-day period by less than 10 dB.
Medium	Exceeds BS 5228 threshold values or trigger levels by less than temporal criteria of significance.
Low	Is within < 10 dB below BS 5228 threshold values or trigger levels.
Very Low	Is more than 10 dB below BS 5228 threshold values or trigger levels.

Once the magnitude of change is determined, the Significance Evaluation Matrix (Table 4) will be consulted to determine the significance of the impact.

2.4 Assessment Criteria for Construction Road Traffic Noise

GHD generated the Basic Noise Level (BNL) at the NSR locations based on traffic counts to evaluate the existing background noise due to road traffic on the Construction Haul Road that runs from the Facility to the Ports as depicted below:

Figure 4 Construction Haul Road

The Haul Road includes the following roads: Seymour Road, North Sound Road, Thomas Russel Avenue, Elgin Avenue, Goring Avenue and Harbour Drive. The BNL was predicted using noise emission rates in accordance with CRTN calculations using total flows, mean speed and %HGVs and can be found in Table 6 in Section 2.2 above.

The limits in Table 6 will be used in the significance assessment made against the short-term impact criteria from DMRB. Table 12 sets out the relevant impact assessment criteria, which will then be compared against Table 4 to determine the significance of the impact.

Table 12 Construction Traffic Short-Term Impact Assessment Criteria

EIA Magnitude of Change	Noise Change $L_{A10,18hr}$ (dB) Criteria	DMRB Short-Term Magnitude of Impact
Very High	N/A	N/A
High	5+	Major
Medium	3 – 4.9	Moderate

EIA Magnitude of Change	Noise Change $L_{A10,18hr}$ (dB) Criteria	DMRB Short-Term Magnitude of Impact
Low	1 – 2.9	Minor
Very Low	0.1 – 0.9	Negligible
No Change	0	No Change

2.5 Assessment Criteria for Construction Vibration

It is expected that during the construction phase there may be some items of plant that could give rise to significant levels of vibration due to activities such as piling if they occur close enough to the sensitive receptors. The assessment criteria given in Table 2.5 (below) has been adopted from Table B.1 of BS5228-2:2009+A1:2014 and should be used to assess the EIA magnitude of change.

Construction Vibration Short-Term Impact Assessment Criteria

EIA Magnitude of Change	Peak Particle Velocity, PPV (mm/s) Criteria
Very High	> 10 mm/s
High	Between 5 mm/s and 10 mm/s
Medium	Between 1 mm/s and 5 mm/s
Low	Between 0.3 mm/s and 1 mm/s
Very Low	< 0.3 mm/s

Per the ToR for this project an evaluation of vibration impacts was excluded due to the ISWMS site operations not having any significant vibratory potential. Additionally, GHD has screened out potential construction vibratory impacts from the worst-case construction equipment including the use of heavy vibratory equipment sources such as impact hammer pile driving. The assessment of vibration effects was made by using the empirical formulas in Table E.1 of BS5228-2:2009+A1:2014 and by referring to the historic data (or manufacturer's data, where available) within the same standard.

GHD evaluated all surrounding sensitive receptors and determined that all sensitive structures/locations are greater than 258 m away from the closest proposed construction activities. GHD determined that the worst-case construction vibration activities such as the use of heavy vibratory equipment sources (impact hammer pile driving) have a maximum zone of influence of 30 meters. Based on a significant buffer distance of 228 m from the zone of influence GHD has deemed construction vibration insignificant for all receptors noting an EIA magnitude of change of "very low" as the vibration impacts would be <0.3mm/s PPV below the Lowest Observed Adverse Effect Level (LOAEL). Based on this evaluation and the significant buffer distance further vibration assessment is not warranted for this EIA process.

3. Assessment Methodology

Available secondary sources of information were collected and reviewed to characterize the Noise existing conditions within the study areas. The following sources of secondary information were collected and reviewed:

- Review of historic complaints
- Review of current zoning plans, definitions and land use designations
- Aerial photographic mapping and field reconnaissance to confirm off-Site receptors
- ISWMS design and operation data and associated topography
- Cruise Berthing Terminal for Cayman Islands - Final EIA Terms of Reference (Mott MacDonald, 2013)

- Grand Cayman Waste Management Facility Draft Environmental Statement (Carddno ENTRIX, 2013)
- Integrated Solid Waste Management System for the Cayman Islands: Environmental Impact Assessment- Terms of Reference. (Wood, 2021)
- Directive for Environmental Impact Assessments Section 43, National Conservation Law (Extraordinary No. 50/2016)
- Proposed Cruise Berthing Facility, Grand Cayman. Environmental and Engineering Consultancy Services: Environmental Statement – Draft. (Baird, 2015)
- Environmental Impact Assessment Scoping Opinion (Environmental Assessment Board (EAB), (EAB, 2017)

The likely significant noise effects that have been taken forward for assessment are summarised in Table 13:

Table 13 Likely Significant Noise Effects

Activity	Effect	Receptor
Site Construction	Emission of noise causing effects on health and quality of life at sensitive receptors	Residential properties, schools, commercial sites
Site Operations	Emission of noise causing effects on health and quality of life at sensitive receptors	Residential properties, schools, commercial sites

In summary, the following general noise assessment methodology was followed:

- The assessment considers the baseline noise levels at existing sensitive receptors and the potential effect of the noise from activities associated with the ISWMS at each receptor.
- Unattended background noise monitoring was undertaken during the daytime and night-time periods at the locations which are representative of the existing sensitive receptors surrounding the site.
- The potential noise impact during the construction phase has been assessed against the BS5228-1 ABC method. The magnitude of any impacts will be established, and the significance of the construction noise impact will be determined.
- The potential noise levels from the ISWMS will be predicted using noise data provided by the Client. These noise emission levels will be used in noise modelling software CadnaA 2023 to create a noise model of the ISWMS and the surrounding area.
- The calculated noise levels will be compared against measured baseline noise levels and guidance contained within British Standard 4142 + A1:2019: Methods for rating and assessing industrial and commercial sound (BS4142).
- To reduce the potential impact of operational noise from the development on existing receptors, mitigation measures will be recommended as required.

3.1 Noise Modelling and Prediction Methodology

Through this assessment, the Project team has quantified the proposed noise levels in the Study Areas by using the appropriate CadnaA Acoustical Modelling Software (CadnaA) 2023 to model the potential impacts of the significant noise sources based on assumptions of typical equipment numbers and locations. CadnaA uses geographical information to generate a model of the study area to generate noise contours. The noise model includes all proposed site buildings and significant sources of noise associated with the operations of the facility. CadnaA calculates sound level emissions based on the ISO 9613-2 standard "Acoustics – Attenuation of Sound during Propagation Outdoors".

The worst-case cumulative site-wide sound levels estimated at the receptor(s) included attenuation effects due to geometric divergence, atmospheric attenuation, barriers/berms, ground absorption and directivity, as applicable significant noise sources at off-site buildings were input into the model as intervening structures.

CadnaA modelling assumptions applied include the following:

- Noise Sources | All sources were modelled using the 1/1 octave band data from manufacturer's sound level data or reference materials.
- Noise Source Elevation | The heights of the noise sources were modelled at the tallest point to represent the worst-case line of sight and emission of noise.
- Ground Absorption | The model included water (G=0), soft/porous ground (G=1), and gravel/hard ground (G=0.25).
- Receptor elevation | NSR heights were modelled appropriately to represent the worst-case elevation based on one or two-storey residences at the worst-case compass directions from the Site.
- Time-weighted Adjustment | Time-weighted adjustments for sources that do not operate continuously were utilized.
- Tonality | A +5 dBA adjustment was applied for tonal sources, if applicable.
- Building Surfaces | The buildings are modelled as reflective surfaces.
- Foliage | Foliage attenuation was not considered in our analysis as a conservative assumption.

Table14 outlines the acoustic modelling parameters used:

Table 14 Acoustic Modelling Parameters

Item	Model Parameters	Model Setting
1	Temperature	20°C
2	Relative humidity	70%
3	Wind speed	Downwind condition; wind speed of 3 m/s
4	Max. Search Radius (m)	2000 m
5	Noise propagation model	CadnaA (DataKustik 2023)
6	Standard	ISO 9613
7	Terrain parameters	Site Specific topography was used
8	Reflection parameters	1 order of reflection

In order to predict the future worst-case noise impacts from the Project activities, representative octave band noise data was used, measured from construction/processing equipment similar to what is noted to be required for the Project. This data was obtained from Annex C of the British Standard BS5228:2009+A1:2014 Code of Practice for noise and vibration control on construction and open sites – Part 1: Noise. The United States Department of Transportation, Federal Highway Administration (FHWA) document FHWA Roadway Construction Noise Model User's Guide, 2006 as well as GHD's own reference spectra were used as supplemental documents to obtain sound level data for equipment not listed by BS5228.

Site-specific topography was acquired from a photogrammetry survey completed by DECCO Consortium (DC) dated July 16, 2021 and various publicly available LIDAR and geospatial databases including USGS, CGIAR, NASA and NGA.

A 3D noise model was created in CadnaA with each significant noise source, vehicle path and operations building included. Noise prediction calculations have been undertaken to predict the noise levels likely to be generated by typical operational activities associated with the proposed ISWMS and the resultant noise levels at existing sensitive receptor locations.

The calculated noise levels have then been compared against measured background sound levels following the guidance in BS4142, and potential impacts evaluated. The magnitude of any impacts has been established, and the significance of the operational noise impact has been determined. In addition to the operational noise from the ISWMS, vehicle movements to and from the ISWMS Development have the potential to generate additional noise at existing sensitive receptors, in the immediate vicinity of the local road network. This potential noise impact has been considered against existing baseline noise levels and existing vehicle movements within the local area.

The worst-case assessment of all road traffic noise was predicted using noise emission rates from road traffic in accordance with CRTN calculations.

Vibration is not considered to be a significant effect during the operational phase of the proposed development and has been scoped out of the assessment. Mitigation measures would be incorporated within the design of the facility in order to reduce or remove any vibration that would result from operation of the site.

The prediction calculations have utilized noise measurement information provided by the Client. The potential sources of noise associated with the proposed ISWMS are detailed in Section 4 of this assessment. The calculations have been carried out in accordance with the prediction methodologies set out in BS5228-1 and BS4142. To reduce the potential impact of operational noise from the ISWMS on existing receptors, mitigation measures will be implemented into the design of the ISWMS. These measures are discussed in Section 4.1.

4. Noise Impact Assessment

This Section reports the likely effects of the Proposed Development in terms of noise impacts in the context of the Site and surrounding area, and whether these would be deemed to be significant. In particular it considers the likely effects of noise from the Proposed Development and its impact on nearby receptors.

4.1 Design Assumptions and Mitigation Summary

The following section details assumptions in the current design and operations of the ISWMS with the associated noise mitigation that was incorporated into the acoustical evaluation for future reference during detailed design of the Facility.

4.1.1 Energy Recovery Facility (ERF)

The ERF will be in the form of a conventional energy recovery facility, which will sustainably manage non-hazardous and non-recyclable residual waste. The ERF will operate 24 hours per day, 7 days per week, 365 days per year. Non-hazardous commercial, construction and industrial waste will be received on site at the ERF between the hours of 07:00 to 18:00 Monday to Friday and 07:00-12:00 on a Saturday.

The waste reception area has been designed to allow ease of access and the most efficient delivery of waste to the facility, which will see waste being delivered via a range of vehicles, including bulk articulated vehicles, refuse collection vehicles, compactors and skip tippers.

Fast acting roller shutter doors will allow multiple delivery vehicles to enter the tipping hall simultaneously. On entering the reception hall vehicles will discharge their payload directly into the waste bunker. Front end loaders will be employed to manage the incoming waste where it cannot be discharged directly into the waste bunker, for example where waste must be quarantined within the waste reception hall.

The fast-acting automatic doors for the tipping hall and roller shutter doors and are understood to provide 10 dB and 18 dB noise attenuation respectively. GHD has conservatively assumed that 50% of the bay doors will be open at any one time and have modelled the breakout emissions from the open doors only.

The design layout and design measures have been considered to minimize the noise impacts associated with the design of the Facility.

Most of the ‘noisy' plant items at the Facility will be installed within the main building and equipped with appropriate noise insulation, if necessary. The air-cooled condensers will be designed to reduce noise and tonal components. If steam bursting discs or pressure relief valves release externally to the building, they will be fitted with appropriate silencers. Doors to the building will be kept closed when not in use in order to prevent noise emissions, with doors to the tipping hall and turbine acoustically rated to appropriate levels.

Vehicle movements at night will be limited where possible and vehicles will be fitted with non-tonal reversing alarms. A one-way system will be in place for HGVs and waste delivery vehicles so they will only reverse once inside the tipping hall. Regular maintenance of plant items will be undertaken in accordance with preventative maintenance procedures.

Any mobile plant to be used on-site will be operated and maintained in accordance with the manufacturer's instructions, whilst complying with the latest standards including those on noise emissions.

There are many aspects associated with noise mitigation which need to be considered, including the following:

– General approach and experience of the Technology Provider
– Tonal noise
– Low frequency noise
– Noise associated with operational emergency steam relief and commissioning steam venting
– General design measures

Plant areas which contain higher than ambient noise sources (e.g., the Turbine Hall, Boiler and Flue Gas Treatment rooms) contain a significant number of individual items of process plant. Trying to abate noise from all of them independently is impracticable, and creates problems with temperature control, access for online operational maintenance, routine observation and ventilation requirements which further limits attenuation at source. Therefore, suitable and efficient layouts and design solutions will be employed, including acoustically designed plant rooms, which will limit noise emissions to the acceptable levels needed comply with all relevant regulations.

The following sub sections present details on noise mitigation measures proposed for the ERF Facility.

4.1.1.1 Principal Noise Sources with Specific Noise Mitigation Measures Incorporated into the Design

The principal operational noise sources from the ERF Facility that have noise mitigation included in the design are as follows:

– ERF Building Shell and Sidewall Air Intakes/Exhausts
– Main stack outlet
– ID Fan (enclosed)
– Turbine hall
– ERF waste reception area or ‘tipping hall'

The principal noise sources and mitigation measures assumed in the noise modelling for each of these areas are set out in the subsequent sections. As the design specification for internal and external plant has yet to be finalised, the noise assessment presented in this NVIA utilises operational noise impact information from a similar sized energy recovery facility in which GHD is familiar with. For the purposes of the assessment, it has been assumed that the majority of the identified sound sources would operate continuously and simultaneously, during both the daytime and night-time periods. However, at night it has been assumed that there would be no reception of waste, hence it has been assumed that there will be no on-site vehicle movements for the assessment of night-time operational sound.

The noise assessment concluded that, for the closest residential receptors, the operational noise impact from the Facility will result in a negligible impact. Therefore, no mitigation measures are proposed other than those already embedded within the design of the Facility. Specific design mitigation measures will be subject to detailed design of the Facility, but the following sections describe general measures and techniques.

4.1.1.2 ERF Building Shell and Penetrations

Noise source: ERF building Shell and Sidewall Air Intakes/Exhausts

Type: Daytime and night-time operation and general noise, no tonal or impulse noise emanating from the building enclosure. A sound power level of 90 dBA (~80 dBA at 1m) was assumed in the modelling for any sidewall air intake/exhaust louvres.

Noise mitigation: The proposed noise mitigation measures for the ERF building are subject to detailed design of the Facility. However, the mitigation measures are expected to include an enclosed building using with standard industrial cladding (walls and roof) with acoustic louvres to mitigate the risk of noise 'break-out' or ensure the noise output with ventilation fans that are <85 dBA at 1m. The roof and façades of the main buildings will be constructed from insulated composite profiled cladding with a sound reduction index (RW) of 24dB.

4.1.1.3 ERF Main Stack Outlet (and ID Fan)

Noise source: ID fan and Stack

Type: Day and night-time operation. General broadband noise – no tonal noise is anticipated, however other characteristic sound from the stack has the potential to be readily distinctive against residual sound levels at night. A sound power level of 104 dBA (93 dBA at 1m) was assumed in the modelling for both point sources representing the ID fan system and the exhaust point from the main stack.

Noise Mitigation: The proposed noise mitigation measures for the ID fan are subject to detailed design of the Facility. It is expected that the ID fan will be located outside the ERF building next to the base of the main stack. It is anticipated that the stack will be fitted with a dedicated silencer. The stack will be designed to ensure that the flue gas flow rate is approximately 15 m/s but always less than 30 m/s (beyond which, in some circumstances, there can be a 'whistle' from the top of the stack). The sound power rating of 104 dBA is expected to be achieved with standard fan systems however if this is not able to be achieved either an acoustical enclosure is required around the main fan with a in line silencer prior to the main stack is required or the selection of low noise equipment meeting this rating.

4.1.1.4 Turbine Hall

Noise source: Turbine Hall including generator within the hall.

Type: Day and night-time operation, potential tonal and general noise. Low frequency sound has been considered within the noise assessment and it was concluded that there will be no significant low frequency sound transmission through the building structure and that the proposed mitigation measures will provide the required level of attenuation for low frequency noise transmission. The following sound power levels were assumed in the modelling:

– Generator Enclosure Air Inlet with Silencer – 102 dBA
– Generator Enclosure Exhaust with Silencer – 102 dBA
– Turbine Combustion Air Inlet Stack with Silencer – 102 dBA
– Heat Recovery Steam Generator Stack with Silencer – 86 dBA
– Turbine Enclosure Exhaust with Silencer – 103 dBA

Noise mitigation: The proposed noise mitigation measures for the turbine hall are subject to detailed design of the Facility. However, the mitigation measures are expected to include constructing the turbine hall with materials which have sound reducing properties, such as concrete, or utilising acoustic cladding (walls and roof) to mitigate the risk of noise 'break-out'. Further noise mitigation measures for the turbine hall may include acoustic doors (providing noise attenuation) kept shut except during maintenance or emergency occurrences, the use of a turbine table with mounts to reduce vibration and the location of the turbine hall providing further noise screening. It is expected that each intake and exhaust stack associated with both the HRGS, Turbine and Generator systems are equipped with silencers to achieve the maximum noise ratings detailed above.

4.1.1.5 ERF Waste Reception Area/Tipping Hall

Noise source: Tipping Hall with mobile plant and HGVs operating inside.

Noise type: Potential intermittent impulse noise offloading during daytime only, reversing alarms. A sound power level of 90 dBA (~80 dBA at 1m) was assumed in the modelling for the waste reception area for the tipping hall open bay doors.

Noise mitigation: Enclosed building using industrial cladding (walls and roof) with acoustic louvres to mitigate the risk of noise 'break-out'. The roof and façades of the main buildings would be constructed from insulated composite profiled cladding with a sound reduction index (RW) of 24dB assumed within the noise assessment.

The fast-acting automatic doors for the tipping hall and roller shutter doors and are understood to provide 10 dB and 18 dB noise attenuation respectively. GHD has conservatively assumed that 50% of the bay doors will be open at any one time and have modelled the breakout emissions from the open doors only.

4.1.1.6 Noise Associated with Operational ERF Emergency Steam Relief and Commissioning Steam Purging

Steam purging (or "steam blowing") is a critical hot commissioning activity that occurs once in the lifetime of the plant following first energization of the plant and following chemical passivation of the boiler internals. Its purpose is to "shock" and remove all internal piping corrosion and scale deposits between the boiler and the steam turbine inlet. The steam purge is a cyclical process of pressuring the boiler at high temperature and pressure. The steam is released in an uncontrolled manner to "blow" through the piping and systems over many cycles. This process, after chemical passivation of the boiler internals, can take up to 2 weeks to complete and is concluded when an adequate steam quality free of particulate/scale is achieved. The residues within the boiler during construction would causes damage to the steam turbine internal blades if not removed prior to the steam being passed to the turbine for the first time during commissioning. This process is achieved using a temporary commissioning dedicated sacrificial pipework system and silencer that is specifically installed for this process. For the avoidance of doubt, it is not possible to undertake steam purging during normal operation of the plant.

The boiler will be designed strictly in accordance with the Pressure Systems Safety Regulations which require any pressurised system to be fitted with emergency pressure relief valves to prevent over pressurisation and an uncontrolled rupture of the boiler. Pressure relief systems and valves are utilised for emergencies only and are not used for normal operation and control of the boiler meaning their use is to prevent an uncontrolled event. During any normal operation of the plant the pressure relief valves will not need to operate. In an exceptional circumstance (i.e., equipment failure elsewhere within the plant) the control system may not be able to prevent an over pressurisation of the steam system and the last line of defence is the pressure release valves within the boiler which will lift and vent the system pressure. The pressure relief cycle, if initiated, will last for approximately 4-6 minutes when normal operating pressure limits within the boiler are returned to 'normal' levels and safe shut-down or ongoing operations can be maintained. The pressure relief system will be fitted with silencer(s) specifically designed to reduce noise from this abnormal event to approximately 50 dB at the boundary of the ERF plant. It is understood from previous experience that it is simply not feasible to reduce noise levels below this level given the nature and requirement for this system to be safely effective.

The pressure relief valves will be safety tested on a periodic basis. The frequency of testing will be determined by the Pressure Equipment Directive written scheme of examination, defined within the UK pressure systems regulations. The frequency of testing will be determined by the written scheme of examination. The frequency of testing is usually between 12-24 months.

Steam purging is a planned event that will occur only during commissioning. Testing of the safety relief valves again is a planned operational activity with a frequency driven by legislation. All of these events will be planned to occur during day-time hours.

If there is an exceptional circumstance operationally where the plant control systems and operators cannot rectify an exceptional event, then an unplanned pressure relief event would occur for 2-4 minutes thereby avoiding a significant incident and risk to personnel safety.

Taking this into consideration and in conclusion, following commencement of operation of the Facility, steam purging will not occur during operation of the Facility. If there is an over pressurisation and uncontrolled event within the pressurised boiler, the pressure relief valve system will function to release the pressure to safe levels within the boiler. If the cause of the over pressurisation has been understood, resolved and stable conditions resumed within the boiler then normal operation will resume. However, if the cause of the over-pressurisation is not resolved, the boiler will shut down safely to enable the issue to be investigated and resolved prior to restarting the plant.

4.1.2 Bottom Ash Handling Building (BAH)

Noise source: Bottom Ash Storage Bay Doors, Sidewall Louvres and Rubble Master

Type: Noise from conveyors generating low-level broad-spectrum noise levels which will not be tonal or impulsive (broadband only). A sound power level of 107.5 dBA was assumed in the modelling for the open bay doors and a sound power level of 112.4 dBA was used for the Rubble Master (mobile Crusher) located outside the building. A sound power level of 90 dBA (~80 dBA at 1m) was assumed in the modelling for any sidewall air intake/exhaust louvres.

Noise mitigation: Enclosed building using standard cladding (walls and roof) with acoustic louvres to mitigate the risk of noise ‘break-out'. The roof and façades of the main buildings would be constructed from insulated composite profiled cladding with a sound reduction index (RW) of 24dB assumed within the noise assessment. The sound power levels modelled for the Rubble Master are expected to be the maximum not to exceed values for this equipment/operation. Should this not be practical then lower noise equipment or on-site berms/barriers would be required to block noise emissions to the sensitive receptors to the west of the BAH facility.

4.1.3 Fire Pump Building (FPB)

Noise source: Fire Pump Building Ventilation Systems

Type: Noise from fire pump systems generating low-level broad-spectrum noise levels which will not be tonal or impulsive (broadband only). A sound power level of 97 dB was assumed in the modelling for the fire pump exhaust with a silencer and a sound power level of 92 dBA was used for the fire pump systems sidewall air intake with an acoustical louvre located on the side of the building.

Noise mitigation: Enclosed building using standard cladding (walls and roof) with acoustic louvres to mitigate the risk of noise ‘break-out'. The roof and façades of the main buildings would be constructed from insulated composite profiled cladding with a sound reduction index (RW) of 24dB assumed within the noise assessment. It is expected that each intake and exhaust stack associated with fire pump systems are equipped with silencers/acoustic louvres to achieve the maximum noise ratings detailed above.

4.1.4 Green Waste Facility (GWF)

Noise sources: Mobark 950 Tub Grinder, Komptech Shredder, Screener & Front-End Loader.

Type: Noise from grinding, screening and shredding systems generating low-level broad-spectrum noise levels which will not be tonal or impulsive (broadband only). A sound power level of 112 dBA was assumed in the modelling for the Screener and Shredder and 114 dBA for the Grinder based on each unit operating 30 minutes per hour during the day.

Noise mitigation: As these significant noise sources have line of sight and exposure to NSR3 and NSR5 GHD recommends re-orientating the GWF operations pad to use the proposed storage area concrete push walls (4.9m above grade) to block line of sight and noise emissions. Yellow lines represent the new location for the existing green push walls as detailed below:

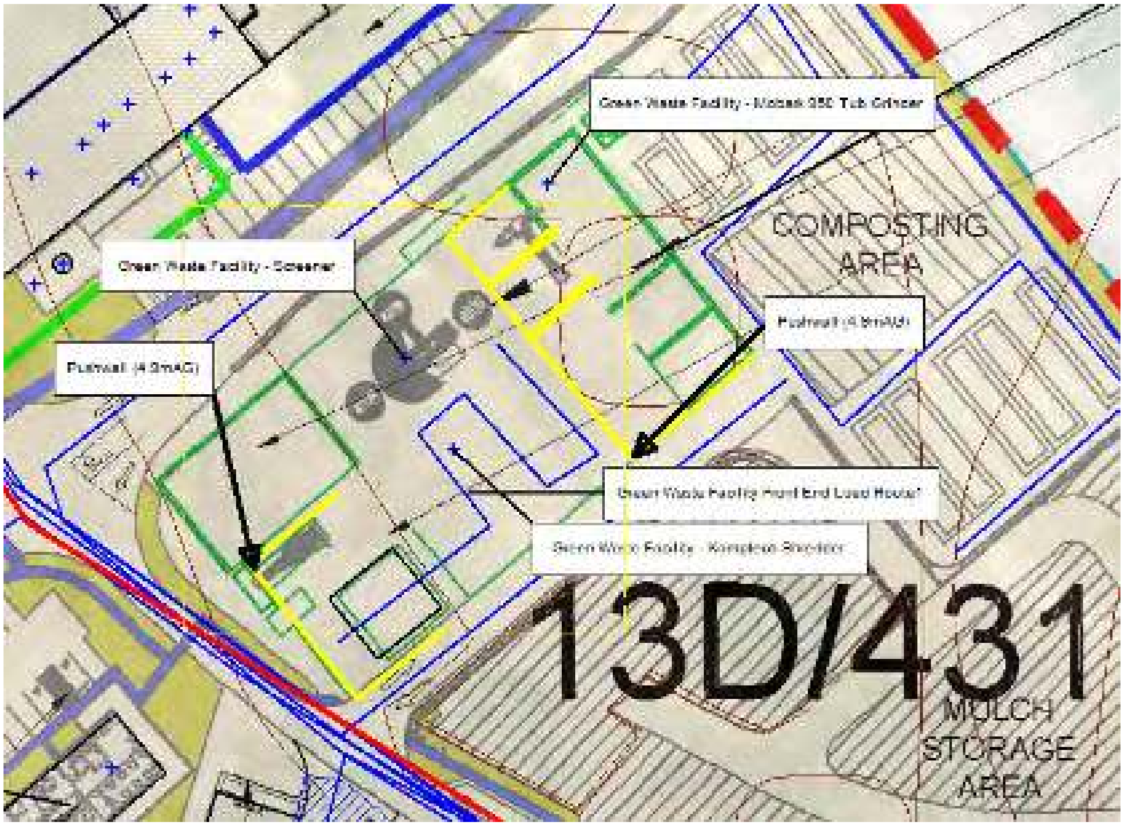


Figure 5 Proposed GWF Equipment/Pad Orientation

It is expected that this equipment and orientation of the operations pad are subject to change but these general recommendations on noise mitigation should be reviewed and re-evaluated during detailed design.

4.1.5 Materials Recycling Facility Building (MRF)

Noise source: MRF Building, Bay Doors and Glass roll off bin.

Type: Noise from inside the MRF building will be generating low-level broad-spectrum noise levels which will may be tonal or impulsive (broadband only). A sound power level of 107.5 dB was assumed in the modelling for the open bay doors and a sound power level of 117 dBA (including penalty adjustments) was used for the raw glass falling into Roll off Bin located outside the building which was assumed to operate 30 minutes out of each hour during the daytime only.

Noise mitigation: Enclosed building using standard cladding (walls and roof) with acoustic louvres to mitigate the risk of noise ‘break-out'. The roof and façades of the main buildings would be constructed from insulated composite profiled cladding with a sound reduction index (RW) of 24dB assumed within the noise assessment. The sound power levels modelled for the air intakes on the side of the building and glass roll off bin are expected to be the maximum not to exceed values for this equipment/operation. Should this not be practical then lower noise equipment would be required to block noise emissions to the sensitive receptors to the west and south of the MRF facility.

Additionally, a noise barrier is required to protect noise emissions toward the south by erecting a 4.9m tall, 6m long noise barrier (yellow line) at the position shown on the figure below to provide reduced line of sight and noise towards NSR3 to the southeast:

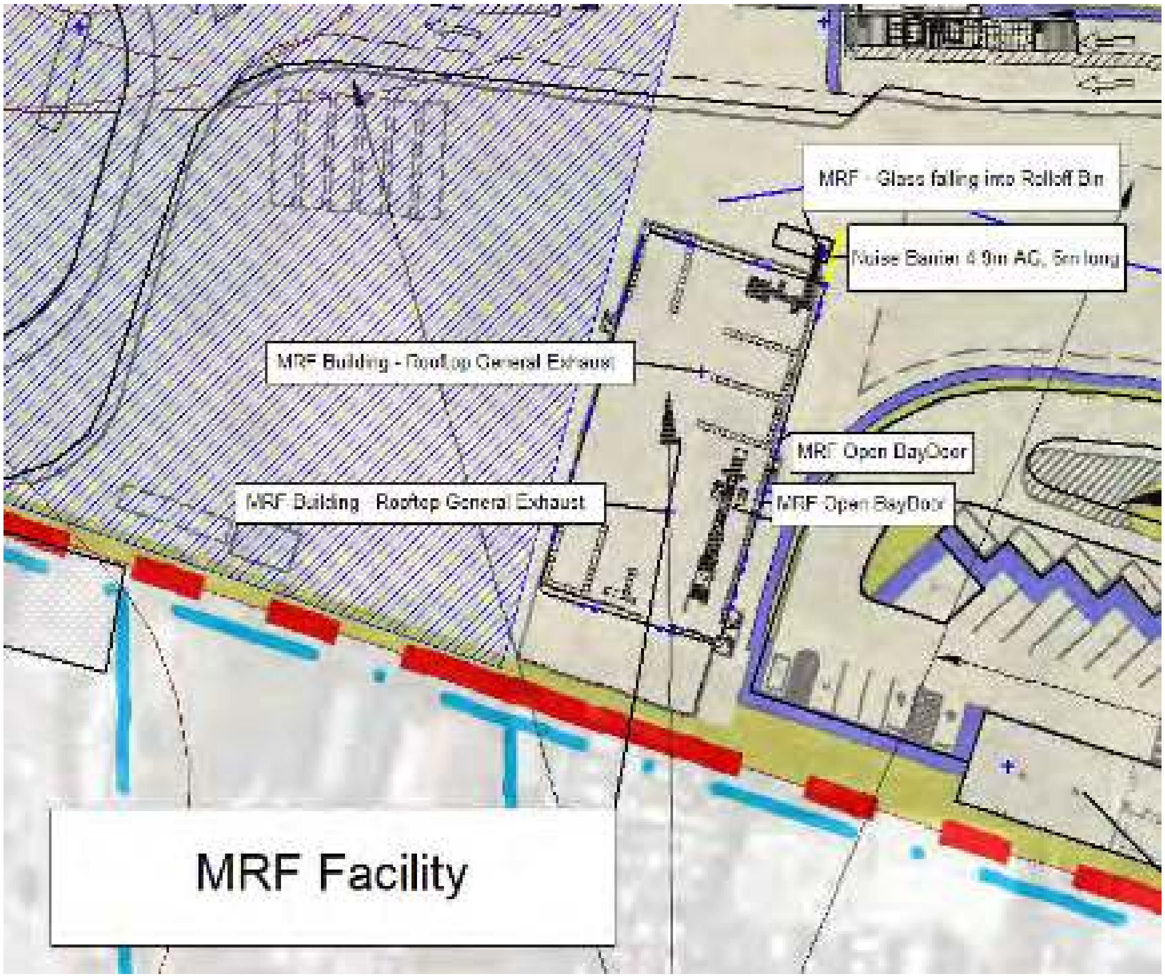


Figure 6 *Proposed MRF Noise Barrier Detail*

4.2 Noise Source Summary

The Applicant is proposing to construct and operate an ISWMS which will incorporate various on-site buildings, operations and energy from Waste systems in addition to the landfilling activities which each have the potential to cause an adverse noise impact at receptors.

This NVIA focuses on the sound emissions from the significant noise sources identified at the ISWMS with the potential to adversely impact the sensitive receptors. The significant noise sources are identified in the Noise Source Summary Table C.1 of Appendix C. The noise source locations are shown in in Figures A.1A – A.1G in Appendix A.

4.2.1 Sitewide Outdoor Truck and Heavy Equipment Volumes

Onsite outdoor truck and heavy equipment activities for operations as well as shipping/receiving loading is summarized in Table 15 below:

Table 15 Sitewide Outdoor Truck and Heavy Equipment Volumes

Type of Vehicle/Description	ISWMS Building/Area	Noise Source ID	Day (07:00 – 19:00) Vehicles / hour	Evening (19:00 – 23:00) Vehicles / hour	Night (23:00 – 07:00) Vehicles / hour
ERF- Inbound/Outbound Truck Route	ERF	ERF_TR1	5	0	0
Green Waste Facility Front End Load Route 1	GWF	GWF_Loader1	20	0	0
Green Waste Facility Front End Load Route 2	GWF	GWF_Loader2	20	0	0
Green Waste Facility - Inbound/Outbound Truck Route	GWF	GWF_TR1	1	0	0
MRF - Forklift Moving Bails Route1	MRF	MRF_Forklift1	10	0	0
ELV - Inbound/Outbound Truck Route	ELV	ELV_TR1	2	0	0
Maintenance Bldg. - Inbound/Outbound Truck Route	Maintenance	Main_TR1	1	0	0
C&D and BAF - Inbound/Outbound Truck Route	CD	CD_BAF_TR1	6	0	0
Medical Waste Bldg. - Inbound/Outbound Truck Route	MW	MW_TR1	1	0	0
Phase 2 Final Landfill Cell - Inbound/Outbound Truck Route	Phase 2 Landfill Cell	S_TR1	13	0	0
Household Waste Recycling Centre – Container Movements	Household Waste Recycling Center	HW_TR1	4	0	0

Note: Noise Source Vehicle routes are identified in Figure A.1D in Appendix A.

Vehicle deliveries and collections will also contribute to the noise climate. However, vehicle movements to and from the site are not considered to significantly impact on road traffic noise levels.

The significant equipment sources are all either trucking related activities, building penetrations, rooftop equipment or outdoor equipment located beside the buildings. Noise predictions are based on noise data provided by the Client as detailed in Section of this report for the various processes anticipated within the ISWMS buildings.

GHD determined that with standard industrial building construction that the building cladding would be an insignificant source of noise and were therefore not modelled in detail as they would provide a minimum sound insulation of 24 dB Rw resulting in minimal off-site impacts.

The existing buildings at the Site are made of standard industrial construction materials. The other noise sources at the Facility have not been included since they are considered insignificant contributors to the overall Facility noise level at the sensitive receptors which are expected to contribute less than 25 dBA at the worst-case receptor.

Some of the proposed ISWMS buildings do have significant interior noise sources resulting in breakout noise from passive sidewall air intake louvres, exhaust points and open bay doors which were modelled in detail.

Noise radiating through the passive louvres or bay doors were modelled as point sources or vertical area source. GHD expects that the Facility will provide GHD with updated equipment selections and specifications following final selection of any proposed equipment to confirm that the noise levels meet the maximum not to exceed noise criteria as specified in this NVIA by proper selection or equivalent noise mitigation measures.

A detailed summary of sound power levels in full octave band centre frequencies for the equipment is presented in Table C.1 of Appendix C.

Noise level checks may be carried out regularly in operational areas where high noise levels may be present, with early warning of increasing noise levels resulting in a noise reduction or mitigation program.

Each potential source of significant operational noise is identified below for each building/operational area:

4.2.2 Energy Recovery Facility (ERF)

The ERF area of the main building includes the following significant outdoor noise sources:

- 1 x Turbine Hall Generator Air Inlet Stack (103 dBA)
- 1 x Turbine Hall Generator Air Exhaust Stack (103 dBA)
- 1 x Turbine Hall Combustion Air Inlet Stack (103 dBA)
- 1 x Turbine Hall Heat Recovery Steam Generator Stack (86 dBA)
- 1 x Turbine Hall Turbine Enclosure Exhaust Stack (103 dBA)
- 1 x Turbine Hall After Cooler (96 dBA)
- 1 x Turbine Hall Oil Cooler (96 dBA)
- 1 x Air Cooled Condenser Unit (97 dBA)
- 14 x Air Sidewall Intake/Exhaust Louvres (96 dBA)
- 2 x Tipping Hall Bay Doors – Open (90 dBA)
- 1 x Silo Loading - Blower Truck (106 dBA)
- 2 x Compressor Intake Louvre (97 dBA)
- 2 x Compressor Exhaust Louvre (97 dBA)
- 2 x Rooftop General Exhaust Fans (85 dBA)
- 1 x Main Stack ID Fan (104 dBA)
- 1 x Main Stack Exhaust (104 dBA)

4.2.3 Site Weighbridges

The weighbridge area includes the following significant outdoor noise sources:

- 2 x Idling Trucks (96 dBA) – Day Only

4.2.4 Green Waste Processing Facility

The Green Waste Processing Facility includes the following significant outdoor noise sources:

- 1 x Komptech Shredder (112 dBA) – Day Only (30 mins/hr)
- 1 x Mobark 950 Tub Grinder (114 dBA) – Day Only (30 mins/hr)
- 1 x Screener (112 dBA) – Day Only (30 mins/hr)
- 1 x Front End Loader Route 1 on Shredder Pad (20 trips/hr) – Day Only
- 1 x Front End Loader Route 2 in Composting area (20 trips/hr) – Day Only

4.2.5 Construction and Demolition Waste Processing Facility

The Construction and Demolition Waste Processing Facility includes the following significant outdoor noise sources:

– 2 x Rooftop General Exhaust Fans (85 dBA)
– 2 x Bay Doors – Open (108 dBA) – Day only
– 4 x Sidewall Exhausts (85 dBA)
– 1 x Front End Loader Operating in Material Handling Area (104 dBA)
– C&D and BAF - Rubble Master (Mobile Crusher) (112 dBA) – Day Only (30 mins/hr)

4.2.6 Bottom Ash Processing Facility

The Bottom Ash Processing Facility includes the following significant outdoor noise sources:

– 2 x Rooftop General Exhaust Fans (85 dBA)
– 2 x Bay Doors – Open (108 dBA) – Day only
– 4 x Sidewall Air Intake Louvre (96 dBA)
– 1 x Front End Loader Operating in Material Handling Area (104 dBA)

4.2.7 Abandoned and End-of-Life / Scrap Metal Processing Facility

The Abandoned and End-of-Life / Scrap Metal Processing Facility includes the following significant outdoor noise sources:

– 2 x Rooftop General Exhaust Fans (85 dBA)
– 2 x Bay Doors – Open (98 dBA) – Day only
– 1 x Torch Cutting Area (100 dBA) – Day only
– 1 x Hydraulic Shear/Baler (107 dBA) – Day only
– 1 x Excavator w/ Grapple Moving Vehicles (100 dBA) – Day only
– 1 x Idling Truck (96 dBA) – Day Only
– 1 x Front End Loader Operating in Material Handling Area (104 dBA)

4.2.8 Medical Waste Facility

The Medical Waste Facility includes the following significant outdoor noise sources:

– 2 x Rooftop HVAC (86 dBA)

4.2.9 Materials Recycling Facility

The Materials Recycling Facility includes the following significant outdoor noise sources:

– 2 x Rooftop HVAC (86 dBA)
– 2 x Bay Doors – Open (98 dBA) – Day only

4.2.10 Household Waste Recycling Centre

The Household Waste Recycling Centre includes the following significant outdoor noise sources:

– 2 x Rooftop HVAC (86 dBA)

4.2.11 Landfill Gas Facility

The Landfill Gas Facility includes the following significant outdoor noise sources:

– 1 x Landfill Gas Flare System (95 dBA)

4.2.12 Admin Building

The Admin Building includes the following significant outdoor noise sources:

– 2 x Rooftop HVAC (86 dBA)

4.2.13 Maintenance Building

The Maintenance Building includes the following significant outdoor noise sources:

– 2 x Rooftop HVAC (86 dBA)
– 2 x Bay Doors – Open – Impact Guns, Air Compressors (112 dBA) – Day only

4.2.14 Future Phase 2 Residual Waste Landfill Operations

The Phase 2 Residual Waste Landfill Operations includes the following significant outdoor noise sources:

– 1 x Bulldozer (106 dBA) – Day only
– 1 x Landfill Compactor (103 dBA) – Day only
– 1 x Landfill Excavator Unloading Trucks (110 dBA) – Day only

4.2.15 Construction Noise Source Summary

Equipment and activities associated with Phases 1 to 3 for the construction of the ISWMS (Project) have the potential to produce noise emissions in the vicinity of the Project above the documented baseline limits. Changes to ambient noise levels and vibrations have the potential to impact existing sensitive receptors. The construction phase of any project is typically considered temporary or short-term relative to the entire life cycle of a project and mostly limited to daytime construction hours. It is anticipated that any construction or operational noise will be at or below the BS threshold limits at the worst-case receptor locations. Should levels above the threshold limits occur, noise mitigating controls will be considered.

The following section details an updated analysis, parameters or assumptions used in the noise evaluation of the construction noise analysis.

Noise Source Operating Parameters/Assumptions

In order to predict the future worst-case noise impacts from the Project activities, representative octave band noise data was used or measured from construction/processing equipment similar to what is noted to be required for the Project. This data was obtained from the tables in the annexes of BS 5228-1:2009+A1:2014. GHD's noise source library was used as a supplemental document to obtain sound level data for equipment not listed in the BS5228-1 Standard.

Annex F of BS5228-1 specifies in its calculation method that the sound power levels of equipment should be adjusted based on the expected percentage of time that the equipment will actually be operational and emitting significant noise. This was accomplished using the "Acoustical Usage Factors" obtained from the United States Department of Transportation, Federal Highway Administration (FHWA) document FHWA Roadway Construction Noise Model User's Guide, 2006. If an acoustical usage factor was not available, the default value of 50% is used.

The equipment to be used during each phase of construction is listed in the tables below, along with their sound power levels and acoustical usage factors.

Table 16 Estimated Sound Power Level and Equipment List for Each Phase of Construction

Equipment	Sound Power Level (dBA)	Acoustical Usage Factor	Phase 1 – Earthworks	Phase 2 – Piling / Concrete	Phase 3 – MEP / Paving
Angle Grinder	112	50%			4
Backhoe	98	40%	1		1
Bulldozer	106	40%	1		1
Concrete Saw	124	20%		5	2
Compactor	112	20%	1		
Concrete Mixer (Small)	93	50%		3	3
Concrete Mixer Truck	111	40%		8	
Concrete Pump (Truck)	111	20%		4	
Core Drill	116	50%		5	1
Crane (150 Ton)	109	16%	1	1	1
Crane (60 Ton)	108	16%	1	1	1
Crane (30 Ton)	101	16%	1	1	1
Dump Truck	116	40%	3	3	3
Drill Rig	105	20%	5	5	
Excavator	108	40%	1	1	1
Excavator (Mini)	99	40%		4	2
Skid Steer	110	40%	2		
Fuel Tanker Lorry	107	50%			2
Gas Cutter	96	40%		5	
Generator	105	50%	1	2	5
Grader	117	40%	1		
Loader	110	40%			4
Hammer Rig (Piling)	120	20%		4	
Paver	115	50%			2
Pneumatic Tool	117	50%			5
Poker Vibrator	110	50%		5	
Road Planer	113	50%			3
Road Planer (Mini)	98	50%			2
Roller	105	20%	1		2
Scissor Lift	98	50%			1
Telescopic Handler	110	50%			1
Water Pump	96	50%		1	1
Welder	105	40%		5	5
Wheel Wash Station	103	50%	1	1	1

There are no other significant noise generating activities or equipment.

Figures A.1E to A1.G have been created to show the noise source locations during each phase of construction. These figures can be found in Appendix A.

4.3 Assessment of Effects

4.3.1 Impact of the Operations Associated with the ISWMS

Noise modelling has been undertaken to predict the noise emissions from the ISWMS at receptors. The predicted noise levels of each process within the ISWMS buildings, operations and vehicle movements have been calculated to provide the total cumulative noise level at each receptor, during typical daytime and night-time periods.

The noise modelling considers that most onsite buildings and operations operate during the daytime only, landfill operates during the daytime and evening, and the ERF process equipment and main stack operates continuously.

The results of the modelling for the operation of the site wide ISWMS at each receptor are shown in Table 17:

Table 17 Predicted Noise Levels Generated by the Operations of the ISWMS at Sensitive Receptor Locations

NSR	Day (07:00 – 18:00) (dBA 1 hr L_{Aeq})	Evening (18:00 – 23:00) (dBA 1 hr L_{Aeq})	Night (23:00 – 07:00) (dBA 1 hr L_{Aeq})
NSR1 – Lakeside Development (7.5 metres above grade [m AG])	56	40	40
NSR2 – Residence on Parkside Cl. (4 m AG)	39	31	31
NSR3 – Residence on Seymour Rd. (1.5 m AG)	52	45	45
NSR4 – Cayman International School (4.5 m AG)	39	29	29
NSR5 – Residence on Woodlake Drive (1.5 m AG)	56	47	47
NSR6 - Proposed New Health City Camana Bay Medical Campus (7.5m AG)	42	35	35

4.3.2 Off-Site Vehicle Movements due to Operations of the ISWMS

There will be additional traffic movements as a result of the proposed ISWMS. Following a review of the information from the National Roads Authority of the Grand Cayman and traffic count data from APEC, the increase in traffic is understood to be approximately 2% on the sections of the Esterly Tibbetts Highway to the west. The increase in HGVs is understood to be around 3% on the section of the North Sound Road to the southwest of the ISWMS and up to 16% on the sections of the Seymour Road to the southeast of the ISWMS.

The Design Manual for Roads and Bridges (DMRB) Volume 11 Section 3 Part 7 HD 213/11 defines the threshold for determining whether a traffic noise assessment is required. If during the daytime and night-time period there is a permanent change in magnitude of 3 dB(A) in the long term (typically 15 years after project opening), then a detailed assessment is required. HD213/11 Chapter 3 Table 3.2 defines a change in noise of 3 dB(A) or less has a negligible impact in the long term. HD213/11 Annex 1 – Assessment Approach paragraph A1.8(ii) states that "a change in noise level of 3 dB(A) is equivalent to a 100% increase… in traffic flow".

Table 18 Operational Route Traffic Noise Change Due to Operations Traffic

Noise Sensitive Receptor	Existing 18 hr Operational Route Traffic Noise (dBA)	Operational 18 hr Haul Route Traffic Noise (dBA)	Change Due to Operation (dBA)	Long-Term Magnitude of Impact
Seymour Rd	65.4	67.9	2.5	Negligible
N Sound Rd. (West)	71.3	72.8	1.5	Negligible
N Sound Rd. (East)	70.6	72.4	1.8	Negligible
Thomas Russel Ave.	75.8	76.1	0.3	Negligible
Elgin Ave.	71.4	72.2	0.8	Negligible
Goring Ave.	71.4	72.2	0.8	Negligible
Harbour Dr.	74.0	74.4	0.4	Negligible
Esterly Tibbets Highway	76.7	77.0	0.3	Negligible

A 2 to 3% increase in traffic flow to the primary and secondary arterials around the site and 16% increase in traffic flow to the collector roads would cause a change of noise level approximately in the order of 3 dB(A) or less on the road network leading away from the site entrance. The impact of increased traffic can be considered to be negligible and has not been assessed further in the long-term.

4.3.3 Noise Impact Assessment - BS4142 Assessment

In accordance with BS4142, an industrial noise assessment has been carried out to assess the impact of sound from the proposed ISWMS on existing sensitive receptors.

4.3.3.1 Rating level

Acoustic Feature Correction

BS4142 includes guidance on the application of an additional weighting which should be applied to the specific sound level should the industrial noise be tonal, impulsive, or intermittent, as experienced at proposed receptors.

All proposed plants operations would run continuously during their periods of operations and therefore no penalty for impulsivity or intermittency has been applied. It is assumed all proposed plants within the ISWMS would be designed with mitigation, such that sound breakout would not be tonal at the existing sensitive receptors. Therefore, no correction has been applied to the specific sound level.

All HGV movements at the facility would be similar to road traffic on the Esterly Tibbetts Highway, which is the dominant noise source heard at all receptors. Therefore, no penalty has been applied to the specific sound level.

Selection of the Background Sound

Section 8 of BS4142 provides guidance on the selection of the background sound to be used in the assessment. BS4142 states that the background sound levels should be representative of the period being assessed (i.e., daytime or night-time periods), and that there is no "single" background sound level.

For the purpose of the assessment the range of background sound levels during the day and night-time periods, measured at monitoring locations 1-4, have been used. The data collected and presented within Section 1.5.3 of this Study details the representative $L_{A90,11hour}$ daytime, $L_{A90,5hour}$ evening and $L_{A90,8hour}$ night-time, background sound levels at existing sensitive receptors.

4.3.3.2 Comparison of the Background Sound and Rating Levels

Daytime Assessment

In accordance with BS4142, the rating level of industrial noise at the existing receptors has been compared with the representative background sound levels. HGV deliveries and most operations associated with the ISWMS will cease at approximately 18:00, therefore, a separate assessment has been undertaken for daytime (07:00 - 18:00) evening (18:00-23:00), and night-time (23:00-07:00). The results for each receptor location are shown in Table 19, Table 20 and Table 21 for the daytime, evening and night-time period respectively.

Table 19 Comparison of Rating Level and Background Sound Levels for Daytime Operations (07:00 and 18:00)

NSR	NSR1 – Lakeside Development	NSR2 – Residence on Parkside Cl	NSR3 – Residence on Seymour Rd.	NSR4 – Cayman International School	NSR5 – Residence on Woodlake Drive	NSR6 – Proposed New Health City Camana Bay Medical Campus
Modelled ISWMS Daytime Noise Level, 1-hour L_{Aeq} (dBA)	56	40	52	39	56	42
Acoustic Feature Correction	0	0	0	0	0	0
Calculated Rating Level (dBA)	56	40	52	39	56	42
Measured Background Sound Level at Each Receptor Location $LA90_{11\ hour}$ (dBA)	51-59	43-46	53-57	43-52	51-59	43-52
Lowest Excess of rating over Background level	-3	-6	-5	-13	-3	-10
Highest Excess of rating over Background level	5	-3	-1	-4	5	-1

Table 20 Comparison of Rating Level and Background Sound Levels for Evening Operations (18:00 and 23:00)

NSR	NSR1 – Lakeside Development	NSR2 – Residence on Parkside Cl	NSR3 – Residence on Seymour Rd.	NSR4 – Cayman International School	NSR5 – Residence on Woodlake Drive	NSR6 - Proposed New Health City Camana Bay Medical Campus
Modelled ISWMS Evening Noise Level, L_{Aeq} (dBA)	43	33	46	32	50	35
Acoustic Feature Correction	0	0	0	0	0	0
Calculated Rating Level (dBA)	43	33	46	32	50	35

NSR	NSR1 – Lakeside Development	NSR2 – Residence on Parkside Cl	NSR3 – Residence on Seymour Rd.	NSR4 – Cayman International School	NSR5 – Residenc e on Woodlake Drive	NSR6 - Proposed New Health City Camana Bay Medical Campus
Measured Background Sound Level at Each Receptor Location LA90 $_{5\ hour}$ (dBA)	49-54	40-43	52-54	42-45	49-54	42-45
Lowest Excess of rating over Background level	-11	-10	-8	-13	-4	-10
Highest Excess of rating over Background level	-6	-7	-6	-10	1	-7

Table 21 Comparison of Rating Level and Background Sound Levels for Night-time Operations (23:00 and 07:00)

NSR	NSR1 – Lakeside Development	NSR2 – Residence on Parkside Cl	NSR3 – Residence on Seymour Rd.	NSR4 – Cayman International School	NSR5 – Residence on Woodlake Drive	NSR6 - Proposed New Health City Camana Bay Medical Campus
Modelled ISWMS Night-Time Noise Level, L_{Aeq} (dBA)	43	33	46	32	50	35
Acoustic Feature Correction	0	0	0	0	0	0
Calculated Rating Level (dBA)	43	33	46	32	50	35
Measured Background Sound Level at Each Receptor Location LA90 $_{8\ hour}$ (dBA)	45 - 47	36-40	49-53	38-41	45 - 47	38-41
Lowest Excess of rating over Background level	-4	-7	-7	-9	3	-6
Highest Excess of rating over Background level	-2	-3	-3	-6	5	-3

The results in Table 19, Table 20 and Table 21 indicate that during the daytime, evening and night-time hours, the predicted rating level likely to be generated by the operations of the proposed ISWMS development will be below the highest existing background noise level at all existing sensitive receptor locations during all periods with the exception of NSR 5 (Woodlake Dr.). NSR5 may experience +3 dBA impacts over the highest background during the night.

Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context. However, during the quieter periods of the daytime, evening and night-time, the predicted rating level likely to be generated by the operations of the proposed development will be above the lowest background noise level at NSR1 and NSR5 during the day by +5 dBA. Additionally, NSR5 may have noise impacts above the lowest background noise level of + 1 dBA during the evening and by +5 dBA during night-time. In accordance with BS4142, a difference of around >5 dB is an indication of an adverse impact, and +10 dB is likely to be an indication of a significant adverse impact, depending on context.

In accordance with BS4142 an assessment of the context in which the industrial sound resides must be undertaken to determine the potential noise impact.

4.3.3.3 BS4142 Context Assessment

BS4142:2014 states "The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound sources exceeds the background sound level and the context in which the sound occurs".

The first requirement of this statement has been determined within the noise impact assessment section above. To determine the context in which the industrial sound will reside, three factors must be considered, these are:

– The absolute level of sound
– The character and level of the residual sound compared to the character and level of the specific sound
– The sensitivity of the receptor

Absolute Level of Sound

To determine the first context test in BS4142 it is necessary to determine whether the residual and background sound levels are high or low. Section 11 of BS4142 states:

> *"Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night.*
>
> *Where residual sound levels are very high, the residual sound might itself result in adverse impacts or significant adverse impacts, and the margin by which the rating level exceeds the background might simply be an indication of the extent to which the specific sound source is likely to make those impacts worse."*

As shown in Tables 19, 20 and 21 (Comparison of Rating Level and Background Sound Levels), the background sound levels and rating levels at each receptor are relatively high. Therefore, in accordance with BS4142, the absolute level is as, or more, relevant when establishing a potential impact.

In order to assess the proposed ISWMS in the context of its environment and that of each of the existing sensitive receptors, the predicted specific sound level from the ISWMS have been added to the measured average ambient noise levels to give the absolute level of noise at receptors with the ISWMS operating.

This future absolute noise level has been compared against the existing ambient noise level, and the predicted change in noise has been stated. The results for the NSR's for daytime, evening and night-time periods are detailed within Tables 22, 23 and 24 respectively.

Table 22 Context Assessment at Existing Sensitive Receptors for Daytime Operations of the ISWMS (07:00 and 18:00)

NSR	NSR1 – Lakeside Development (db $L_{Aeq\ 11hr}$)	NSR2 – Residence on Parkside Cl. (db $L_{Aeq11hr}$)	NSR3 – Residence on Seymour Rd. (db $L_{Aeq11hr}$)	NSR4 – Cayman International School (db $L_{Aeq11hr}$)	NSR5 – Residence on Woodlake Drive (db $L_{Aeq11hr}$)	NSR6 - Proposed New Health City Camana Bay Medical Campus
Average Measured Ambient Noise Level i.e. Existing sound level without the proposed ISWMS operations	63	56	66	61	63	61
Predicted Specific Noise i.e. Operational noise level of the ISWMS only	56	40	52	39	56	42
Total absolute level of sound i.e. Existing sound level plus ISWMS sound level	64	56	66	61	64	61
Difference between existing ambient sound levels and predicted future sound levels	1	0	0	0	1	0

Table 23 Context Assessment at Existing Sensitive Receptors for Evening Operations of the ISWMS (18:00 and 23:00)

NSR	NSR1 – Lakeside Development (db L_{Aeq5hr})	NSR2 – Residence on Parkside Cl. (db L_{Aeq5hr})	NSR3 – Residence on Seymour Rd. (db L_{Aeq5hr})	NSR4 – Cayman International School (db L_{Aeq5hr})	NSR5 – Residence on Woodlake Drive (db L_{Aeq5hr})	NSR6 - Proposed New Health City Camana Bay Medical Campus
Average Measured Ambient Noise Level i.e. Existing sound level without the proposed ISWMS operations	58	48	57	54	58	54

NSR	NSR1 – Lakeside Development (db L_{Aeq5hr})	NSR2 – Residence on Parkside Cl. (db L_{Aeq5hr})	NSR3 – Residence on Seymour Rd. (db L_{Aeq5hr})	NSR4 – Cayman International School (db L_{Aeq5hr})	NSR5 – Residence on Woodlake Drive (db L_{Aeq5hr})	NSR6 - Proposed New Health City Camana Bay Medical Campus
Predicted Specific Noise i.e. Operational noise level of the ISWMS only	41	31	45	30	48	35
Total absolute level of sound i.e. Existing sound level plus ISWMS sound level	58	48	57	54	58	54
Difference between existing ambient sound levels and predicted future sound levels	0	0	0	0	0	0

Table 24 Context Assessment at Existing Sensitive Receptors for Night-Time Operations of the ISWMS (23:00 and 07:00)

NSR	NSR1 – Lakeside Development (db L_{Aeq8hr})	NSR2 – Residence on Parkside Cl. (db L_{Aeq8hr})	NSR3 – Residence on Seymour Rd. (db L_{Aeq8hr})	NSR4 – Cayman International School (db L_{Aeq8hr})	NSR5 – Residence on Woodlake Drive (db L_{Aeq8hr})	NSR6 - Proposed New Health City Camana Bay Medical Campus
Average Measured Ambient Noise Level i.e. Existing sound level without the proposed ISWMS operations	58	44	57	51	58	51
Predicted Specific Noise i.e. Operational noise level of the ISWMS only	41	31	45	30	48	35
Total absolute level of sound i.e. Existing sound level plus ISWMS sound level	58	44	57	51	58	51

NSR	NSR1 – Lakeside Development (db L_{Aeq8hr})	NSR2 – Residence on Parkside Cl. (db L_{Aeq8hr})	NSR3 – Residence on Seymour Rd. (db L_{Aeq8hr})	NSR4 – Cayman International School (db L_{Aeq8hr})	NSR5 – Residence on Woodlake Drive (db L_{Aeq8hr})	NSR6 - Proposed New Health City Camana Bay Medical Campus
Difference between existing ambient sound levels and predicted future sound levels	0	0	0	0	0	0

The assessment of the absolute level of noise shows that the proposed ISWMS will not lead to any increase in the existing ambient noise levels at the nearby sensitive receptors during the daytime period with the exception of NSR1 and NSR5 which may experience up to +1 dBA when adding the ISWMS impacts to the existing background.

The assessment of the absolute level of noise shows that the proposed ISWMS will not lead to any increase in the existing ambient noise levels at the nearby sensitive receptors during the evening and night-time period.

A change in noise of up to 3 dBA is generally regarded as a negligible change and not perceivable by most people. Therefore, it is unlikely that this increase will be noticeable to residents. This is a positive indication that noise from the ISWMS will not be significant at the existing sensitive receptor locations.

Therefore, the potential noise impact of the ISWMS at NSRs is likely to be less than is suggested by Tables 19, 20 and 21 (Comparison of Rating Level and Background Sound Levels).

Character and Level of Residual and Specific Sound

The character of the residual sound, which contains mid frequency noise from road traffic and industrial noise from the existing industrial area to the south and Esterly Tibbetts Highway to the east means that the character of the specific sound of the proposed development will be very similar to existing conditions and in keeping with the immediate area.

The assessment shows that the average level of the residual sound and the calculated level of the specific sound are similar. In addition, they are both considered to be relatively high.

This is a positive indication that the noise impact from the proposed development would be less than is suggested by 19, 20 and 21 (Comparison of Rating Level and Background Sound Levels).

Sensitivity of Receptor and Existing Acoustic Conditions

With regard to pertinent factors to be taken into consideration, Section 11 of BS4142 states;

> *"The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as:*
>
> *i. façade insulation treatment;*
>
> *ii. ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation;*
>
> *iii. and acoustic screening."*

The proposed receptors will have moderate sensitivity given their residential nature, as in accordance with Table 3, except for NSR4 and NSR6 which are high sensitivity.

Additionally, there appears to be no screening or shielding effect of the proposed ISWMS for sensitive receptors at the residential locations.

Summary of BS4142 Context Assessment

The context assessment shows that the measured, existing ambient sound level is very similar to the predicted ambient sound level with the ISWMS in place and that the character of the specific sound is very similar to the residual sound in the surrounding area. It can be concluded that the effect of the proposed development is overstated slightly by the exceedance of the background noise levels by the specific noise from the proposed ISWMS.

In order to determine the significance of the noise levels with the proposed ISWMS in place, the absolute noise levels have been compared to guideline noise levels, as detailed in BS8233.

4.3.3.4 BS8233 Context Assessment

Based on site observations and local knowledge, some existing sensitive receptors appear to be naturally ventilated with no specific mitigation measures to control noise ingress from the surrounding area with the exception of the Cayman International School and the proposed New Health City Medical Campus which were assumed to be climate-controlled buildings with closed windows providing 23 dBA attenuation. For the purpose of the assessment, it was conservatively assumed that of the residential areas will have windows open and the attenuation provided by the façade will be approximately 13 dBA.

In order to assess the proposed ISWMS in the context of its environment and that of each of the existing sensitive receptors, a comparison of the absolute noise level and guideline noise levels has been undertaken, for both external and internal living areas, as shown in Table 25 and Table 26 below.

Table 25 Comparison of Absolute Noise Levels at Sensitive Receptor Locations and Guideline Noise Levels – External Areas

NSR	NSR1 – Lakeside Development Day (07:00 – 18:00) (dB $L_{aeq\ 11hr}$)	NSR2 – Residence on Parkside Cl. Day (07:00 – 18:00) (dB $L_{aeq11hr}$)	NSR3 – Residence on Seymour Rd. Day (07:00 – 18:00) (dB $L_{aeq11hr}$)	NSR4 – Cayman International School Day (07:00 – 18:00) (dB $L_{aeq11hr}$)	NSR5 – Residence on Woodlake Drive Day (07:00 – 18:00) (dB $L_{aeq11hr}$)	NSR6 - Proposed New Health City Camana Bay Medical Campus
Absolute Noise Level, Laeq (dB)	64	56	66	61	64	61
Attenuation, L_{aeq} (dB)	0	0	0	0	0	0
Desirable Noise Guideline Level stated in BS8233, L_{aeq} (dB)	50	50	50	50	50	50
Upper Noise Guideline Level stated in BS8233, L_{aeq} (dB)	55	55	55	55	55	55
Comparison between absolute level and desirable guideline level	14	6	16	11	14	11
Comparison between absolute level and upper guideline level	9	1	11	6	9	6

Table 26 Comparison of Absolute Noise Levels at Sensitive Receptor Locations and Guideline Noise Levels – Internal Areas

NSR	NSR1 – Lakeside Development			NSR2 – Residence on Parkside Cl.			NSR3 – Residence on Seymour Rd.			NSR4 – Cayman International School			NSR5 – Residence on Woodlake Drive			NSR6 – Proposed New Health City Camana Bay Medical Campus		
	D (07:00 - 18:00)	E (18:00 - 23:00)	N (23:00 - 07:00)	D (07:00 - 18:00)	E (18:00 - 23:00)	N (23:00 - 07:00)	D (07:00 - 18:00)	E (18:00 - 23:00)	N (23:00 - 07:00)	D (07:00 - 18:00)	E (18:00 - 23:00)	N (23:00 - 07:00)	D (07:00 - 18:00)	E (18:00 - 23:00)	N (23:00 - 07:00)	D (07:00 - 18:00)	E (18:00 - 23:00)	N (23:00 - 07:00)
Absolute Noise Level, Laeq (dB)	64	58	58	56	48	44	66	57	57	61	54	51	64	58	58	61	54	51
Façade Attenuation, Laeq (dB)	13									23			13			23		
Calculated Internal Noise Level, Laeq (dB)	51	45	45	43	35	31	53	44	44	38	31	28	51	45	45	38	31	28
Noise Guideline Level Stated in BS8233, Laeq (dB)	35		30	35		30	35		30	35		30	35		30	35		30
Comparison between calculated level and guideline level	16	10	15	8	0	1	18	9	14	3	-4	-2	16	10	15	3	-4	-2

Table 25 shows that during the daytime, in external areas, the absolute sound level would above the upper guideline noise level of 55 dB(A) and above the desirable noise guideline level of 50dB(A) at all NSRs. However, as shown in Table 22 (Context Assessment at Existing Sensitive Receptors), the measured ambient noise levels at all receptors are close to the same or less than the absolute level shown in Table 25 above. Therefore, the impact of the ISWMS is negligible.

Table 26 above shows that during the daytime, evening and night-time, with windows open, the absolute sound level would exceed internal noise guideline levels in living rooms and bedrooms of NSRs. However, as shown in Table 22 (Context Assessment at Existing Sensitive Receptors), the measured ambient noise levels at all receptors already exceed internal noise levels, without the proposed ISWMS in place, and therefore the impact of the ISWMS is negligible.

Taking this context into consideration, the impact at the NSR's during the daytime, evening and night-time is considered is likely to be significantly less than is suggested in Tables 19, 20 and 21 (Comparison of Rating Level and Background Sound Levels).

4.3.3.5 Summary of BS4142 Assessment

In summary, we have found that noise from the ISWMS, on occasions, would exceed the background sound level at receptors. However, both the background sound levels are low, and noise from the ISWMS will not significantly change the existing ambient sound levels at receptors. In addition, noise from the ISWMS is thought to be in keeping with the character of noise at the receptors. Ambient noise levels which include noise from the ISWMS, are significantly above the internal and external noise guideline levels stated in BS8233 when considering a conservative attenuation scenario of open windows.

Therefore, when considering the context of the sound from the ISWMS, the overall noise impact is considered to be low during the daytime and medium moderate during the quiet parts of the evening and night-time.

In any case, mitigation measures will be incorporated into the site design to reduce noise emissions where feasible and Best Available Technology (BAT) will be adopted, which will further reduce noise from the ISWMS at receptors.

The affected sensitive receptors are considered to be of medium and high sensitivity in accordance with Table 3. It is considered that the magnitude will be low in accordance with Table 2 as the activities will cause a change in the baseline environment and may cause an exceedance of guideline objectives. The impact is therefore considered to be moderate, however with mitigation measures in place the impact is seen as minor or negligible.

4.3.4 Construction Noise Assessment

It is expected that noise generated during the construction phase will propagate beyond the site boundary and be audible at the nearest NSRs.

The amount and types of equipment used in the construction of the ISWMS will change over the construction process, and so the profile of the noise propagating off-site will also change. In order to capture the changing noise profile, three evaluations were done at three different phases of construction, with different equipment being used in each evaluation, representing the worst-case months (most equipment) during the different phases:

1. Phase 1 – Earthworks
2. Phase 2 – Piling and Concrete Works
3. Phase 3 – MEP (Mechanical, Electrical, Plumbing), Paving, Completion of Concrete

Construction is planned to occur during daytime hours, with after-hours work reserved for limited, low-noise work. The equipment is classified as "stationary sources" of sound.

The worst-case assessment of steady-state noise sources at the selected points-of-reception was based on measured sound pressure levels. CadnaA Acoustical Modelling Software (CadnaA), version 2023, was used to model the potential impacts of the significant construction noise sources.

The magnitude of noise impacts associated with construction will be dependent upon a number of factors including:

– The intensity of construction activities
– The location of construction activities
– The type of equipment used
– Existing local noise sources
– Intervening terrain
– The prevailing weather conditions

The resulting noise levels at the NSRs and the corresponding impact during each phase are shown below:

Table 27 Resulting Noise Levels for Each Phase of Construction at Each NSR

Worst-case NSR	Phase 1 (Earthworks)		Phase 2 (Piling / Concrete)		Phase 3 (MEP / Paving)	
	Predicted Level (dBA)	Magnitude of Change	Predicted Level (dBA)	Magnitude of Change	Predicted Level (dBA)	Magnitude of Change
NSR1 – Lakeside Development (7.5 m AG)	51	Very Low	58	Low	59	Low
NSR2 – Residence on Parkside Cl. (4 m AG)	41	Very Low	49	Very Low	49	Very Low
NSR3 – Residence on Seymour Rd. (1.5 m AG)	48	Very Low	55	Very Low	56	Low
NSR4 – Cayman International School (4.5 m AG)	38	Very Low	46	Very Low	47	Very Low
NSR5 – Residence on Woodlake Drive (1.5 m AG)	55	Very Low	63	Low	63	Low
NSR6 – Hospital on Minerva Drive (7.5 m AG)	45	Very Low	54	Very Low	54	Very Low

The modelled noise impacts associated with each stage of construction meet the daytime threshold limit of 65/70 dBA $L_{eq,T}$ and in many instances will be much lower than that. Since the selected instances represent the worst case for each phase of construction, it can be considered that the magnitude of change at each NSR will be Low or Very Low throughout the entire construction process. At the high sensitivity receptors (NSR4 and NSR6), the magnitude of change is always Very Low.

The magnitude of impact at each NSR, according to Table 4, is therefore found to be Minor or Negligible, and thus considered Not Significant. In no scenario does the noise impact created by the construction site meet the threshold limit set out by the BS5228 ABC method.

Estimated Noise Contours for each construction phase can be found on Figures A.2C to A.2E in Appendix A.

4.3.5 Construction Traffic Noise Assessment

The worst-case assessment of construction traffic noise at the selected points-of-reception was based on the change sound pressure levels after adding the additional construction traffic.

The total number of increased trucks per hour includes a maximum of 3 dump trucks and 4 cement/concrete trucks for a total of 7 additional heavy trucks per hour. The predicted change in noise levels at the NSRs is as follows:

Table 28 Haul Route Traffic Noise Change Due to Construction Traffic - Day

Noise Sensitive Receptor	Existing 18 hr Daytime Haul Route Traffic Noise (dBA)	Construction 18 hr Haul Route Traffic Noise (dBA)	Change Due to Construction (dBA)	Magnitude of Impact
Seymour Rd	65.4	66.3	0.9	Negligible
N Sound Rd.	71.3	72.2	0.9	Negligible
Thomas Russel Ave.	75.8	75.9	0.1	Negligible
Elgin Ave.	71.4	71.6	0.2	Negligible
Goring Ave.	71.4	71.6	0.2	Negligible
Harbour Dr.	74.0	74.1	0.1	Negligible

Table 29 Haul Route Traffic Noise Change Due to Construction Traffic – Night

Noise Sensitive Receptor	Existing 6 hr Haul Route Traffic Noise (dBA)	Construction 6 hr Haul Route Traffic Noise (dBA)	Change Due to Construction (dBA)	Magnitude of Impact
Seymour Rd	58.2	61,1	2.9	Minor
N Sound Rd.	64.1	65.7	1.6	Minor
Thomas Russel Ave.	64.8	65.7	0.9	Negligible
Elgin Ave.	60.5	62.4	2.0	Minor
Goring Ave.	60.5	62.4	2.0	Minor
Harbour Dr.	63.5	64.6	1.1	Minor

As expected, Seymour Road was the most affected road. As traffic volumes on Seymour Road are the lowest compared to all other roads along the Haul route it is expected that the change in traffic noise due to construction will be Negligible or have No Change.

5. Noise Mitigation Measures

5.1 Noise from the ISWMS Operations

As part of the safe and on-going operation of the ISWMS, best available technology will be implemented. This will help to ensure that the noise impact of the operational activities of the proposed facility on existing receptors is further reduced.

Using best available technology, specific mitigation will be applied to the operating machinery within the internal areas of the ISWMS buildings. It is understood that these mitigation measures will be put in places to comply with worker hearing protection standards. Once implemented, these measures will ensure that the noise levels within the vicinity of the operational plant buildings associated with the ISWMS will be 80dB(A) or less. This will have a positive effect on the noise impact experienced at existing sensitive receptors and can be confirmed through compliance testing at existing sensitive receptors once the facility is in full operation.

Other mitigation measures outlined in the Environmental Statement will include the implementation of best working practice to ensure that the impact of the operational activities of the proposed facilities on existing receptors is minimised. These include:

– All plant and machinery will be regularly maintained to control noise emissions, with particular emphasis on lubrication of bearings and the integrity of silencers.
– Broadband reversing alarms will be chosen instead of tonal alarms.
– Site staff will be aware that they are working in the vicinity of residential properties and avoid all unnecessary noise due to misuse of tools and equipment, unnecessary shouting and radios. Noisy external activities such as cleaning and maintenance will be scheduled to avoid night-time working in the vicinity of sensitive receptors where possible.
– All works and ancillary operations that are audible at sensitive receptors outside the Site boundary shall be carried out only during hours of 8am till 6pm.
– All equipment and machinery in use shall be properly silenced where practicable and economic and maintained in accordance with the manufacturer's instructions.
– Any emergency deviation from these conditions shall be reported to the Contractor without delay.
– All vehicles to switch off engines upon arrival at site. The Site is to be a no-idling site.
– The majority of lorry movements will be carried out in forward gear in order to minimise noise associated with vehicle manoeuvring.

Noise management objectives will be established in accordance with the Environmental Management Plan as follows:

– 65 dB(A) at a distance of one meter from existing building facades
– 75 dB (A) at the site boundaries neighbouring roads and car parks
– 80 dB (A) at all other site boundaries

In addition, once haulage routes to and from the ports are determined for both the construction and operational phases, road traffic noise monitoring will be undertaken at agreed locations along the main route(s) to and from the facilities in accordance with the shortened method within the UK's CRTN "Calculation of Road Traffic Noise".

5.2 Noise from Construction Phase Activities

To minimise the potential levels of noise generated by the construction works, best working practice would be put in place where possible. The construction works will follow the guidelines in BS5228-1 and the guidance in BRE Controlling Particles, Vapour and Noise Pollution from Construction Sites, Parts 1 to 5, 2003.

The following measures will be put in place to minimise noise emissions:

– All plant and machinery will be regularly maintained to control noise emissions, with particular emphasis on lubrication of bearings and the integrity of silencers.
– Broadband reversing alarms will be chosen instead of tonal alarms.
– Site staff will be made aware that they are working adjacent to a residential area and avoid all unnecessary noise due to misuse of tools and equipment, unnecessary shouting and radios.
– A further measure to reduce noise levels at the sensitive receptors will include, as far as possible, the avoidance of two noisy operations occurring simultaneously in close proximity to the same sensitive receptor.
– Adherence to the restriction of operating hours.
– Ensure engines are turned off when possible.

- Should construction activities need to be carried out during night-time hours, this will be discussed with the local authority, which may include a planning condition which requests advance notice and details of any night working to provided.
- The majority of lorry movements will be carried out in forward gear in order to minimise noise associated with vehicle manoeuvring.

Construction management procedures will be used to minimise noise associated with construction activity. This is likely to include the application of techniques in accordance with BS 5228: 2009 (Code of practice for noise and vibration control on construction and open sites). Such measures will where necessary include:

- Use of mufflers or silencers on tools and plant.
- Where practicable and economic, electrically powered equipment will be used in preference to diesel or gasoline, as it is quieter.
- Low noise emissions and white noise reversing alarms on vehicles that are procured for the Works Period.
- Shut down (or throttle down) of machines in intermittent use in periods between work.
- Use of acoustic fencing or stockpiles for screening sound.
- Particularly noisy activities will be limited to certain periods of the day where appropriate.
- ReGen will keep neighbours informed regarding the work that is to be undertaken on site and the associated duration.
- Prior to commencement of particularly noisy operations, an environmental procedure detailing the method of works, program of work, predicted noise levels and manufacturers specifications for equipment and machinery will be submitted to the Contractor by the Construction Sub-Contractors for acceptance.
- Where practicable noisy equipment will be located away from sensitive noise boundaries.
- Loading and unloading of vehicles, dismantling of site equipment such as scaffolding or moving equipment or materials around site will be conducted in such a manner as to reduce noise generation and where practicable will be conducted away from noise sensitive areas.
- If elevated noise / vibration levels are encountered, the source of noise or vibration is to be identified and alternative methods or additional control measures are to be implemented.
- A maximum speed limit of 5 mph (8 kph) will apply on the site for the safety of the workforce and to minimize disturbance from noise and vibration in dusty areas. During regular operations on paved roads maximum operations a maximum speed limit of 13 mph (20kph) will apply.

5.3 Residual Effects

Given compliance with the above measures, in particular the proper maintenance of equipment and of the access road surface, there will not be any significant residual impact of noise on nearby existing sensitive receptors.

5.4 Inter-Related Effects

The NSRs most susceptible to inter-related effects involving noise are NSR1 (Lakeside Residential Development) and NSR5 (Woodside Drive/Glenwood Drive Residence), as these are the receptors most affected by noise during both the construction and operational phase. Residents at these receptors may experience a slightly higher background noise level for some hours of the day during both the construction and operational phases of the ISWMS (though the adverse effects have been determined to be not significant). However, these receptors are well outside of the potential zone of influence for vibration from the facility; the local roads connecting to these residences do not lie upon the operational and haul routes for the ISWMS, so they will not be significantly impacted by traffic changes; according to the Quantitative Air Quality Assessment, air quality effects were determined to be insignificant, and odour in the area is actually expected to improve due to diversion of waste from the landfill; and view of the IWSMS from these receptors will be obscured or blocked completely by trees and other buildings. Thus, it has been judged that these receptors will not experience any significant inter-related effects due to a combination of noise effects with other environmental impacts such as terms of vibration, traffic, air quality or visual amenity.

6. Conclusions

This NVIA describes an assessment of the potential noise impacts associated with the proposed ISWMS construction and operation.

The sound characteristics and existing ambient acoustical environment at the 4 different noise monitoring locations are characterized by road traffic noise attributed to the Esterly Tibbetts Highway, the Cayman's International Airport, local commercial/industry areas to the southeast and the natural environment. The baseline noise data collected is a good representation of typical existing sound characteristics around the ISWMS development.

GHD has measured the existing noise levels in the Study Area based on the baseline noise monitoring program described in this report. This assessment confirms that the sound levels in the Study Areas in close proximity of the Esterly Tibbetts Highway are generally high during the day and low at night, residential receptors close to commercial industries generally experience higher sound levels during the day and night, and in residential areas removed from road traffic and industry areas are generally lower, consistent with an urban area. These documented baseline sound levels were used for comparison to the predicted noise impacts during the construction and operation phases of the proposed ISWMS Project to determine the potential for noise impacts.

The potential noise impacts affecting existing sensitive receptors with regard to construction and operational activities associated with the facility have been considered, and have been assessed using appropriate guidance. A robust, ‘worst- case' scenario has been considered, with the ISWMS facility operating fully.

Where mitigation measures are required to control potential noise levels from the facility, details of such measures have been provided in outline terms.

6.1 Noise from the Proposed ISWMS Operations

Prediction calculations have been carried out to determine the noise levels likely to be generated by noise breaking out of the facility buildings, together with on-site vehicle movements, at each of the existing residential receptors. Noise levels have been predicted based on data provided by the technology providers, GHD's noise library for representative equipment and BS 5228-1.

Based on several assessments, in accordance with BS4142, it has been found that there is a potential for operational noise levels to exceed the lowest range of measured background levels during the daytime period at existing sensitive receptors located closest to the ISWMS. This is likely to be an indication of a medium/moderate magnitude of change (potentially significant) which may be an adverse impact (+5 dBA) depending on the context.

In accordance with BS4142, the context in which the sound resides must be considered as part of the assessment. As demonstrated in this assessment, when considering context, the noise impact at receptors will be significantly less and is not considered to be significant adverse due to the existing ambient environment with high existing average levels throughout the day without the ISWMS.

The impact is considered to be moderate, however with mitigation measures in place the impact is seen as low/minor in accordance with Table 7.

6.2 ISWMS Generated Road Traffic Noise

Access to the site is gained directly from the Seymour Road via the existing site access already used to route HGVs onto the local road network. It is considered that the additional HGVs will result in a negligible to minor short-term increase and a negligible long-term increase to road traffic noise levels at existing sensitive receptors. However, vehicle movements on the site have the potential to increase the ambient noise levels at existing receptors located in the immediate vicinity of the site. These movements have therefore been considered within the operational noise assessment.

The noise from additional HGVs is considered to be negligible and have a moderate or no impact in accordance with Table 4.

6.3 Noise and Vibration from Construction Phase Activities

During the construction phase, any work carried out at the proposed development may generate noise that may propagate beyond the proposed development boundary. However, the noise generated is predicted to be within the appropriate threshold limits set out by the BS5228 standard and thus noise from construction activities has a minor or negligible impact at all sensitive receptors, in accordance with Table 4.

To minimise the potential levels of noise generated by the construction works, best working practice will be put in place where possible. The construction works will follow the guidelines in BS5228-1 and the guidance in BRE Controlling particles, vapour and noise pollution from construction sites, Parts 1 to 5, 2003.

GHD has deemed construction vibration insignificant for all receptors noting an EIA magnitude of change of “very low” as the vibration impacts would be <0.3 mm/s PPV below the Lowest Observed Adverse Effect Level (LOAEL).

6.4 Noise from Construction Traffic

Construction traffic along the defined Haul Route which accesses the site from Seymour Road and ends at the port will result in a minor magnitude of impact for areas along Seymour Road and a negligible magnitude of impact along the rest of the Haul route during the daytime, and a minor magnitude of impact along most roads at night. The construction traffic will therefore have a non-significant impact overall in accordance with Table 4.

6.5 Mitigation Measures

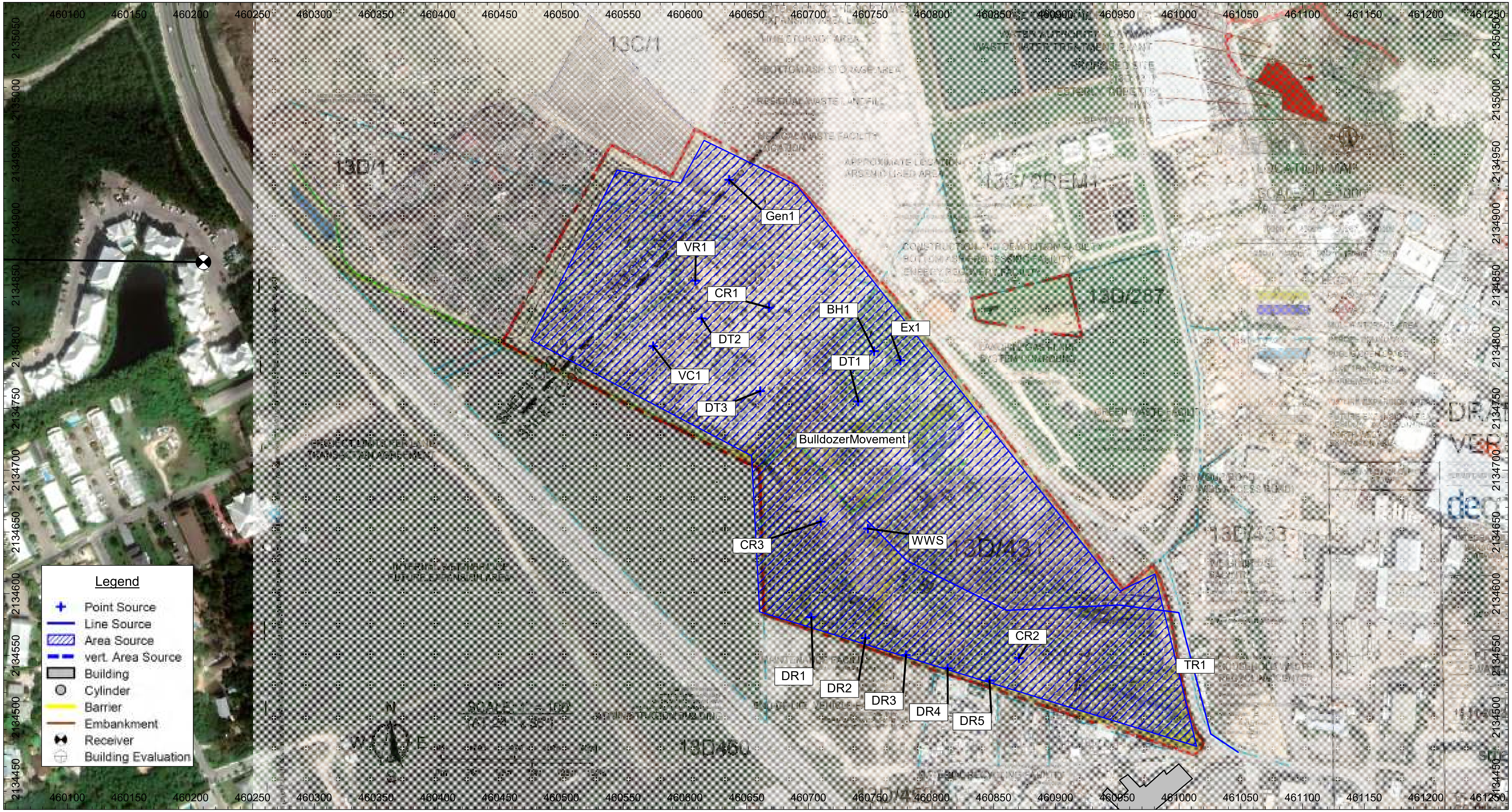
Mitigation measures have been presented within this NVIA to minimise noise emissions during construction phase activities.

During the operational phase of the development, best available technology will be used to reduce the potential impact of noise levels generated by the operational phase of the facility.

Appendices

Appendix A

Figures



Source: Google Satellite

N

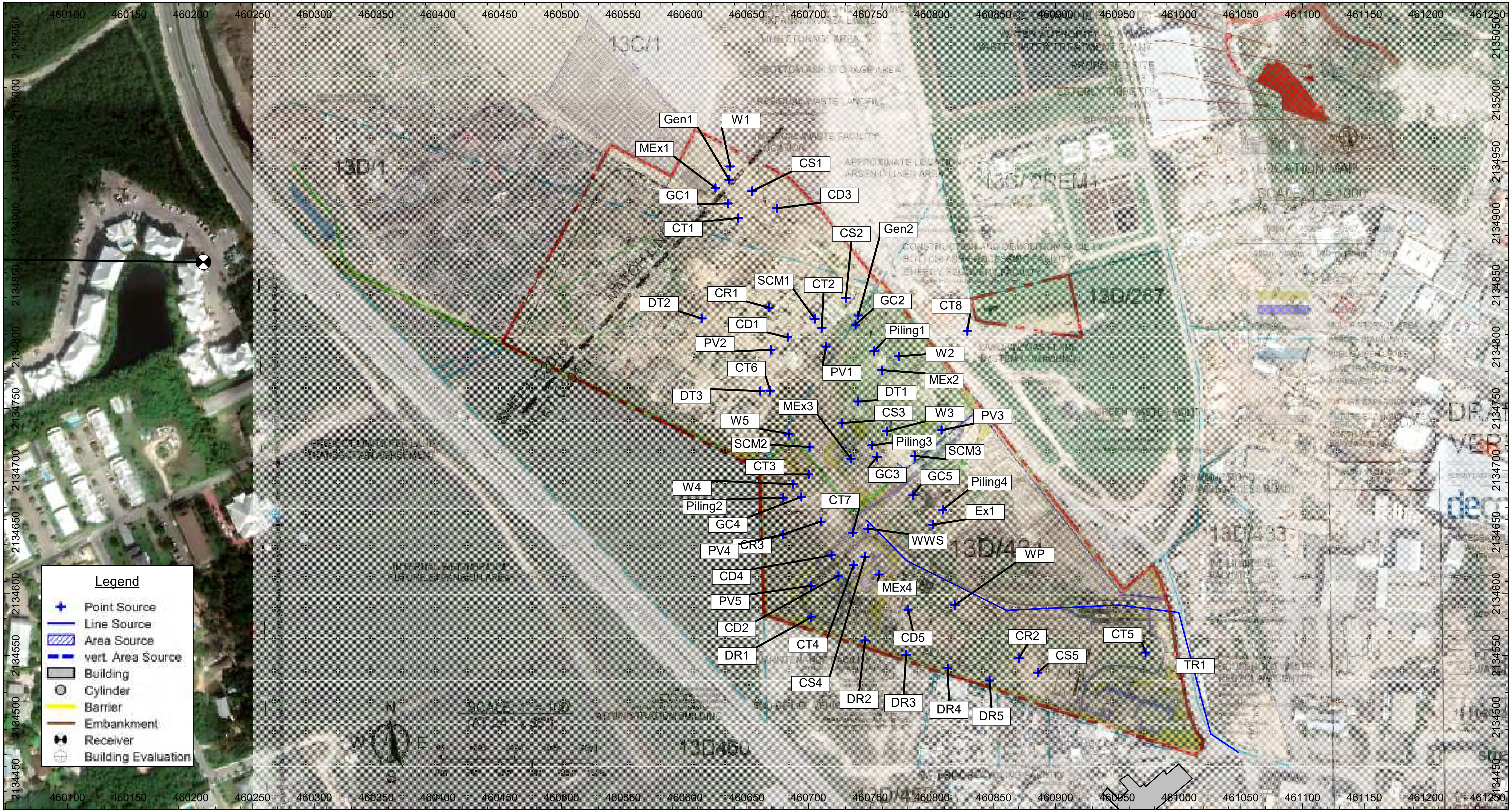
IWSMS NOISE AND VIBRATION ASSESSMENT
DART
GEORGE TOWN, CAYMAN ISLANDS

NOISE SOURCE LOCATION PLAN - CONSTRUCTION, PHASE 1

11201588
11.04.2023

FIGURE A.1A

CadnaA File: \\ghdnet\ghd\CA\Whitby\Projects\401\12563972\Tech\Noise Work\12563972_Master_Model.cna



Source: Google Satellite

N

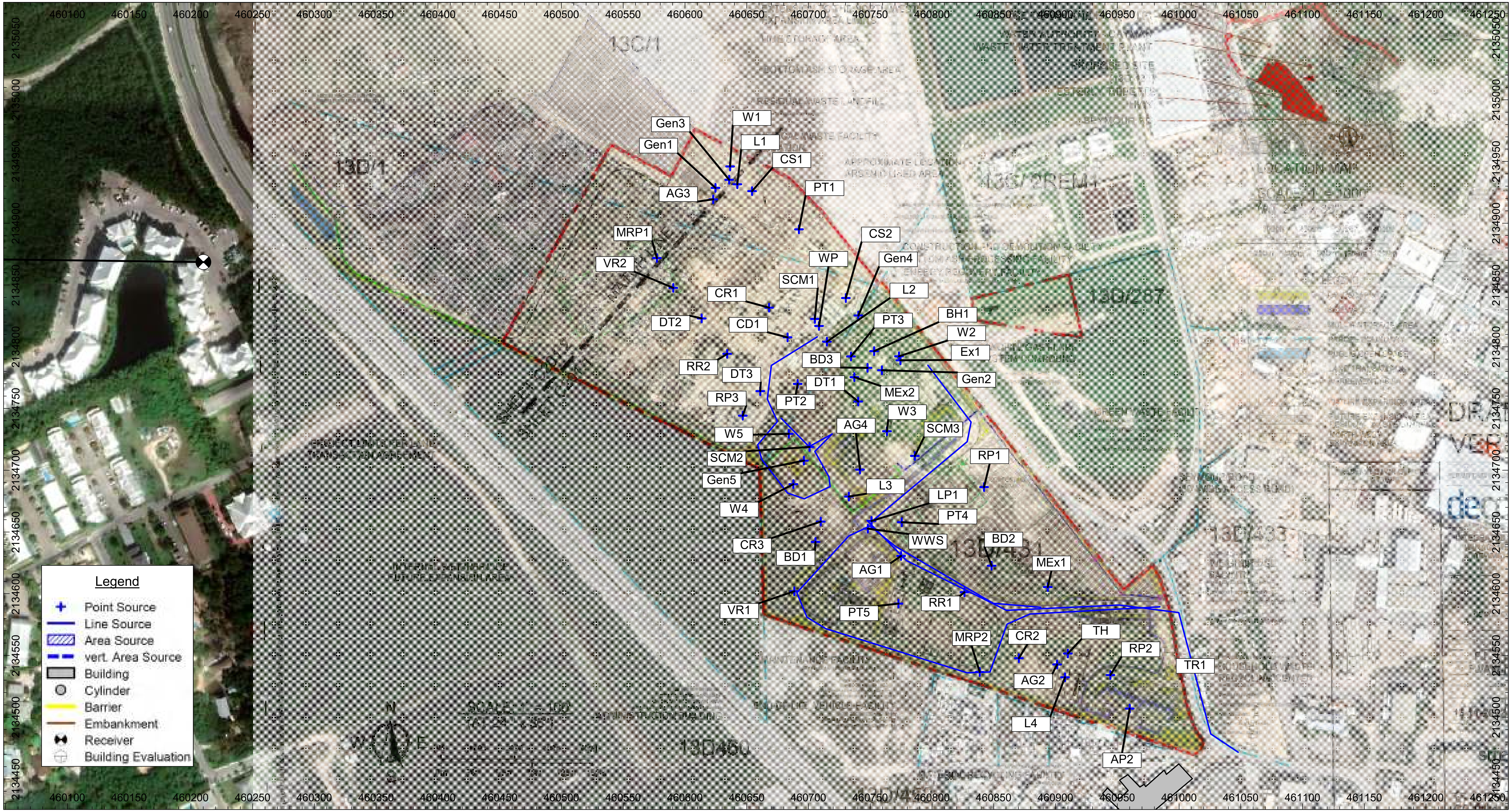
IWSMS NOISE AND VIBRATION ASSESSMENT
DART
GEORGE TOWN, CAYMAN ISLANDS

NOISE SOURCE LOCATION PLAN - CONSTRUCTION, PHASE 2

11201588
11.04.2023

FIGURE A.1B

CadnaA File: \\ghdnet\ghd\CA\Whitby\Projects\401\12563972\Tech\Noise Work\12563972_Master_Model.cna



Source: Google Satellite

N

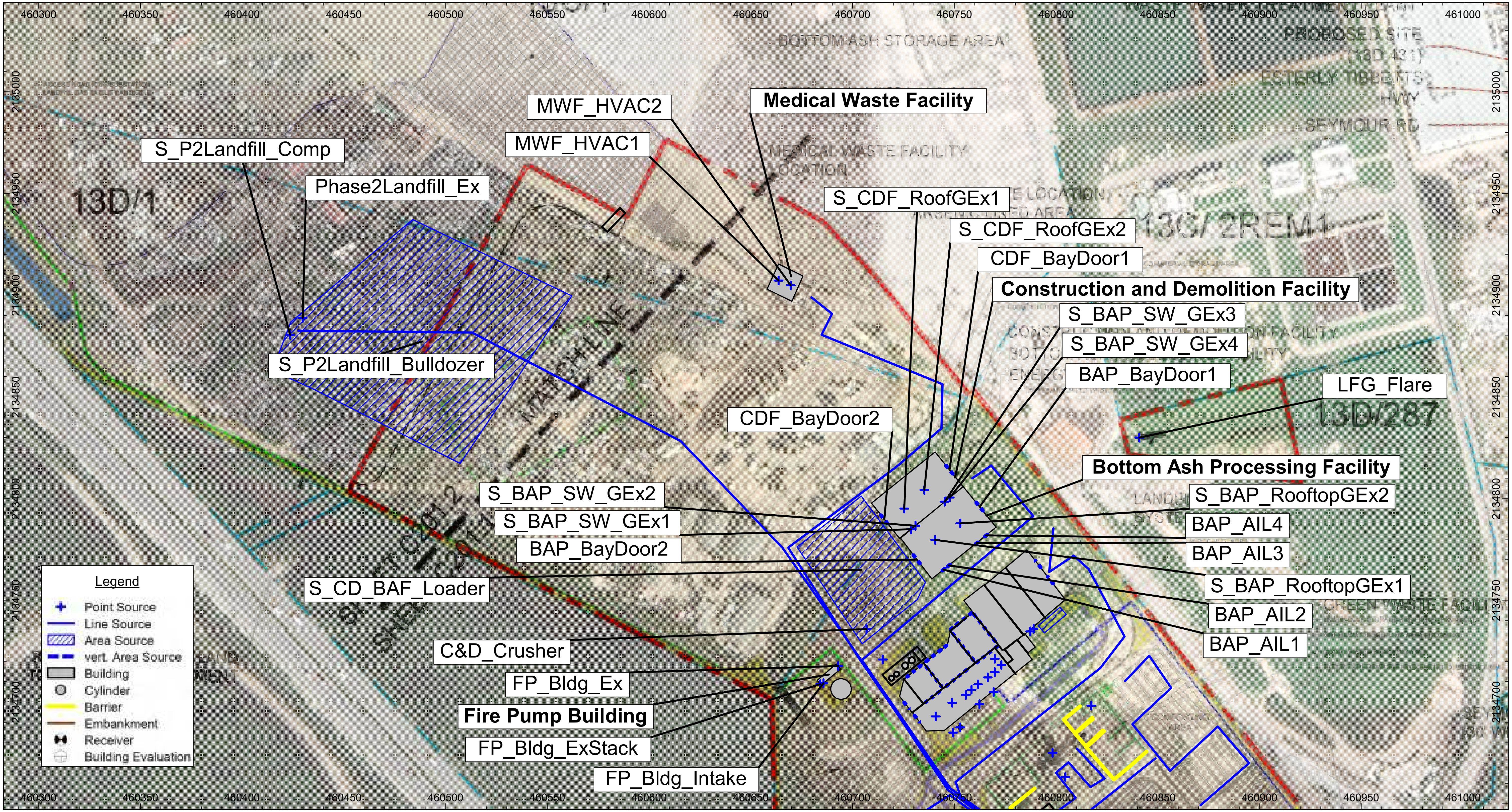
IWSMS NOISE AND VIBRATION ASSESSMENT
DART
GEORGE TOWN, CAYMAN ISLANDS

NOISE SOURCE LOCATION PLAN - CONSTRUCTION, PHASE 3

11201588
11.04.2023

FIGURE A.1C

CadnaA File: \\ghdnet\ghd\CA\Whitby\Projects\401\12563972\Tech\Noise Work\12563972_Master_Model.cna



Source: Google Satellite

N

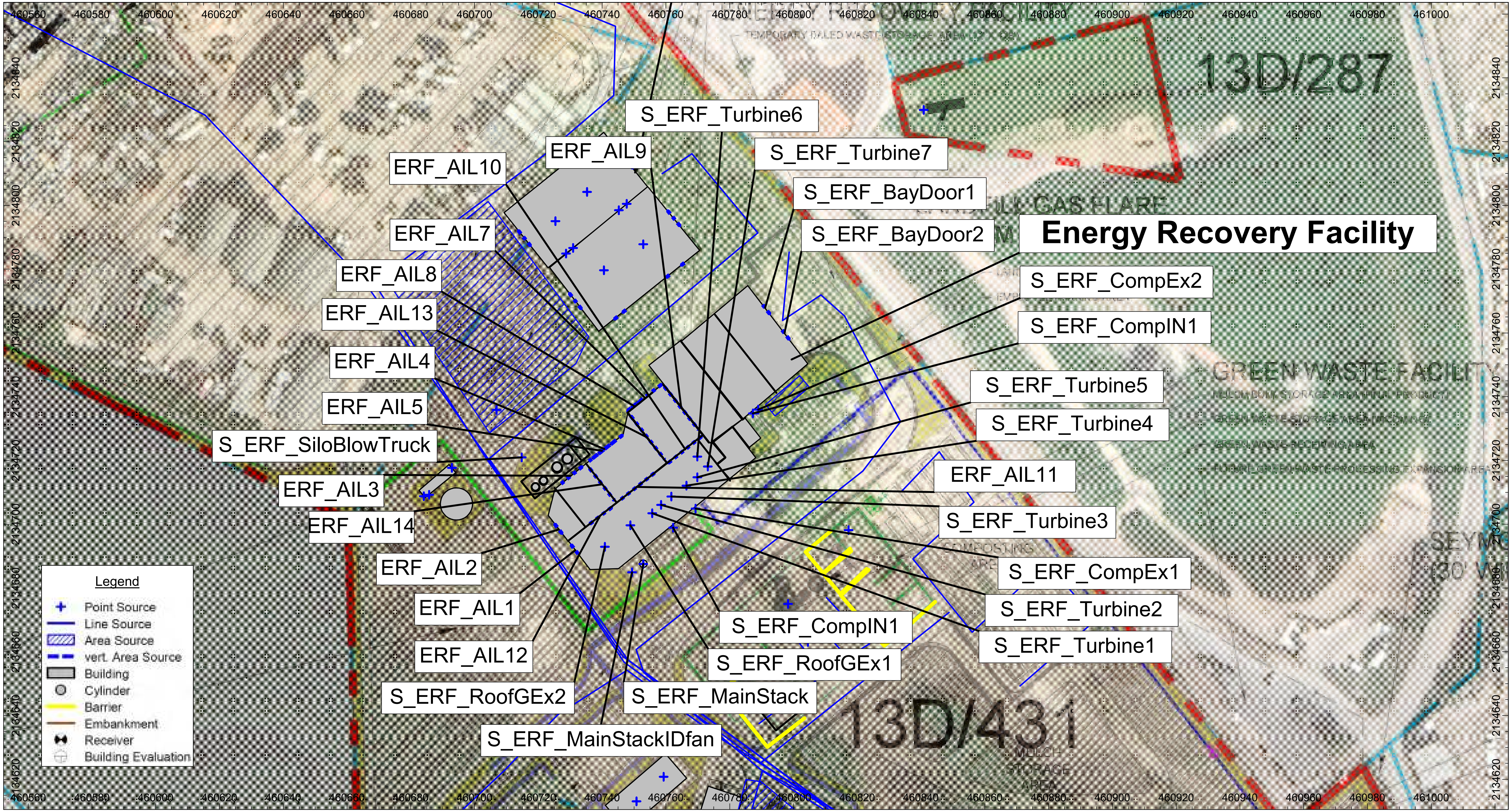
IWSMS NOISE AND VIBRATION ASSESSMENT
DART
GEORGE TOWN, CAYMAN ISLANDS

NOISE SOURCE LOCATION PLAN - OPERATIONS, WEST

11201588
21.03.2023

FIGURE A.1D

CadnaA File: C:\Users\sdiehl\Desktop\Projects\12563972 Cayman Islands\offline12563972_Master_Model.cna



Source: Google Satellite

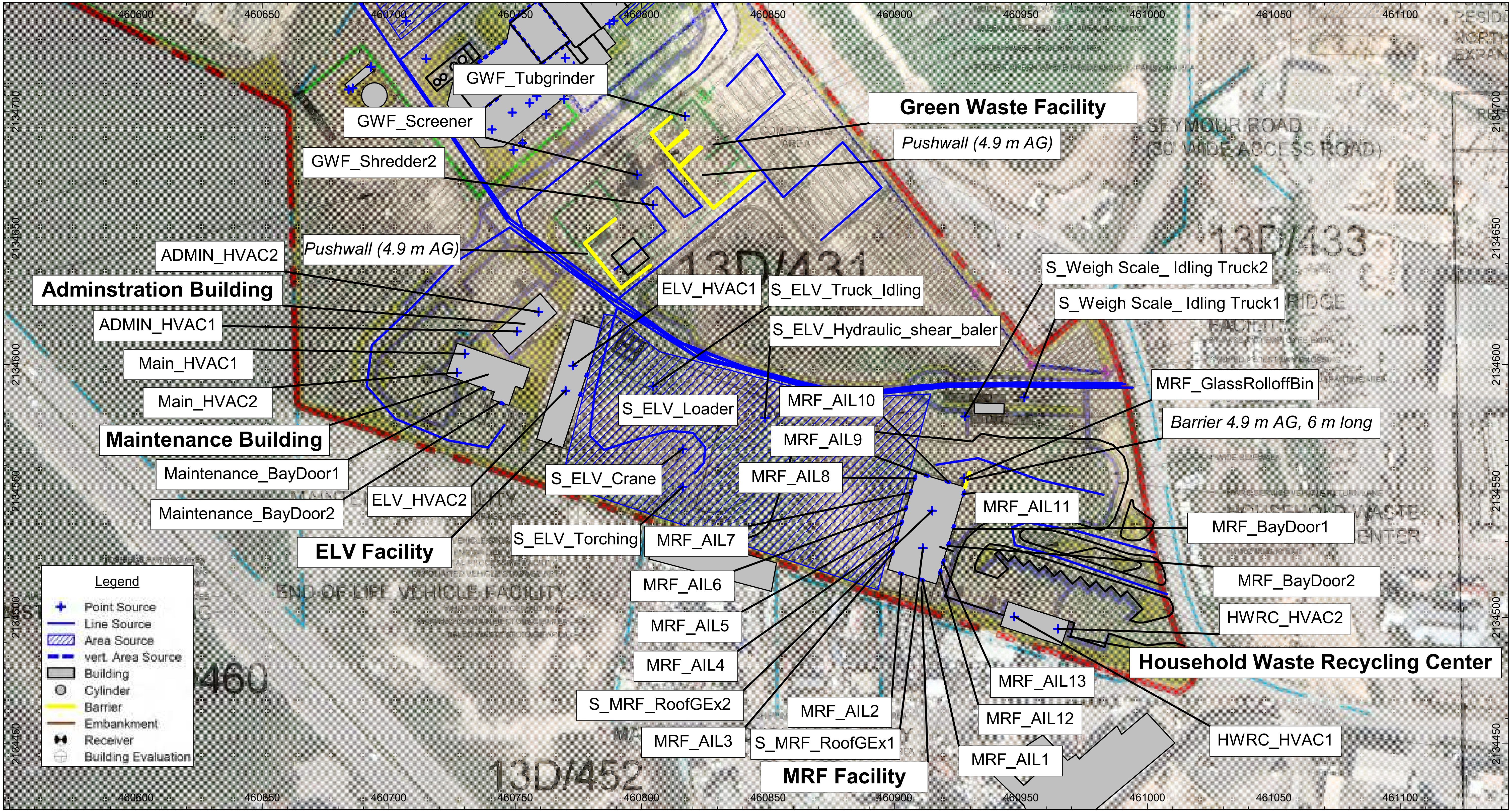
IWSMS NOISE AND VIBRATION ASSESSMENT
DART
GEORGE TOWN, CAYMAN ISLANDS

NOISE SOURCE LOCATION PLAN - OPERATIONS, ENERGY RECOVERY FACILITY

11201588
27.02.2023

FIGURE A.1E

CadnaA File: C:\Users\sdiehl\Desktop\Projects\12563972 Cayman Islands\12563972_Master_Model.cna



Source: Google Satellite

N

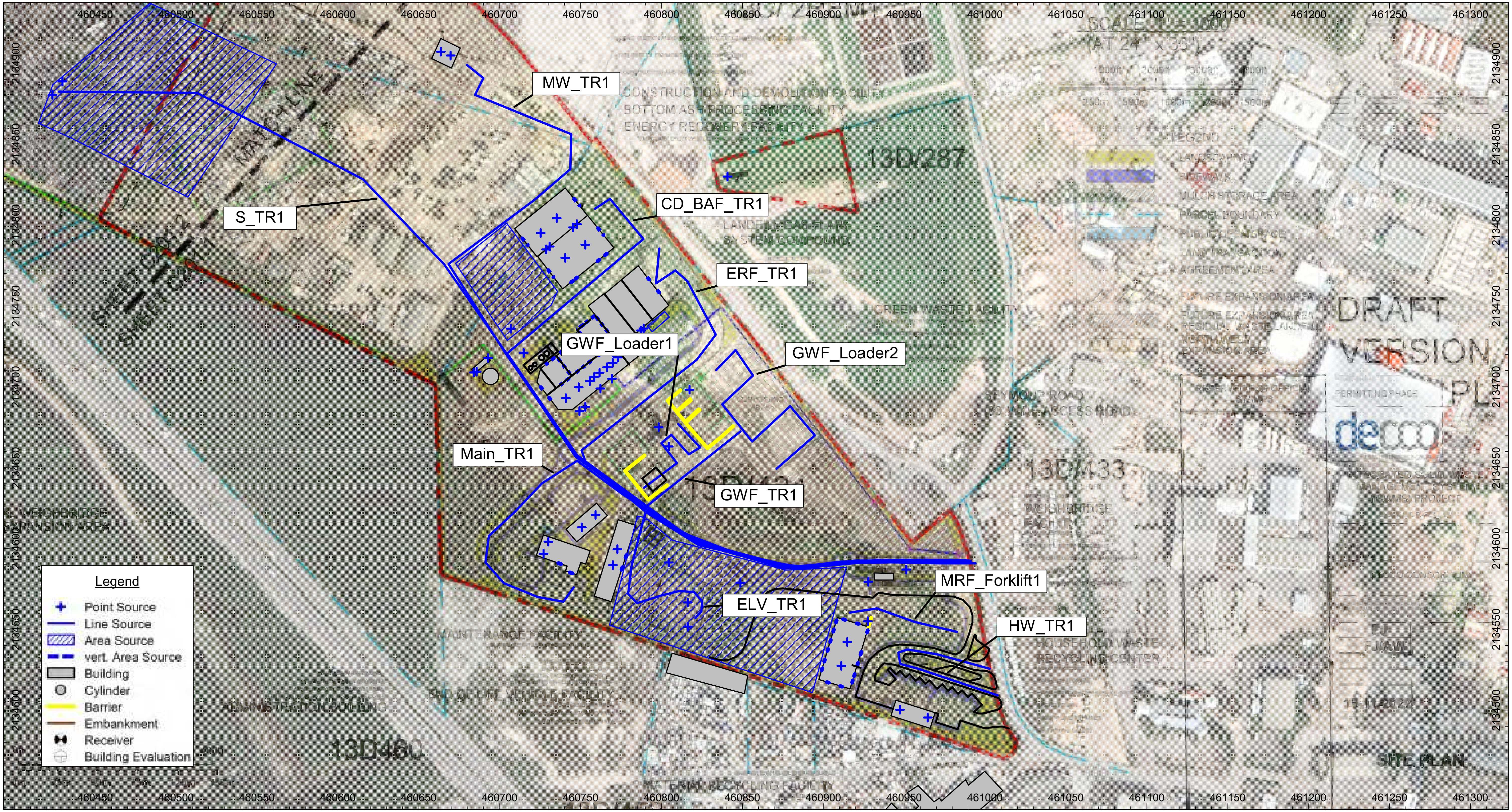
IWSMS NOISE AND VIBRATION ASSESSMENT
DART
GEORGE TOWN, CAYMAN ISLANDS

NOISE SOURCE LOCATION PLAN - OPERATIONS, EAST

11201588
19.05.2023

FIGURE A.1F

CadnaA File: \\ghdnet\ghd\CA\Whitby\Projects\401\12563972\Tech\Noise Work\12563972_Master_Model.cna



Source: Google Satellite

N

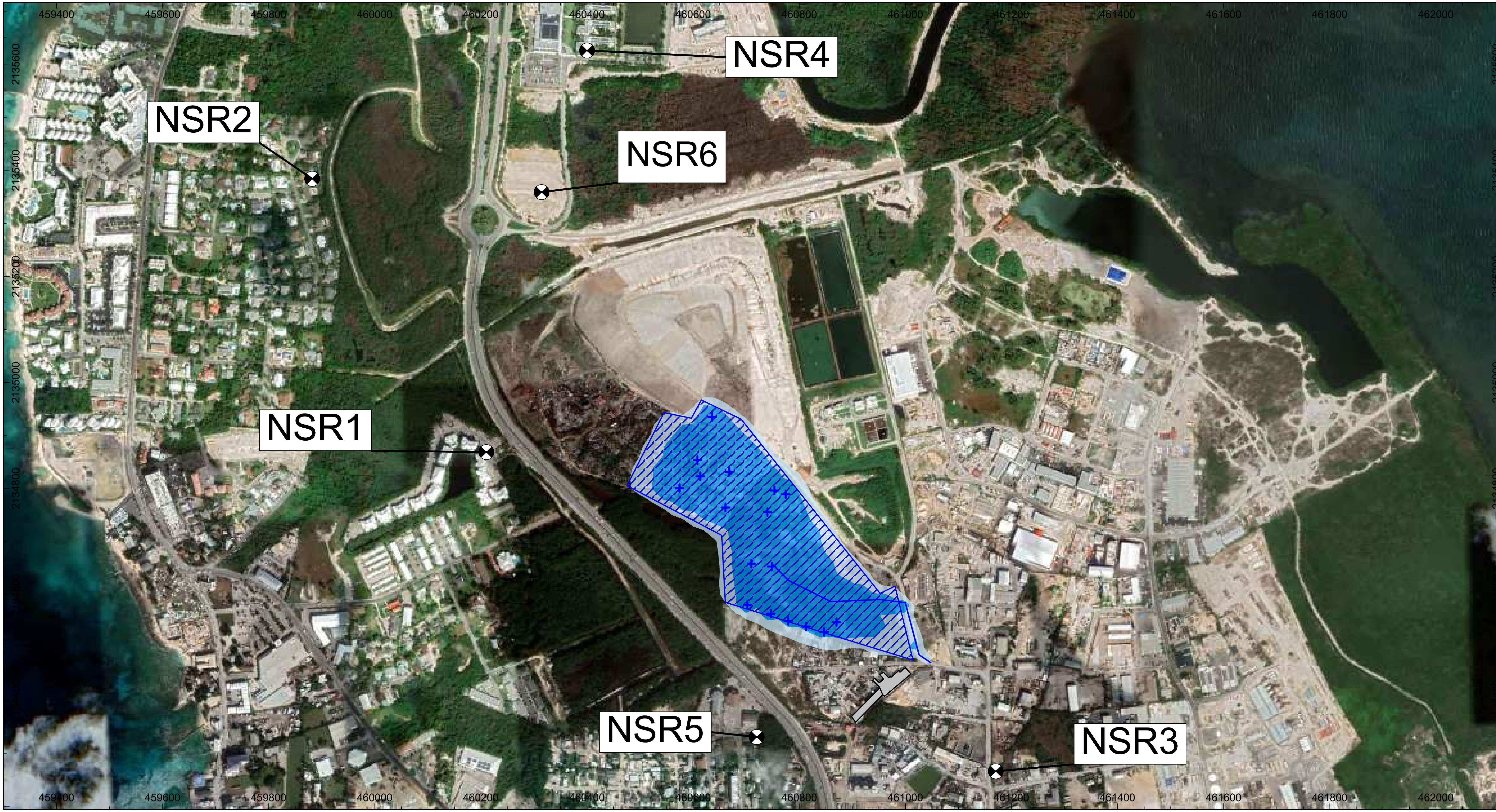
IWSMS NOISE AND VIBRATION ASSESSMENT
DART
GEORGE TOWN, CAYMAN ISLANDS

NOISE SOURCE LOCATION PLAN - OPERATIONS, VEHICLE ROUTES

11201588
19.05.2023

FIGURE A.1G

CadnaA File: \\ghdnet\ghd\CA\Whitby\Projects\401\12563972\Tech\Noise Work\12563972_Master_Model.cna



Source: Google Satellite

N

Legend

> 65 dBA
> 70 dBA

Notes:
Noise level contours presented above represent A-weighted 1-hour equivalent sound levels calculated at a grid height of 1.5 metres above grade.

GHD

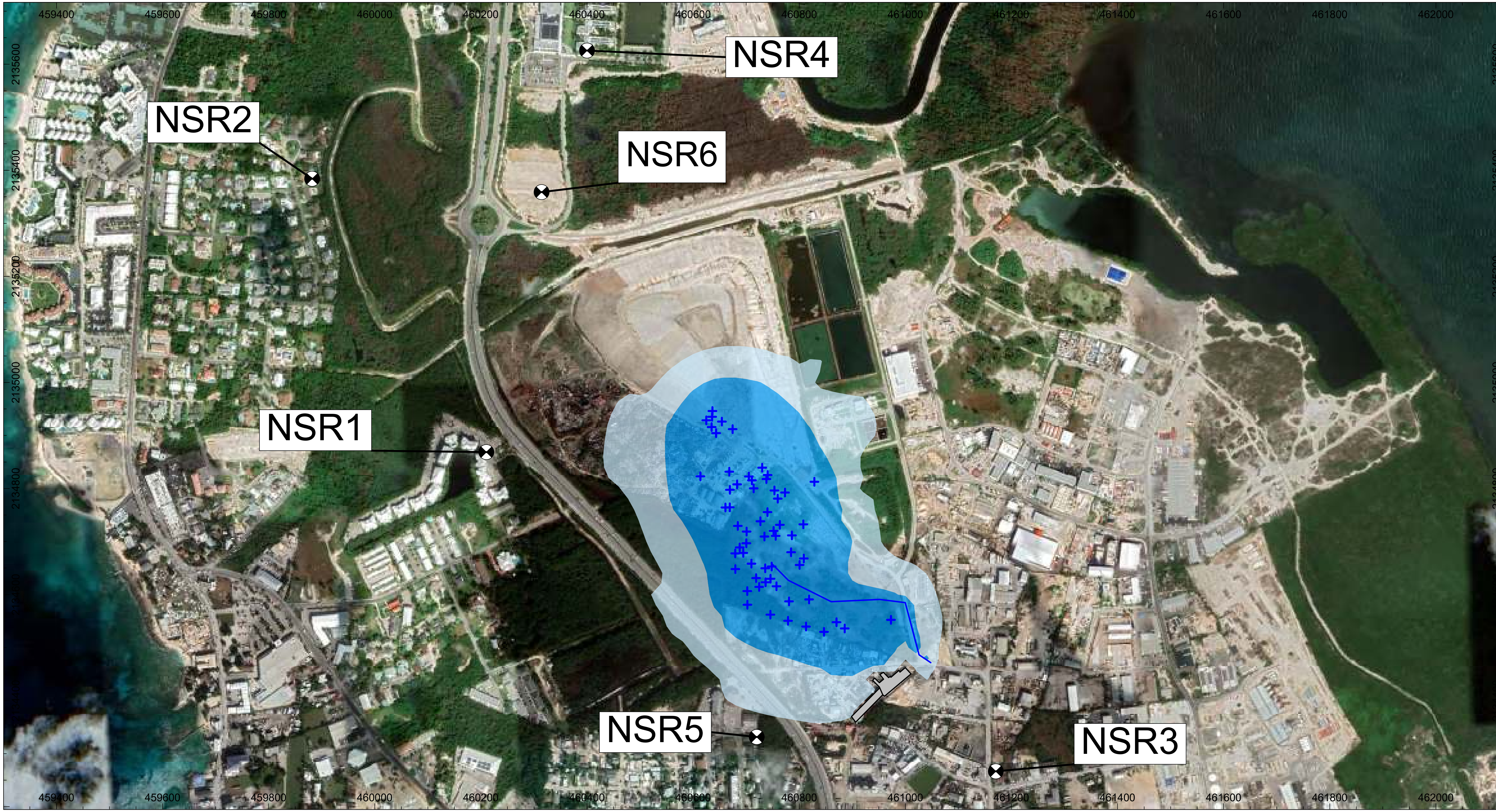
IWSMS NOISE AND VIBRATION ASSESSMENT
DART
GEORGE TOWN, CAYMAN ISLANDS

NOISE CONTOUR PLOT - CONSTRUCTION, PHASE 1

11201588
11.04.2023

FIGURE A.2A

CadnaA File: \\ghdnet\ghd\CA\Whitby\Projects\401\12563972\Tech\Noise Work\12563972_Master_Model.cna



Source: Google Satellite

Legend

> 65 dBA
> 70 dBA

Notes:
Noise level contours presented above represent A-weighted 1-hour equivalent sound levels calculated at a grid height of 1.5 metres above grade.

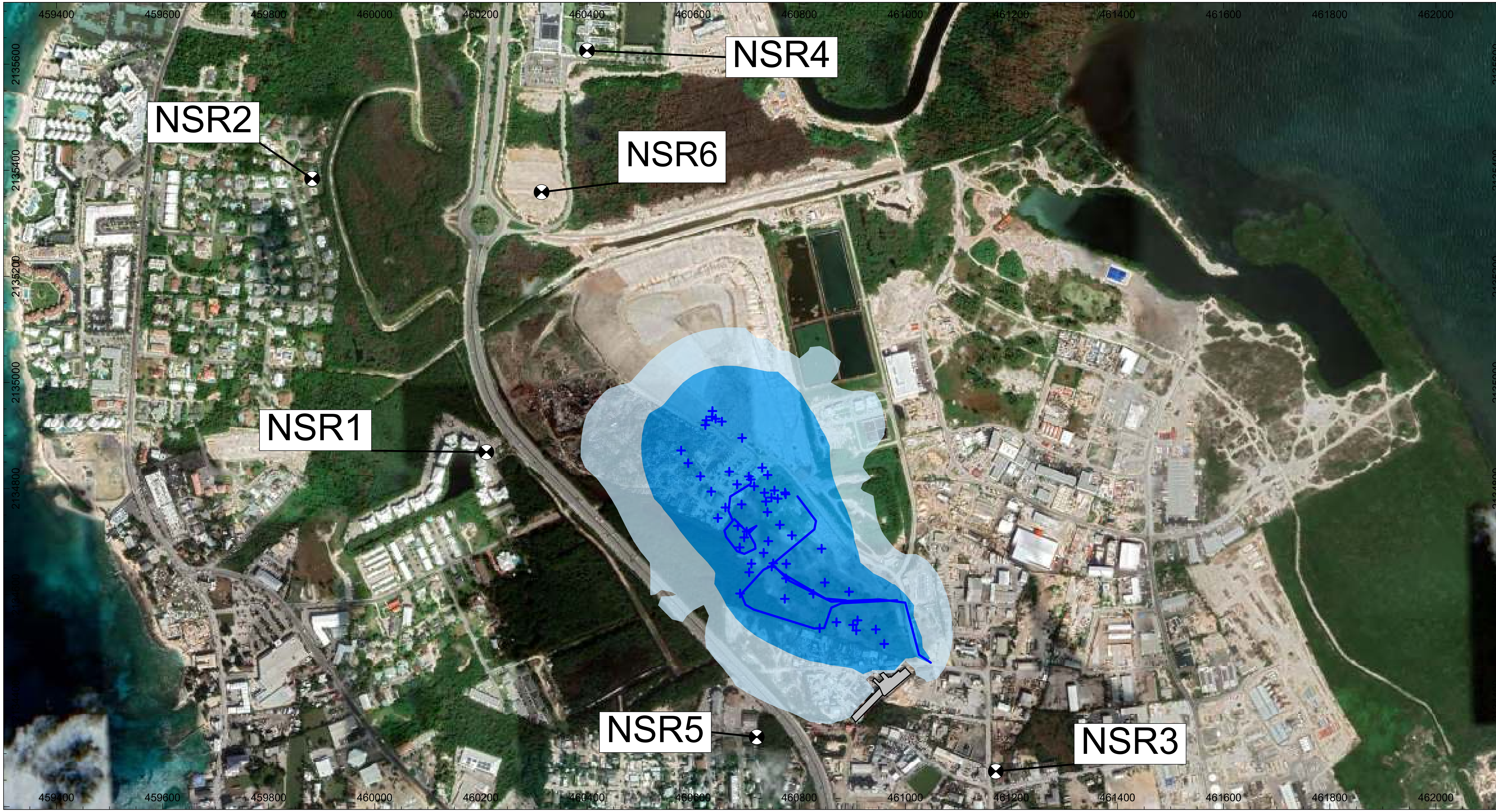
IWSMS NOISE AND VIBRATION ASSESSMENT
DART
GEORGE TOWN, CAYMAN ISLANDS

NOISE CONTOUR PLOT - CONSTRUCTION, PHASE 2

11201588
11.04.2023

FIGURE A.2B

CadnaA File: \\ghdnet\ghd\CA\Whitby\Projects\401\12563972\Tech\Noise Work\12563972_Master_Model.cna



Source: Google Satellite

N

Legend

> 65 dBA

> 70 dBA

Notes:
Noise level contours presented above represent A-weighted 1-hour equivalent sound levels calculated at a grid height of 1.5 metres above grade.

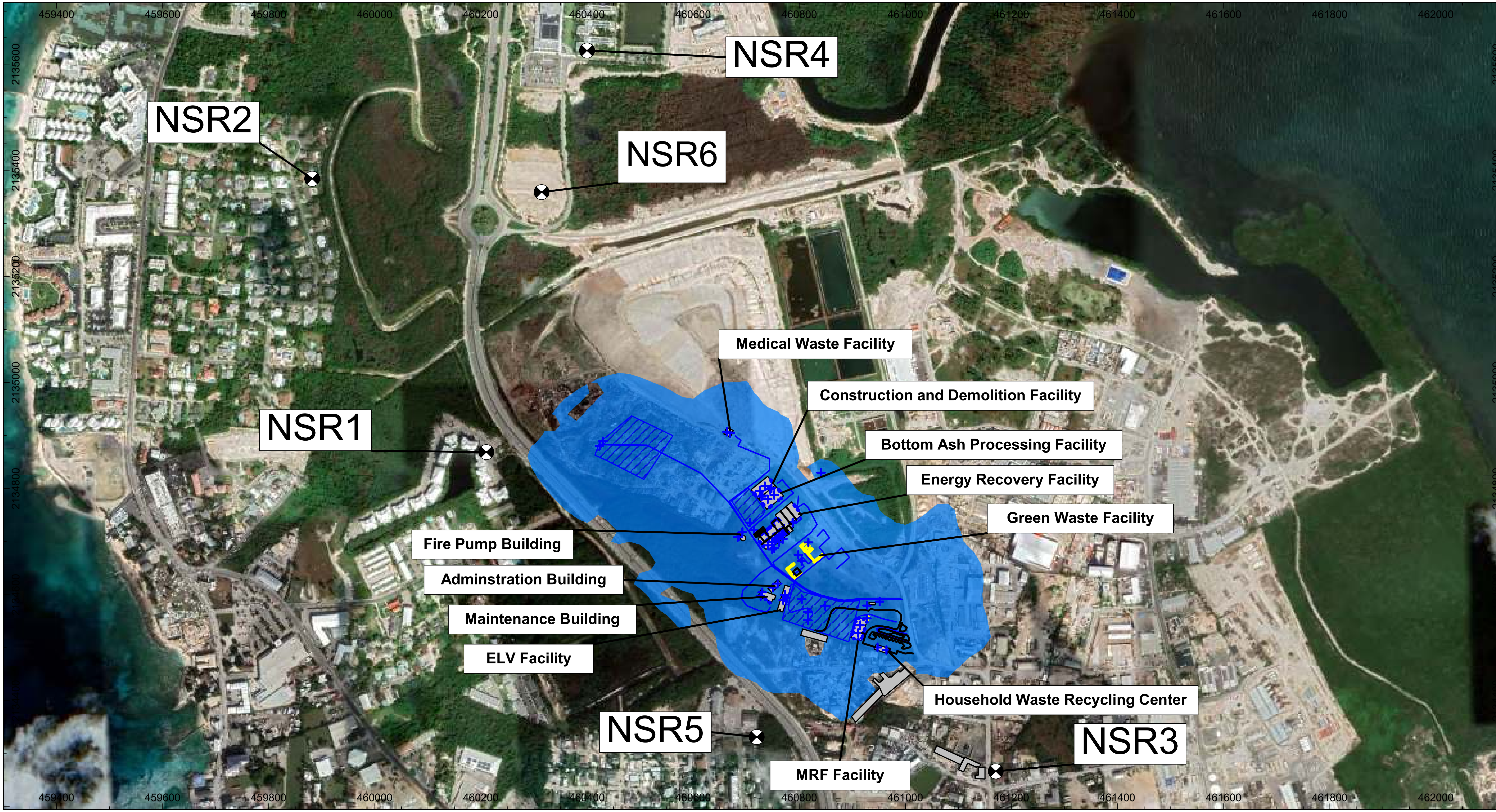
IWSMS NOISE AND VIBRATION ASSESSMENT
DART
GEORGE TOWN, CAYMAN ISLANDS

NOISE CONTOUR PLOT - CONSTRUCTION, PHASE 3

11201588
19.05.2023

FIGURE A.2C

CadnaA File: \\ghdnet\ghd\CA\Whitby\Projects\401\12563972\Tech\Noise Work\12563972_Master_Model.cna



Source: Google Satellite

N

Legend

> 59 dBA

Notes:
Noise level contours presented above represent A-weighted 1-hour equivalent sound levels calculated at a grid height of 1.5 metres above grade.

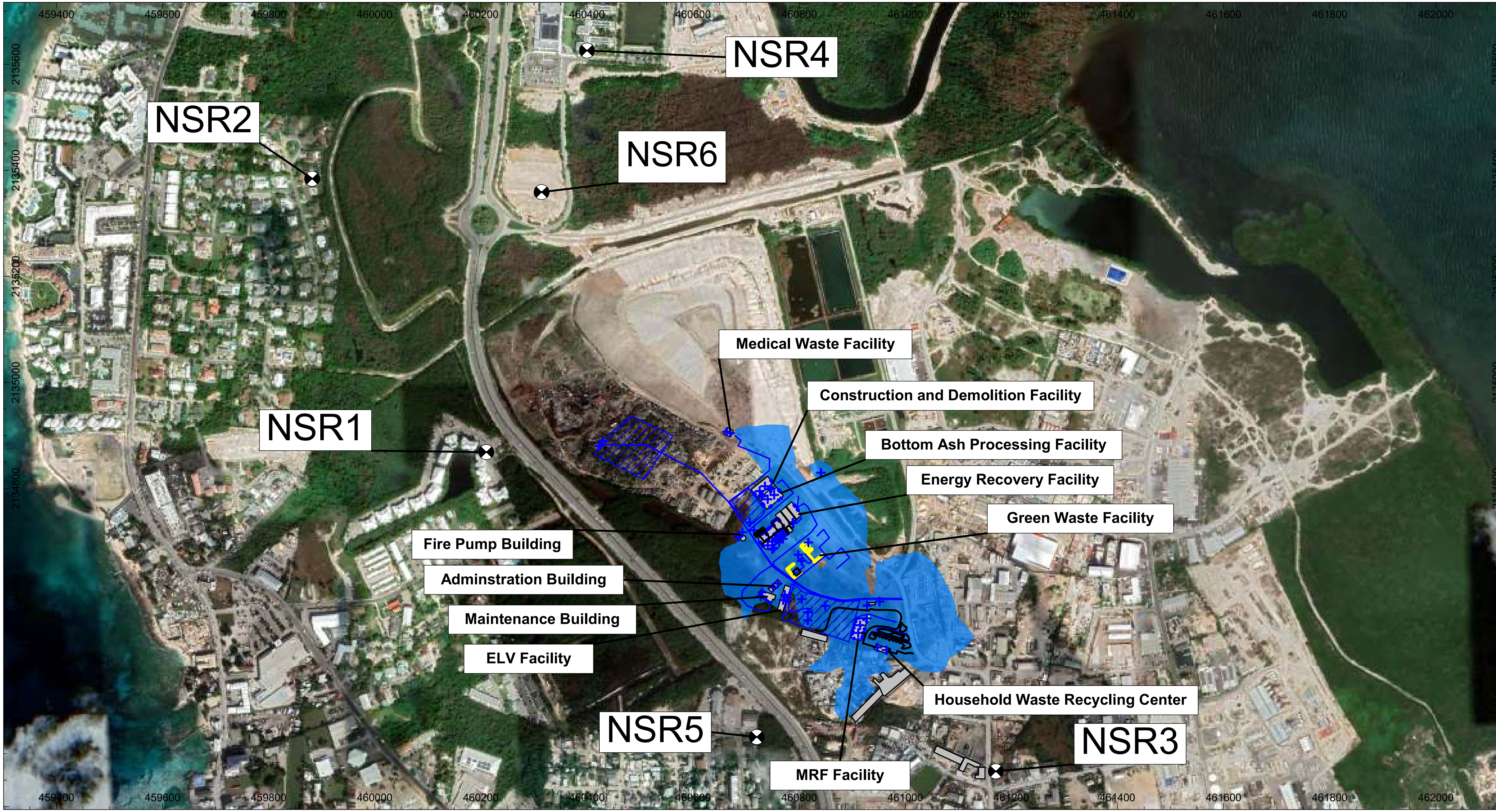
IWSMS NOISE AND VIBRATION ASSESSMENT
DART
GEORGE TOWN, CAYMAN ISLANDS

NOISE CONTOUR PLOT - OPERATIONS, DAYTIME

11201588
19.05.2023

FIGURE A.2D

CadnaA File: \\ghdnet\ghd\CA\Whitby\Projects\401\12563972\Tech\Noise Work\12563972_Master_Model.cna



Source: Google Satellite

N

Legend

> 56 dBA

Notes:
Noise level contours presented above represent A-weighted 1-hour equivalent sound levels calculated at a grid height of 1.5 metres above grade.

GHD

IWSMS NOISE AND VIBRATION ASSESSMENT
DART
GEORGE TOWN, CAYMAN ISLANDS

NOISE CONTOUR PLOT - OPERATIONS, NIGHT

11201588
19.05.2023

FIGURE A.2E

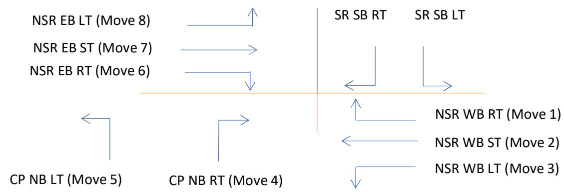
CadnaA File: \\ghdnet\ghd\CA\Whitby\Projects\401\12563972\Tech\Noise Work\12563972_Master_Model.cna

Appendix B

Road Traffic Data

REGEN TIA TRAFFIC COUNT

DATE: WEDNESDAY 26-JAN-23



MOVEMENT		MOVEMENT 1 NORTH SOUND ROAD WESTBOUND RIGHT TURN					MOVEMENT 2 NORTH SOUND ROAD WESTBOUND STRAIGHT					MOVEMENT 3 NORTH SOUND ROAD WESTBOUND LEFT TURN					
	TIME	BICYCLE MOTORCYCLE	CAR PICKUP SUV	BUSES (PUBLIC & PRIVATE)	TRUCKS		BICYCLE MOTORCYCLE	CAR PICKUP SUV	BUSES (PUBLIC & PRIVATE)	TRUCKS		BICYCLE MOTORCYCLE	CAR PICKUP SUV	BUSES (PUBLIC & PRIVATE)	TRUCKS		
NORTH SOUND ROAD - SEYMOUR ROAD (DUMP ROAD) JUNCTION MORNING PEAK	1630-1645	0	22	0	0	22	1	65	2	0	68	0	8	0	1	9	99
	1645-1700	1	23	0	6	30	0	90	2	2	94	0	8	0	1	9	133
	1700-1715	0	22	0	2	24	12	110	3	1	126	0	5	0	0	5	155
	1715-1730	0	10	0	3	13	3	108	2	3	116	0	0	0	0	0	129
	1730-1745	1	22	0	6	29	3	100	2	5	110	0	2	0	0	2	141
	1745-1800	0	27	0	3	30	2	127	3	3	135	0	0	0	0	0	165
	1800-1815	0	25	0	1	26	2	110	5	2	119	1	3	0	0	4	149
	1815-1830	0	23	0	2	25	5	127	2	3	137	0	2	0	0	2	164
		2	174	0	23		28	837	21	19		1	28	0	2		516
		199					905					31					
		1%	87%	0%	12%		3%	92%	2%	2%		0%	3%	0%	0%		
			81	0	14			445	10	12			7	0	0		

MOVEMENT		MOVEMENT 4 CANNON PLACE (MIRCO CENTRE) NORTHBOUND RIGHT TURN					MOVEMENT 5 CANNON PLACE (MIRCO CENTRE) NORTHBOUND LEFT TURN					
	TIME	BICYCLE MOTORCYCLE	CAR PICKUP SUV	BUSES (PUBLIC & PRIVATE)	TRUCKS		BICYCLE MOTORCYCLE	CAR PICKUP SUV	BUSES (PUBLIC & PRIVATE)	TRUCKS		
NORTH SOUND ROAD - SEYMOUR ROAD (DUMP ROAD) JUNCTION MORNING PEAK	1630-1645	0	21	0	0	21	0	10	0	0	10	31
	1645-1700	0	12	0	0	12	0	7	0	0	7	19
	1700-1715	1	10	0	0	11	2	19	0	0	21	32
	1715-1730	0	10	0	0	10	0	20	0	0	20	30
	1730-1745	0	13	0	0	13	0	25	0	0	25	38
	1745-1800	1	10	0	0	11	2	20	0	1	23	34
	1800-1815	0	3	0	0	3	0	31	0	0	31	34
	1815-1830	0	7	0	0	7	1	21	0	0	22	29
		2	86	0	0		5	153	0	1		112
		88					159					
		1%	43%	0%	0%		1%	17%	0%	0%		
			43	0	0			84	0	1		

MOVEMENT		MOVEMENT 6 NORTH SOUND ROAD EASTHBOUND RIGHT TURN					MOVEMENT 7 NORTH SOUND ROAD EASTBOUND STRAIGHT					MOVEMENT 8 NORTH SOUND ROAD EASTBOUND LEFT TURN					
	TIME	BICYCLE MOTORCYCLE	CAR PICKUP SUV	BUSES (PUBLIC & PRIVATE)	TRUCKS		BICYCLE MOTORCYCLE	CAR PICKUP SUV	BUSES (PUBLIC & PRIVATE)	TRUCKS		BICYCLE MOTORCYCLE	CAR PICKUP SUV	BUSES (PUBLIC & PRIVATE)	TRUCKS		
NORTH SOUND ROAD - SEYMOUR ROAD (DUMP ROAD) JUNCTION MORNING PEAK	1630-1645	1	14	0	3	18	2	52	0	7	61	0	10	0	0	10	89
	1645-1700	2	20	0	7	29	2	63	1	6	72	0	5	0	0	5	106
	1700-1715	0	33	0	0	33	0	81	1	4	86	0	6	1	0	7	126
	1715-1730	0	30	0	3	33	1	88	1	3	93	0	17	0	0	17	143
	1730-1745	1	21	0	3	25	2	96	0	3	101	0	9	0	0	9	135
	1745-1800	1	10	0	3	14	1	81	1	5	88	0	13	0	0	13	115
	1800-1815	0	25	0	1	26	2	75	0	3	80	0	12	0	0	12	118
	1815-1830	0	12	0	2	14	1	86	1	1	89	1	10	0	0	11	114
		5	165	0	22		11	622	5	32		1	82	1	0		464
		192					670					84					
		3%	83%	0%	11%		1%	69%	1%	4%		0%	9%	0%	0%		
			94	0	9			346	3	15			45	1	0		

MOVEMENT		MOVEMENT 9					MOVEMENT 10					
	TIME	BICYCLE MOTORCYCLE	CAR PICKUP SUV	BUSES (PUBLIC & PRIVATE)	TRUCKS		BICYCLE MOTORCYCLE	CAR PICKUP SUV	BUSES (PUBLIC & PRIVATE)	TRUCKS		
NORTH SOUND ROAD - SEYMOUR ROAD (DUMP ROAD) JUNCTION MORNING PEAK	1630-1645	0	15	0	1	16	0	5	0	2	7	23
	1645-1700	0	16	1	1	18	0	9	0	2	11	29
	1700-1715	3	24	0	1	28	0	15	0	2	17	45
	1715-1730	3	34	0	0	37	0	33	0	0	33	70
	1730-1745	1	39	0	0	40	0	21	0	2	23	63
	1745-1800	0	18	0	2	20	1	18	0	0	19	39
	1800-1815	0	20	0	0	20	0	14	0	1	15	35
	1815-1830	2	28	0	0	30	0	18	1	0	19	49
		9	194	1	5		1	133	1	9		167
		209					144					
		5%	97%	1%	3%		0%	15%	0%	1%		
			115	0	3			87	0	4		

National Roads Authority

370 North Sound Road | P.O. Box 10426
Grand Cayman | KY1-1004 | Cayman Islands

Site Code: ATR 305
Station ID:
NORTH SOUND RD AT TONYS CAR LOT

Latitude: 0' 0.0000 Undefined

Start	21-Feb-17	WESTBOUND		EASTBOUND		Combined		22-Feb	WESTBOUND		EASTBOUND		Combined	
Time	Tue	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	Wed	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
12:00		11	165	12	184	23	349		19	205	16	176	35	**381**
12:15		12	135	18	163	30	298		17	165	17	**195**	34	**360**
12:30		12	134	17	199	29	333		9	174	13	**206**	22	**380**
12:45		10	129	6	185	16	314		9	140	9	**205**	18	**345**
01:00		7	166	8	206	15	372		9	148	5	**185**	14	333
01:15		9	150	10	170	19	320		9	154	5	180	14	334
01:30		2	126	4	179	6	305		5	144	7	195	12	339
01:45		11	152	2	190	13	**342**		5	155	7	195	12	350
02:00		4	119	5	**217**	9	**336**		4	139	3	178	7	317
02:15		4	174	6	**212**	10	**386**		5	140	4	183	9	323
02:30		3	170	3	**194**	6	**364**		4	163	0	187	4	350
02:45		0	131	1	**208**	1	339		3	153	2	190	5	343
03:00		2	140	3	199	5	339		0	140	4	181	4	321
03:15		1	159	2	172	3	331		0	137	2	194	2	331
03:30		3	148	3	191	6	339		2	163	2	182	4	345
03:45		2	166	1	177	3	343		1	161	3	179	4	340
04:00		1	171	13	190	14	361		3	150	10	182	13	332
04:15		4	160	6	163	10	323		0	185	4	176	4	361
04:30		5	178	9	181	14	359		7	187	4	156	11	343
04:45		9	**175**	6	156	15	331		3	148	10	154	13	302
05:00		11	**180**	17	167	28	347		11	149	19	155	30	304
05:15		10	**163**	29	120	39	283		13	146	18	130	31	276
05:30		17	**180**	29	143	46	323		17	**227**	29	3	46	230
05:45		22	150	35	127	57	277		19	**201**	35	0	54	201
06:00		30	141	42	145	72	286		31	**219**	40	0	71	219
06:15		28	121	51	136	79	257		28	**207**	62	0	90	207
06:30		27	160	54	96	81	256		44	173	80	0	124	173
06:45		63	167	100	102	163	269		65	157	108	0	173	157
07:00		84	130	151	107	235	237		83	170	181	0	264	170
07:15		95	123	190	83	285	206		101	155	**202**	0	303	155
07:30		129	93	193	84	322	177		155	119	**182**	0	337	119
07:45		126	106	190	86	316	192		150	119	**193**	0	**343**	119
08:00		160	80	186	63	346	143		147	126	**192**	0	**339**	126
08:15		125	77	220	59	345	136		157	95	171	0	**328**	95
08:30		155	70	169	63	324	133		171	75	190	0	**361**	75
08:45		146	74	194	74	340	148		153	80	172	0	325	80
09:00		143	73	191	71	334	144		140	74	217	0	357	74
09:15		130	47	192	46	322	93		156	95	171	0	327	95
09:30		132	55	193	53	325	108		131	91	189	0	320	91
09:45		**160**	50	182	40	342	90		160	85	181	0	341	85
10:00		**153**	43	198	28	351	71		164	77	179	0	343	77
10:15		**185**	38	182	23	367	61		136	71	182	0	318	71
10:30		**169**	32	178	21	347	53		144	68	193	0	337	68
10:45		151	25	183	26	334	51		**174**	41	176	0	350	41
11:00		159	23	**209**	16	**368**	39		**151**	46	183	0	334	46
11:15		141	23	**215**	15	**356**	38		**165**	36	173	0	338	36
11:30		161	16	**194**	17	**355**	33		**145**	25	198	0	343	25
11:45		198	18	**184**	16	**382**	34		143	41	192	1	335	42
Total		3222	5506	4286	5763	7508	11269		3268	6319	4235	3968	7503	10287
Day Total		8728		10049		18777			9587		8203		17790	
% Total		17.2%	29.3%	22.8%	30.7%				18.4%	35.5%	23.8%	22.3%		
Peak	-	09:45	04:45	11:00	02:00	11:00	01:45	-	10:45	05:30	07:15	00:15	07:45	12:00
Vol.	-	667	698	802	831	1461	1428	-	635	854	769	791	1371	1466
P.H.F.		0.901	0.969	0.933	0.957	0.956	0.925		0.912	0.941	0.952	0.960	0.949	0.962

National Roads Authority
370 North Sound Road | P.O. Box 10426
Grand Cayman | KY1-1004 | Cayman Islands

Site Code: ATR 305
Station ID:
NORTH SOUND RD AT TONYS CAR LOT

Latitude: 0' 0.0000 Undefined

Start	23-Feb-17	WESTBOUND		EASTBOUND		Combined		24-Feb	WESTBOUND		EASTBOUND		Combined	
Time	Thu	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	Fri	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
12:00		23	445	0	6	23	451		*	*	*	*	*	*
12:15		20	399	0	7	20	406		*	*	*	*	*	*
12:30		18	341	0	6	18	347		*	*	*	*	*	*
12:45		25	266	0	7	25	273		*	*	*	*	*	*
01:00		17	209	1	28	18	237		*	*	*	*	*	*
01:15		15	206	0	21	15	227		*	*	*	*	*	*
01:30		8	225	0	0	8	225		*	*	*	*	*	*
01:45		9	221	0	3	9	224		*	*	*	*	*	*
02:00		12	229	0	8	12	237		*	*	*	*	*	*
02:15		5	221	0	17	5	238		*	*	*	*	*	*
02:30		3	218	0	24	3	242		*	*	*	*	*	*
02:45		7	223	0	3	7	226		*	*	*	*	*	*
03:00		9	229	0	8	9	237		*	*	*	*	*	*
03:15		10	245	0	2	10	247		*	*	*	*	*	*
03:30		2	234	0	9	2	243		*	*	*	*	*	*
03:45		3	236	0	2	3	238		*	*	*	*	*	*
04:00		14	224	0	2	14	226		*	*	*	*	*	*
04:15		10	234	0	5	10	239		*	*	*	*	*	*
04:30		12	231	0	3	12	234		*	*	*	*	*	*
04:45		18	229	0	2	18	231		*	*	*	*	*	*
05:00		36	200	0	4	36	204		*	*	*	*	*	*
05:15		21	210	0	2	21	212		*	*	*	*	*	*
05:30		41	230	0	0	41	230		*	*	*	*	*	*
05:45		37	237	0	0	37	237		*	*	*	*	*	*
06:00		71	221	0	0	71	221		*	*	*	*	*	*
06:15		78	199	0	0	78	199		*	*	*	*	*	*
06:30		74	198	0	0	74	198		*	*	*	*	*	*
06:45		131	177	1	0	132	177		*	*	*	*	*	*
07:00		178	169	1	0	179	169		*	*	*	*	*	*
07:15		209	173	0	0	209	173		*	*	*	*	*	*
07:30		215	155	1	0	216	155		*	*	*	*	*	*
07:45		212	137	1	0	213	137		*	*	*	*	*	*
08:00		230	134	5	0	235	134		*	*	*	*	*	*
08:15		220	115	28	0	248	115		*	*	*	*	*	*
08:30		279	113	6	0	285	113		*	*	*	*	*	*
08:45		229	83	68	0	297	83		*	*	*	*	*	*
09:00		267	81	66	0	333	81		*	*	*	*	*	*
09:15		290	114	60	0	350	114		*	*	*	*	*	*
09:30		290	100	27	0	317	100		*	*	*	*	*	*
09:45		250	82	43	0	293	82		*	*	*	*	*	*
10:00		344	67	37	0	381	67		*	*	*	*	*	*
10:15		278	66	40	0	318	66		*	*	*	*	*	*
10:30		271	69	68	0	339	69		*	*	*	*	*	*
10:45		258	67	40	0	298	67		*	*	*	*	*	*
11:00		270	53	21	0	291	53		*	*	*	*	*	*
11:15		337	43	8	0	345	43		*	*	*	*	*	*
11:30		311	42	16	0	327	42		*	*	*	*	*	*
11:45		422	42	26	0	448	42		*	*	*	*	*	*
Total		6089	8642	564	169	6653	8811		0	0	0	0	0	0
Day Total		14731		733		15464			0		0		0	
% Total		39.4%	55.9%	3.6%	1.1%				0.0%	0.0%	0.0%	0.0%		
Peak	-	11:00	12:00	08:45	00:30	11:00	12:00	-	-	-	-	-	-	-
Vol.	-	1340	1451	221	62	1411	1477	-	-	-	-	-	-	-
P.H.F.		0.794	0.815	0.813	0.554	0.787	0.819							

ADT	ADT 17,344	AADT 17,344

Site Code: ATR501-NB
Station ID:
Location 1: NORTH SOUTH RD - (NB
Location 2: CAYMAN COMPASS site
Location 3:
Location 4:

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR501-NORTH W2019 -
Date Printed: 12/5/2022
Start Date: 3/17/2019
End Date: 3/24/2019

	3/18/2019		Tuesday		Wednesday		Thursday		Friday		Saturday		Sunday		Average Day	
Time	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
12:00	26	272	27	252	29	267	30	252	34	279	49	294	52	*	35	269
12:15	23	265	17	276	24	292	21	301	22	306	59	310	44	*	30	292
12:30	14	259	15	284	11	253	10	279	28	288	45	263	42	*	24	271
12:45	13	276	7	273	12	279	13	277	31	300	33	272	42	*	22	280
1:00	6	270	14	242	8	294	13	260	14	266	44	283	29	*	18	269
1:15	9	235	13	268	7	275	11	228	15	274	29	268	15	*	14	258
1:30	14	254	11	261	13	241	11	254	15	324	29	275	26	*	17	268
1:45	16	249	3	227	3	286	14	265	12	268	34	248	33	*	16	257
2:00	13	233	8	239	5	258	19	250	18	271	31	257	14	*	15	251
2:15	16	217	8	220	7	217	7	225	6	267	24	280	22	*	13	238
2:30	11	257	3	283	8	259	7	293	8	250	31	261	16	*	12	267
2:45	12	246	5	259	5	294	5	245	7	269	22	275	7	*	9	265
3:00	8	255	6	254	4	240	6	223	5	264	20	241	5	*	8	246
3:15	7	274	4	257	4	290	5	262	0	296	16	236	6	*	6	269
3:30	12	244	4	276	5	243	3	249	6	257	20	233	15	*	9	250
3:45	13	285	5	268	12	246	7	278	11	283	12	253	7	*	10	269
4:00	13	237	7	252	7	245	4	251	7	281	20	230	11	*	10	249
4:15	13	233	17	236	11	246	18	194	12	244	17	250	15	*	15	234
4:30	34	235	22	255	25	243	21	253	21	240	22	233	9	*	22	243
4:45	30	235	30	231	31	232	35	252	28	308	22	224	20	*	28	247
5:00	32	257	33	266	29	245	27	250	37	265	14	229	12	*	26	252
5:15	42	234	47	265	50	251	36	288	43	265	21	215	14	*	36	253
5:30	43	217	40	225	51	251	40	242	50	265	34	251	37	*	42	242
5:45	81	211	76	247	78	245	75	252	72	231	40	256	26	*	64	240
6:00	89	191	88	215	84	236	71	240	72	215	46	235	36	*	69	222
6:15	143	169	148	193	141	184	133	190	125	223	71	205	55	*	117	194
6:30	203	176	203	181	233	196	207	192	230	209	105	240	54	*	176	199
6:45	237	160	286	171	255	189	269	182	258	194	166	238	66	*	220	189
7:00	290	158	278	160	243	165	248	184	274	195	118	218	66	*	217	180
7:15	236	156	268	139	285	203	267	175	265	179	158	202	70	*	221	176
7:30	295	162	302	190	289	163	308	198	317	196	184	182	79	*	253	182
7:45	339	135	331	157	341	163	331	175	315	194	203	182	120	*	283	168
8:00	292	115	313	132	340	136	302	145	296	155	208	165	103	*	265	141
8:15	304	118	318	112	278	111	296	118	306	158	194	172	128	*	261	132
8:30	305	103	293	143	310	100	310	118	279	174	238	173	123	*	265	135
8:45	293	78	298	113	303	108	302	85	300	145	274	155	133	*	272	114
9:00	274	82	291	95	286	93	281	101	290	152	286	124	141	*	264	108
9:15	238	69	256	91	268	78	266	104	281	121	246	124	143	*	243	98
9:30	224	69	225	90	240	78	232	85	246	138	245	129	154	*	224	98
9:45	232	78	224	84	222	101	266	68	223	112	291	137	216	*	239	97
10:00	215	56	192	67	197	83	225	83	235	110	276	92	176	*	217	82
10:15	201	60	206	59	190	63	227	73	236	102	278	117	169	*	215	79
10:30	208	41	206	48	204	53	221	58	234	68	262	80	193	*	218	58
10:45	197	41	202	47	232	37	231	44	241	79	280	91	168	*	222	57
11:00	224	35	201	50	263	43	215	44	230	85	317	78	150	*	229	56
11:15	224	33	209	30	235	35	246	51	241	103	279	44	171	*	229	49
11:30	251	29	241	19	224	27	235	38	269	66	267	41	120	*	230	37
11:45	238	24	270	29	245	29	255	31	278	68	284	43	0	*	224	37
Total	6253	8288	6271	8731	6347	8866	6382	8905	6543	10002	5964	9604	3353	0	5873	9066
Day Total	14541		15002		15213		15287		16545		15568		3353		14939	
% Splits	43.0%	57.0%	41.8%	58.2%	41.7%	58.3%	41.7%	58.3%	39.5%	60.5%	38.3%	61.7%	100.0%	0.0%	39.3%	60.7%
Peak	7:45	12:00	7:30	12:00	7:45	12:15	7:45	12:15	7:30	12:00	11:00	12:00	9:45		7:45	12:00
Volume	1240	1072	1264	1085	1269	1118	1239	1117	1234	1173	1147	1139	754		1074	1112
Peak Factor	0.914	0.971	0.955	0.955	0.930	0.951	0.936	0.928	0.973	0.958	0.905	0.919	0.873		0.949	0.952

ADT ADT: 15,322 AADT: 15,322

Site Code: ATR501-NB
Station ID:
Location 1: NORTH SOUTH RD - (NB Lanes)
Location 2: CAYMAN COMPASS site
Location 3:
Location 4:
Direction: Northbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR501-NORTH W2019 - RAW
Date Printed: 12/6/2022
Start Date: 3/17/2019
End Date: 3/24/2019

3/17/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
2:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
3:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
4:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
5:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
6:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
7:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
8:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
9:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
10:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
11:00	7	396	13	0	1	6	0	1	0	3	0	0	0	21	448	11
12:00 PM	8	571	14	0	0	9	0	2	1	3	0	0	0	26	634	15
1:00	4	671	18	0	2	4	0	1	2	0	0	0	1	17	720	10
2:00	3	542	24	1	2	4	0	1	1	1	0	1	1	25	606	12
3:00	4	501	12	0	2	2	0	0	0	2	0	0	0	15	538	6
4:00	0	566	18	0	0	7	0	0	0	2	2	0	0	26	621	11
5:00	4	541	11	0	1	3	1	0	0	0	0	1	0	25	587	6
6:00	3	546	16	0	0	3	0	2	0	0	0	1	0	19	590	6
7:00	7	496	20	1	1	5	0	0	3	8	0	1	1	25	568	20
8:00	6	543	9	0	0	7	0	1	1	9	0	0	2	27	605	20
9:00	0	374	8	1	1	5	0	2	0	8	0	0	1	16	416	18
10:00	2	274	8	1	2	0	0	0	0	6	0	0	0	11	304	9
11:00	0	198	4	0	0	1	0	0	1	0	0	0	0	2	206	2
	1	129	4	0	0	0	0	0	0	0	0	0	0	1	135	0
Total	49	6348	179	4	12	56	1	10	9	42	2	4	6	256	6978	146
Percent	0.7%	91.0%	2.6%	0.1%	0.2%	0.8%	0.0%	0.1%	0.1%	0.6%	0.0%	0.1%	0.1%	3.7%		2.1%
AM Peak	11:00	11:00	11:00		10:00	11:00		11:00	11:00	10:00				11:00	11:00	11:00
	8	571	14	*	1	9	*	2	1	3	*	*	*	26	634	15
PM Peak	6:00	12:00 PM	1:00	1:00	12:00 PM	3:00	4:00	5:00	6:00	7:00	3:00	1:00	7:00	7:00	12:00 PM	6:00
	7	671	24	1	2	7	1	2	3	9	2	1	2	27	720	20

Site Code: ATR501-NB
Station ID:
Location 1: NORTH SOUTH RD - (NB Lanes)
Location 2: CAYMAN COMPASS site
Location 3:
Location 4:
Direction: Northbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR501-NORTH W2019 - RAW
Date Printed: 12/6/2022
Start Date: 3/17/2019
End Date: 3/24/2019

3/18/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	0	73	1	0	0	0	0	0	0	0	0	0	0	2	76	0
2:00	0	29	2	0	1	1	0	0	0	11	0	0	0	1	45	13
3:00	2	31	0	0	0	1	0	0	0	17	0	0	0	1	52	18
4:00	0	24	2	0	1	0	0	0	0	13	0	0	0	0	40	14
5:00	0	72	3	0	0	1	0	0	0	13	0	0	0	1	90	14
6:00	0	183	9	0	0	2	0	0	0	0	0	0	0	4	198	2
7:00	10	564	38	0	1	3	1	3	1	2	0	2	1	46	672	14
8:00	15	988	36	6	2	18	2	5	1	4	1	3	1	78	1160	43
9:00	13	1040	40	3	1	14	5	0	1	2	3	2	0	70	1194	31
10:00	7	810	45	5	4	17	2	2	1	3	1	2	2	67	968	39
11:00	9	677	46	3	6	9	4	5	3	5	0	1	1	52	821	37
12:00 PM	9	804	43	4	2	11	1	1	4	1	0	2	1	54	937	27
1:00	13	873	43	5	7	19	3	2	3	3	1	1	5	94	1072	49
2:00	13	807	64	2	6	9	1	6	3	3	2	2	1	89	1008	35
3:00	14	781	32	3	8	20	2	3	6	4	1	2	4	73	953	53
4:00	8	884	43	10	6	14	2	3	5	2	1	1	2	77	1058	46
5:00	7	800	35	4	4	8	4	4	6	1	1	1	2	63	940	35
6:00	7	795	22	4	2	4	3	4	4	3	0	1	2	68	919	27
7:00	3	628	18	1	0	6	2	3	1	1	1	0	1	31	696	16
8:00	3	540	16	1	1	7	0	2	1	7	0	0	0	33	611	19
9:00	5	378	13	0	1	1	0	0	0	6	0	0	0	10	414	8
10:00	2	277	11	0	0	0	0	0	0	4	0	0	0	4	298	4
11:00	3	177	3	0	1	0	0	0	0	11	0	0	0	3	198	12
	2	108	2	0	0	0	0	0	0	6	0	0	0	3	121	6
Total	145	12343	567	51	54	165	32	43	40	122	12	20	23	924	14541	562
Percent	1.0%	84.9%	3.9%	0.4%	0.4%	1.1%	0.2%	0.3%	0.3%	0.8%	0.1%	0.1%	0.2%	6.4%		3.9%
AM Peak	7:00	8:00	10:00	7:00	10:00	7:00	8:00	7:00	11:00	2:00	8:00	7:00	9:00	7:00	8:00	7:00
	15	1040	46	6	6	18	5	5	4	17	3	3	2	78	1194	43
PM Peak	2:00	3:00	1:00	3:00	2:00	2:00	4:00	1:00	2:00	10:00	1:00	1:00	12:00 PM	12:00 PM	12:00 PM	2:00
	14	884	64	10	8	20	4	6	6	11	2	2	5	94	1072	53

Site Code: ATR501-NB
Station ID:
Location 1: NORTH SOUTH RD - (NB Lanes)
Location 2: CAYMAN COMPASS site
Location 3:
Location 4:
Direction: Northbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR501-NORTH W2019 - RAW
Date Printed: 12/6/2022
Start Date: 3/17/2019
End Date: 3/24/2019

3/19/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	0	63	0	0	0	0	0	0	0	3	0	0	0	0	66	3
2:00	0	30	2	0	0	0	0	0	0	8	0	0	0	1	41	8
3:00	0	19	1	0	1	2	0	0	0	1	0	0	0	0	24	4
4:00	1	16	2	0	0	0	0	0	0	0	0	0	0	0	19	0
5:00	1	64	5	0	0	1	0	0	0	0	0	0	0	5	76	1
6:00	2	175	11	1	0	2	0	1	0	0	0	0	0	4	196	4
7:00	2	641	34	0	2	7	2	1	1	2	0	0	0	33	725	15
8:00	16	1005	42	4	2	9	2	1	2	4	2	2	1	87	1179	29
9:00	14	1067	22	5	1	16	2	5	1	7	1	1	3	77	1222	42
10:00	11	833	46	1	10	10	1	1	6	3	1	1	2	70	996	36
11:00	3	693	47	2	4	4	2	2	3	2	2	1	1	40	806	23
12:00 PM	8	769	52	2	5	10	1	2	2	4	1	0	5	60	921	32
1:00	4	923	43	1	7	14	1	1	2	1	4	2	1	81	1085	34
2:00	10	825	44	10	9	12	2	2	0	0	0	3	4	77	998	42
3:00	18	813	38	4	8	15	1	2	4	2	3	1	4	88	1001	44
4:00	14	863	45	11	11	10	1	2	3	3	1	1	3	87	1055	46
5:00	6	813	35	6	3	15	0	4	5	5	1	2	1	78	974	42
6:00	11	860	26	5	1	7	1	2	2	5	0	1	4	78	1003	28
7:00	7	682	15	3	5	3	0	0	1	6	0	1	0	37	760	19
8:00	0	575	22	1	1	3	0	1	0	10	0	0	0	33	646	16
9:00	7	425	14	1	0	6	0	0	3	18	0	0	0	26	500	28
10:00	6	316	14	0	0	2	0	0	0	10	0	0	1	11	360	13
11:00	1	193	5	0	0	0	0	0	2	16	0	0	0	4	221	18
	1	117	1	0	0	0	0	0	1	6	0	0	0	2	128	7
Total	143	12780	566	57	70	148	16	27	38	116	16	16	30	979	15002	534
Percent	1.0%	85.2%	3.8%	0.4%	0.5%	1.0%	0.1%	0.2%	0.3%	0.8%	0.1%	0.1%	0.2%	6.5%		3.6%
AM Peak	7:00	8:00	11:00	8:00	9:00	8:00	6:00	8:00	9:00	1:00	7:00	7:00	11:00	7:00	8:00	8:00
	16	1067	52	5	10	16	2	5	6	8	2	2	5	87	1222	42
PM Peak	2:00	12:00 PM	3:00	3:00	3:00	2:00	1:00	4:00	4:00	8:00	12:00 PM	1:00	1:00	2:00	12:00 PM	3:00
	18	923	45	11	11	15	2	4	5	18	4	3	4	88	1085	46

Site Code: ATR501-NB
Station ID:
Location 1: NORTH SOUTH RD - (NB Lanes)
Location 2: CAYMAN COMPASS site
Location 3:
Location 4:
Direction: Northbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR501-NORTH W2019 - RAW
Date Printed: 12/6/2022
Start Date: 3/17/2019
End Date: 3/24/2019

3/20/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	0	73	2	0	0	0	0	0	0	0	0	0	0	1	76	0
2:00	0	28	1	0	1	1	0	0	0	0	0	0	0	0	31	2
3:00	2	21	1	0	0	0	0	0	0	0	0	0	0	1	25	0
4:00	0	24	1	0	0	0	0	0	0	0	0	0	0	0	25	0
5:00	1	67	2	0	0	3	0	0	0	0	0	0	0	1	74	3
6:00	0	188	13	0	0	2	1	0	1	0	0	0	0	3	208	4
7:00	8	617	34	1	3	6	0	1	2	2	1	1	0	37	713	17
8:00	8	996	40	5	6	7	0	4	4	4	0	1	6	77	1158	37
9:00	20	1059	30	5	3	18	2	1	3	3	0	0	2	85	1231	37
10:00	13	856	46	2	3	22	3	1	2	6	0	1	1	60	1016	41
11:00	7	683	39	8	4	12	3	2	2	5	0	1	0	57	823	37
12:00 PM	10	808	53	1	2	18	2	3	3	5	2	1	0	59	967	37
1:00	7	935	45	1	2	8	2	2	1	4	2	2	2	78	1091	26
2:00	9	898	49	10	6	13	1	3	5	4	1	1	4	92	1096	48
3:00	11	872	31	4	5	8	3	5	4	7	1	2	1	74	1028	40
4:00	13	830	43	7	5	14	0	5	5	4	1	1	1	90	1019	43
5:00	15	789	48	9	6	13	2	2	2	3	3	1	3	70	966	44
6:00	18	784	20	12	7	9	2	2	3	2	0	1	1	131	992	39
7:00	5	721	18	5	2	1	0	0	2	4	3	0	1	43	805	18
8:00	4	620	18	1	0	5	0	1	4	10	1	0	2	28	694	24
9:00	2	401	14	1	1	4	0	0	4	14	0	1	0	13	455	25
10:00	2	312	12	0	1	2	0	0	1	6	1	0	0	13	350	11
11:00	1	216	9	0	0	2	0	0	2	1	0	0	0	5	236	5
	5	121	4	0	0	1	0	0	0	0	0	0	0	3	134	1
Total	161	12919	573	72	57	169	21	32	50	84	16	14	24	1021	15213	539
Percent	1.1%	84.9%	3.8%	0.5%	0.4%	1.1%	0.1%	0.2%	0.3%	0.6%	0.1%	0.1%	0.2%	6.7%		3.5%
AM Peak	8:00	8:00	11:00	10:00	7:00	9:00	9:00	7:00	7:00	9:00	11:00	6:00	7:00	8:00	8:00	9:00
	20	1059	53	8	6	22	3	4	4	6	2	1	6	85	1231	41
PM Peak	5:00	12:00 PM	1:00	5:00	5:00	3:00	2:00	2:00	1:00	8:00	4:00	12:00 PM	1:00	5:00	1:00	1:00
	18	935	49	12	7	14	3	5	5	14	3	2	4	131	1096	48

Site Code: ATR501-NB
Station ID:
Location 1: NORTH SOUTH RD - (NB Lanes)
Location 2: CAYMAN COMPASS site
Location 3:
Location 4:
Direction: Northbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR501-NORTH W2019 - RAW
Date Printed: 12/6/2022
Start Date: 3/17/2019
End Date: 3/24/2019

3/21/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	0	73	1	0	0	0	0	0	0	0	0	0	0	0	74	0
2:00	2	47	0	0	0	0	0	0	0	0	0	0	0	0	49	0
3:00	0	35	2	0	1	0	0	0	0	0	0	0	0	0	38	1
4:00	0	20	0	0	0	1	0	0	0	0	0	0	0	0	21	1
5:00	1	71	5	0	0	0	0	0	0	0	0	0	0	1	78	0
6:00	2	159	10	0	0	0	0	1	0	0	0	0	0	6	178	1
7:00	12	577	27	2	2	8	1	4	0	2	0	1	1	43	680	21
8:00	16	968	33	6	3	15	3	3	4	5	3	1	2	92	1154	45
9:00	14	1046	39	3	8	14	3	0	2	7	0	0	4	70	1210	41
10:00	11	879	44	4	3	13	0	6	2	5	1	2	3	72	1045	39
11:00	8	768	45	2	7	4	1	2	2	2	0	0	1	62	904	21
12:00 PM	10	808	45	2	7	3	1	2	3	3	1	1	4	61	951	27
1:00	10	904	47	6	0	16	1	6	5	5	0	2	4	103	1109	45
2:00	12	854	35	2	6	12	1	1	2	2	0	3	1	76	1007	30
3:00	9	852	53	4	6	11	1	1	1	4	2	0	2	67	1013	32
4:00	7	843	41	8	7	13	2	5	1	1	1	1	4	78	1012	43
5:00	6	831	30	3	7	7	1	3	1	1	1	0	3	56	950	27
6:00	21	755	22	20	12	9	1	8	3	3	4	1	4	169	1032	65
7:00	8	716	32	2	2	7	0	0	0	1	0	2	0	34	804	14
8:00	8	637	17	4	1	8	1	1	2	4	1	0	2	46	732	24
9:00	2	433	14	0	0	2	0	0	0	2	0	0	0	13	466	4
10:00	4	322	9	2	0	2	0	2	0	1	0	0	2	14	358	9
11:00	5	235	6	0	3	1	0	0	0	0	0	0	0	8	258	4
	3	152	8	0	0	0	0	0	0	0	0	0	0	1	164	0
Total	171	12985	565	70	75	146	17	45	28	48	14	14	37	1072	15287	494
Percent	1.1%	84.9%	3.7%	0.5%	0.5%	1.0%	0.1%	0.3%	0.2%	0.3%	0.1%	0.1%	0.2%	7.0%		3.2%
AM Peak	7:00	8:00	10:00	7:00	8:00	7:00	7:00	9:00	7:00	8:00	7:00	9:00	8:00	7:00	8:00	7:00
	16	1046	45	6	8	15	3	6	4	7	3	2	4	92	1210	45
PM Peak	5:00	12:00 PM	2:00	5:00	5:00	12:00 PM	3:00	5:00	12:00 PM	12:00 PM	5:00	1:00	12:00 PM	5:00	12:00 PM	5:00
	21	904	53	20	12	16	2	8	5	5	4	3	4	169	1109	65

Site Code: ATR501-NB
Station ID:
Location 1: NORTH SOUTH RD - (NB Lanes)
Location 2: CAYMAN COMPASS site
Location 3:
Location 4:
Direction: Northbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR501-NORTH W2019 - RAW
Date Printed: 12/6/2022
Start Date: 3/17/2019
End Date: 3/24/2019

3/22/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	0	110	4	0	0	0	0	0	0	0	0	0	0	1	115	0
2:00	0	50	5	0	0	0	0	0	0	0	0	0	0	1	56	0
3:00	0	37	1	0	0	1	0	0	0	0	0	0	0	0	39	1
4:00	1	21	0	0	0	0	0	0	0	0	0	0	0	0	22	0
5:00	1	63	2	0	0	1	0	0	0	0	0	0	0	1	68	1
6:00	1	186	13	0	0	1	0	0	0	0	0	0	0	1	202	1
7:00	7	597	31	3	4	4	0	2	3	2	0	0	1	31	685	19
8:00	12	1008	34	7	1	14	7	3	5	1	1	1	4	73	1171	44
9:00	16	1006	29	4	9	12	1	2	8	4	0	2	8	80	1181	50
10:00	9	854	47	7	6	18	3	3	1	6	0	1	1	84	1040	46
11:00	8	805	45	4	1	9	1	2	3	2	0	0	0	66	946	22
12:00 PM	11	829	52	6	9	15	3	3	3	3	1	0	1	82	1018	44
1:00	20	967	56	6	10	13	1	1	1	5	1	3	3	86	1173	44
2:00	17	919	53	3	5	13	4	4	3	5	1	0	2	103	1132	40
3:00	5	888	44	7	6	10	2	2	3	2	3	1	2	82	1057	38
4:00	19	916	49	6	4	9	3	4	4	3	2	2	4	75	1100	41
5:00	15	880	56	7	6	11	3	5	4	2	3	1	2	78	1073	44
6:00	22	808	26	16	6	12	0	5	1	2	4	1	0	123	1026	47
7:00	8	738	19	1	2	8	0	0	1	5	1	0	2	56	841	20
8:00	8	670	19	3	2	5	1	4	4	11	0	0	1	36	764	31
9:00	2	571	16	1	0	5	0	0	2	7	0	0	1	27	632	16
10:00	5	471	15	0	0	4	0	0	0	7	1	1	0	19	523	13
11:00	4	323	12	0	1	1	0	0	2	9	0	0	0	7	359	13
	1	293	13	0	1	1	0	0	2	6	0	0	0	5	322	10
Total	192	14010	641	81	73	167	29	40	50	82	18	13	32	1117	16545	585
Percent	1.2%	84.7%	3.9%	0.5%	0.4%	1.0%	0.2%	0.2%	0.3%	0.5%	0.1%	0.1%	0.2%	6.8%		3.5%
AM Peak	8:00	7:00	11:00	7:00	8:00	9:00	7:00	7:00	8:00	9:00	7:00	8:00	8:00	9:00	8:00	8:00
	16	1008	52	7	9	18	7	3	8	6	1	2	8	84	1181	50
PM Peak	5:00	12:00 PM	12:00 PM	5:00	12:00 PM	12:00 PM	1:00	4:00	3:00	7:00	5:00	12:00 PM	3:00	5:00	12:00 PM	5:00
	22	967	56	16	10	13	4	5	4	11	4	3	4	123	1173	47

Site Code: ATR501-NB
Station ID:
Location 1: NORTH SOUTH RD - (NB Lanes)
Location 2: CAYMAN COMPASS site
Location 3:
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Direction: Northbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR501-NORTH W2019 - RAW
Date Printed: 12/6/2022
Start Date: 3/17/2019
End Date: 3/24/2019

3/23/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	0	184	1	0	0	0	0	0	0	1	0	0	0	0	186	1
2:00	0	122	3	0	0	0	0	0	3	5	0	0	0	3	136	8
3:00	2	82	1	0	1	0	0	0	6	15	0	0	0	1	108	22
4:00	2	52	1	0	0	0	0	0	0	12	0	0	0	1	68	12
5:00	0	77	2	0	0	0	0	0	0	0	0	0	0	2	81	0
6:00	0	103	2	0	0	0	0	0	0	0	0	0	0	4	109	0
7:00	1	348	21	1	1	1	0	1	1	0	0	0	1	12	388	6
8:00	3	578	40	0	2	6	1	0	4	2	1	1	2	23	663	19
9:00	6	805	33	0	4	8	0	2	1	4	0	0	2	49	914	21
10:00	6	921	33	8	6	12	1	3	3	2	0	1	4	68	1068	40
11:00	11	947	34	1	4	6	2	0	2	4	1	3	0	81	1096	23
12:00 PM	8	953	39	13	7	6	3	7	1	8	0	1	0	101	1147	46
1:00	8	942	30	19	4	13	1	4	0	5	1	2	3	107	1139	52
2:00	5	932	40	1	3	14	1	2	3	4	0	0	1	68	1074	29
3:00	8	915	30	11	3	7	0	3	0	7	0	0	6	83	1073	37
4:00	9	833	29	0	3	8	2	2	4	5	1	1	1	65	963	27
5:00	7	800	45	4	3	5	1	0	3	11	0	1	3	54	937	31
6:00	13	838	19	3	1	7	0	2	3	12	2	0	1	50	951	31
7:00	9	815	18	3	2	8	0	2	1	11	1	0	1	47	918	29
8:00	6	706	17	1	5	6	0	3	3	3	0	0	1	33	784	22
9:00	5	596	18	0	1	2	0	2	2	16	1	0	0	22	665	24
10:00	4	464	15	1	1	2	0	0	1	5	1	0	0	20	514	11
11:00	4	354	5	0	0	1	0	0	1	3	0	0	1	11	380	6
	1	192	6	0	0	0	0	0	1	4	0	1	0	1	206	6
Total	118	13559	482	66	51	112	12	33	43	139	9	11	27	906	15568	503
Percent	0.8%	87.1%	3.1%	0.4%	0.3%	0.7%	0.1%	0.2%	0.3%	0.9%	0.1%	0.1%	0.2%	5.8%		3.2%
AM Peak	10:00	11:00	7:00	11:00	11:00	9:00	11:00	11:00	2:00	2:00	7:00	10:00	9:00	11:00	11:00	11:00
	11	953	40	13	7	12	3	7	6	15	1	3	4	101	1147	46
PM Peak	5:00	12:00 PM	4:00	12:00 PM	7:00	1:00	3:00	12:00 PM	3:00	8:00	5:00	12:00 PM	2:00	12:00 PM	12:00 PM	12:00 PM
	13	942	45	19	5	14	2	4	4	16	2	2	6	107	1139	52

Site Code: ATR501-NB
Station ID:
Location 1: NORTH SOUTH RD - (NB Lanes)
Location 2: CAYMAN COMPASS site
Location 3:
Location 4:
Direction: Northbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR501-NORTH W2019 - RAW
Date Printed: 12/6/2022
Start Date: 3/17/2019
End Date: 3/24/2019

3/24/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	1	168	5	0	0	0	0	0	2	2	0	0	0	2	180	4
2:00	0	89	2	0	0	0	0	0	1	11	0	0	0	0	103	12
3:00	0	38	2	0	0	0	0	0	2	17	0	0	0	0	59	19
4:00	0	26	0	1	1	0	0	0	0	4	0	0	0	1	33	6
5:00	0	43	1	0	0	0	0	0	2	9	0	0	0	0	55	11
6:00	0	82	1	0	0	0	0	0	1	5	0	0	0	0	89	6
7:00	3	178	6	1	1	0	0	0	3	7	0	0	0	12	211	12
8:00	2	295	13	0	0	3	0	0	1	2	1	0	0	18	335	7
9:00	3	451	15	0	0	1	0	1	2	1	0	0	0	13	487	5
10:00	4	591	22	1	0	4	1	2	1	1	0	0	0	27	654	10
11:00	7	624	22	2	1	6	1	0	0	2	0	0	1	40	706	13
12:00 PM	5	376	13	0	0	4	0	0	1	0	1	0	0	41	441	6
1:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
2:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
3:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
4:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
5:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
6:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
7:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
8:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
9:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
10:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
11:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
Total	25	2961	102	5	3	18	2	3	16	61	2	0	1	154	3353	111
Percent	0.7%	88.3%	3.0%	0.1%	0.1%	0.5%	0.1%	0.1%	0.5%	1.8%	0.1%	0.0%	0.0%	4.6%		3.3%
AM Peak	10:00	10:00	9:00	10:00	3:00	10:00	9:00	9:00	6:00	2:00	7:00		10:00	11:00	10:00	2:00
	7	624	22	2	1	6	1	2	3	17	1	*	1	41	706	19
PM Peak																
	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Grand Total	1004	87905	3675	406	395	981	130	233	274	694	89	92	180	6429	102487	3474

Site Code: ATR501-SB
Station ID:
Location 1: NORTH SOUTH RD (SB Lanes)
Location 2: PLAZA VENEZIA
Location 3:
Location 4:

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR501-SOUTH W2019 -
Date Printed: 12/5/2022
Start Date: 3/17/2019
End Date: 3/24/2019

	3/18/2019		Tuesday		Wednesday		Thursday		Friday		Saturday		Sunday		Average Day	
Time	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
12:00	40	300	37	284	26	309	45	287	35	278	101	308	140	*	61	294
12:15	35	279	21	278	46	298	42	281	42	280	80	290	109	*	54	284
12:30	32	293	22	288	29	280	27	302	24	292	58	315	84	*	39	295
12:45	29	292	18	297	23	257	17	293	17	283	54	296	80	*	34	286
1:00	23	293	18	296	15	300	19	289	23	293	58	313	85	*	34	297
1:15	20	307	17	286	17	282	9	295	21	308	41	302	38	*	23	297
1:30	18	271	13	286	15	300	13	287	17	272	48	275	29	*	22	282
1:45	15	302	10	283	5	294	13	276	19	290	72	254	29	*	23	283
2:00	24	279	9	230	11	296	13	288	20	272	51	287	25	*	22	275
2:15	21	296	11	311	5	298	13	291	13	271	59	303	26	*	21	295
2:30	15	293	6	294	12	306	14	289	16	242	55	298	15	*	19	287
2:45	12	313	6	306	14	283	5	290	8	297	42	281	12	*	14	295
3:00	7	305	0	295	4	255	5	286	5	239	25	276	10	*	8	276
3:15	8	297	5	308	5	225	7	271	10	235	34	297	13	*	12	272
3:30	10	267	4	292	9	205	6	270	5	260	32	299	12	*	11	266
3:45	12	281	3	302	7	248	10	309	10	259	47	291	19	*	15	282
4:00	17	307	5	296	4	260	8	307	5	247	17	263	7	*	9	280
4:15	12	258	4	291	7	250	9	233	11	232	21	281	5	*	10	258
4:30	19	261	14	252	10	238	13	274	12	231	17	303	15	*	14	260
4:45	18	258	14	254	16	246	15	255	19	270	20	273	16	*	17	259
5:00	25	227	24	243	23	231	33	240	23	249	17	259	8	*	22	242
5:15	15	207	19	220	25	223	27	254	23	243	17	271	15	*	20	236
5:30	32	255	30	265	33	262	29	278	37	246	21	254	19	*	29	260
5:45	53	274	49	270	51	285	55	281	46	298	28	257	18	*	43	278
6:00	51	271	60	281	66	286	44	264	48	296	34	242	28	*	47	273
6:15	67	252	90	272	91	267	71	279	77	269	35	255	23	*	65	266
6:30	102	257	104	273	110	244	110	265	104	255	58	236	37	*	89	255
6:45	132	223	148	247	136	231	150	261	134	286	81	231	42	*	118	247
7:00	173	270	178	262	190	280	185	275	172	261	91	230	52	*	149	263
7:15	259	226	276	265	252	231	237	255	269	242	86	233	39	*	203	242
7:30	321	190	310	239	323	225	326	220	251	216	121	202	69	*	246	215
7:45	289	186	322	199	283	210	298	232	255	226	135	180	78	*	237	206
8:00	320	166	296	202	279	188	307	192	269	191	152	203	64	*	241	190
8:15	326	187	304	185	302	167	303	160	290	187	176	184	80	*	254	178
8:30	244	173	268	162	276	175	273	166	301	211	170	172	81	*	230	177
8:45	224	167	280	147	290	156	279	159	290	222	205	187	87	*	236	173
9:00	229	125	220	167	203	170	236	186	267	210	224	182	109	*	213	173
9:15	213	143	226	139	258	166	233	162	238	201	200	237	123	*	213	175
9:30	212	109	227	120	219	133	207	126	255	153	243	198	143	*	215	140
9:45	251	105	217	123	229	126	216	136	258	155	247	165	158	*	225	135
10:00	249	108	205	134	223	132	236	102	273	157	276	170	183	*	235	134
10:15	219	89	216	102	203	114	245	100	242	157	263	168	148	*	219	122
10:30	199	69	207	70	246	98	249	123	254	149	239	152	142	*	219	110
10:45	211	70	244	86	255	63	255	86	249	131	263	131	151	*	233	95
11:00	252	45	212	62	246	66	225	63	260	118	274	109	133	*	229	77
11:15	239	55	251	71	261	67	288	74	249	111	254	119	129	*	239	83
11:30	288	42	276	37	269	40	280	61	286	95	299	104	144	*	263	63
11:45	254	37	295	25	287	49	303	56	290	87	292	93	55	*	254	58
Total	5836	10280	5791	10597	5909	10315	6003	10729	6042	10973	5433	11229	3127	0	5449	10687
Day Total	16116		16388		16224		16732		17015		16662		3127		16136	
% Splits	36.2%	63.8%	35.3%	64.7%	36.4%	63.6%	35.9%	64.1%	35.5%	64.5%	32.6%	67.4%	100.0%	0.0%	33.8%	66.2%
Peak	7:30	2:30	7:30	2:15	7:30	1:45	7:30	12:30	8:00	12:30	11:00	12:30	9:30		11:00	12:30
Volume	1256	1208	1232	1206	1187	1194	1234	1179	1150	1176	1119	1226	632		985	1175
Peak Factor	0.963	0.965	0.957	0.969	0.919	0.975	0.946	0.976	0.955	0.955	0.936	0.973	0.863		0.936	0.989

ADT ADT: 16,507 AADT: 16,507

Site Code: ATR501-SB
Station ID:
Location 1: NORTH SOUTH RD (SB Lanes)
Location 2: PLAZA VENEZIA
Location 3:
Location 4:
Direction: Southbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR501-SOUTH W2019 - RAW
Date Printed: 12/6/2022
Start Date: 3/17/2019
End Date: 3/24/2019

3/17/2019 Time	Motor Cycles	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
2:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
3:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
4:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
5:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
6:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
7:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
8:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
9:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
10:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
11:00	1	175	5	1	1	1	1	1	0	0	0	0	0	4	190	5
12:00 PM	7	526	20	0	1	2	1	0	0	0	0	0	0	15	572	4
1:00	3	581	26	0	1	3	0	2	0	0	0	1	0	16	633	7
2:00	8	612	31	0	1	2	0	0	0	0	0	1	0	21	676	4
3:00	2	674	24	0	2	1	1	1	0	1	0	1	0	15	722	7
4:00	1	520	12	0	3	1	0	0	0	0	0	0	1	15	553	5
5:00	3	570	25	0	2	2	0	0	0	0	0	0	0	6	608	4
6:00	2	651	18	0	1	5	1	1	0	1	0	0	0	23	703	9
7:00	6	638	21	1	1	3	1	0	3	7	0	0	0	16	697	16
8:00	6	654	26	0	1	3	2	0	0	6	0	0	0	17	715	12
9:00	0	482	18	2	2	2	1	1	1	5	0	0	0	19	533	14
10:00	2	531	19	0	0	2	0	1	1	5	0	0	0	10	571	9
11:00	1	343	8	0	1	2	0	0	1	0	0	0	0	8	364	4
	1	189	7	0	0	0	0	0	0	0	0	0	0	3	200	0
Total	43	7146	260	4	17	29	8	7	6	25	0	3	1	188	7737	100
Percent	0.6%	92.4%	3.4%	0.1%	0.2%	0.4%	0.1%	0.1%	0.1%	0.3%	0.0%	0.0%	0.0%	2.4%		1.3%
AM Peak	11:00	11:00	11:00	10:00	10:00	11:00	10:00	10:00						11:00	11:00	10:00
	7	526	20	1	1	2	1	1	*	*	*	*	*	15	572	5
PM Peak	1:00	2:00	1:00	8:00	3:00	5:00	7:00	12:00 PM	6:00	6:00		12:00 PM	3:00	5:00	2:00	6:00
	8	674	31	2	3	5	2	2	3	7	*	1	1	23	722	16

Site Code: ATR501-SB
Station ID:
Location 1: NORTH SOUTH RD (SB Lanes)
Location 2: PLAZA VENEZIA
Location 3:
Location 4:
Direction: Southbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR501-SOUTH W2019 - RAW
Date Printed: 12/6/2022
Start Date: 3/17/2019
End Date: 3/24/2019

3/18/2019 Time	Motor Cycles	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	2	122	6	0	0	0	0	0	0	4	0	0	1	1	136	5
2:00	0	64	2	0	0	1	0	0	0	9	0	0	0	0	76	10
3:00	2	47	5	0	0	0	0	0	0	17	0	0	0	1	72	17
4:00	0	21	1	0	1	0	0	0	0	12	0	0	1	1	37	14
5:00	2	45	6	1	1	1	0	0	0	9	0	0	0	1	66	12
6:00	1	102	14	0	2	1	0	1	0	0	0	0	0	4	125	4
7:00	0	307	28	2	5	1	0	0	1	0	0	0	0	8	352	9
8:00	8	899	41	7	4	7	0	2	1	3	2	1	1	66	1042	28
9:00	11	911	65	10	7	10	1	2	5	0	0	0	0	92	1114	35
10:00	6	755	75	5	9	10	1	1	0	2	0	0	0	41	905	28
11:00	11	733	59	3	12	5	4	1	2	1	0	0	1	46	878	29
12:00 PM	11	847	57	5	15	14	3	1	1	0	0	0	1	78	1033	40
1:00	22	917	56	14	13	17	2	2	2	3	0	1	1	114	1164	55
2:00	16	904	57	17	8	11	3	2	4	1	0	3	1	146	1173	50
3:00	23	832	50	30	13	10	2	13	0	3	2	1	2	200	1181	76
4:00	13	874	59	28	8	8	1	2	4	1	0	0	2	150	1150	54
5:00	32	644	34	45	15	20	2	9	11	6	4	3	8	251	1084	123
6:00	38	547	16	60	12	19	2	7	7	4	3	1	9	238	963	124
7:00	7	889	34	4	2	1	4	5	6	3	1	1	0	46	1003	27
8:00	11	774	28	1	2	5	0	3	3	2	1	1	0	41	872	18
9:00	6	635	22	0	1	0	0	0	1	4	0	0	0	24	693	6
10:00	3	450	13	0	0	1	0	0	0	7	0	0	0	8	482	8
11:00	1	305	11	1	1	0	0	0	0	10	0	0	0	7	336	12
	2	160	4	0	1	1	0	1	0	4	0	0	0	6	179	7
Total	228	12784	743	233	132	143	25	52	48	105	13	12	28	1570	16116	791
Percent	1.4%	79.3%	4.6%	1.4%	0.8%	0.9%	0.2%	0.3%	0.3%	0.7%	0.1%	0.1%	0.2%	9.7%		4.9%
AM Peak	8:00	8:00	9:00	8:00	11:00	11:00	10:00	7:00	8:00	2:00	7:00	7:00	12:00 AM	8:00	8:00	11:00
	11	911	75	10	15	14	4	2	5	17	2	1	1	92	1114	40
PM Peak	5:00	12:00 PM	3:00	5:00	4:00	4:00	6:00	2:00	4:00	10:00	4:00	1:00	5:00	4:00	2:00	5:00
	38	917	59	60	15	20	4	13	11	10	4	3	9	251	1181	124

Site Code: ATR501-SB
Station ID:
Location 1: NORTH SOUTH RD (SB Lanes)
Location 2: PLAZA VENEZIA
Location 3:
Location 4:
Direction: Southbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR501-SOUTH W2019 - RAW
Date Printed: 12/6/2022
Start Date: 3/17/2019
End Date: 3/24/2019

3/19/2019 Time	Motor Cycles	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	1	91	3	0	1	0	0	0	0	1	0	0	0	1	98	2
2:00	0	47	2	0	0	0	0	0	0	8	0	0	0	1	58	8
3:00	0	29	2	0	0	1	0	0	0	0	0	0	0	0	32	1
4:00	0	9	0	0	0	0	0	0	0	0	0	0	0	3	12	0
5:00	0	32	5	0	0	0	0	0	0	0	0	0	0	0	37	0
6:00	1	97	17	0	0	0	0	1	1	0	0	0	0	5	122	2
7:00	3	358	25	2	2	6	0	0	0	0	0	0	0	6	402	10
8:00	10	946	47	11	9	10	0	1	2	0	0	0	0	50	1086	33
9:00	8	930	57	9	17	5	0	1	5	3	1	2	0	110	1148	43
10:00	7	770	42	2	8	11	1	2	1	1	1	1	0	43	890	28
11:00	4	738	65	3	7	7	0	2	2	1	0	0	0	43	872	22
12:00 PM	6	875	64	7	11	10	0	0	3	2	2	0	0	54	1034	35
1:00	15	921	64	15	7	18	1	3	3	2	0	1	0	97	1147	50
2:00	18	895	45	19	6	12	0	6	4	3	2	1	1	139	1151	54
3:00	27	785	57	27	11	15	1	10	3	1	1	0	0	203	1141	69
4:00	18	897	56	30	19	8	0	4	5	3	1	0	2	154	1197	72
5:00	32	614	37	46	17	11	5	12	8	5	6	3	4	293	1093	117
6:00	25	673	23	43	10	11	3	7	5	4	1	1	2	190	998	87
7:00	9	943	31	6	3	6	4	2	1	5	0	1	0	62	1073	28
8:00	6	857	26	2	3	4	1	1	3	9	0	0	1	52	965	24
9:00	2	616	18	1	1	0	0	1	3	14	0	0	0	40	696	20
10:00	5	493	17	2	2	2	0	0	2	11	0	0	1	14	549	20
11:00	2	344	13	2	0	2	0	0	3	17	0	0	0	9	392	24
	1	185	3	0	2	0	0	0	0	3	0	0	0	1	195	5
Total	200	13145	719	227	136	139	16	53	54	93	15	10	11	1570	16388	754
Percent	1.2%	80.2%	4.4%	1.4%	0.8%	0.8%	0.1%	0.3%	0.3%	0.6%	0.1%	0.1%	0.1%	9.6%		4.6%
AM Peak	7:00	7:00	10:00	7:00	8:00	9:00	9:00	9:00	8:00	1:00	11:00	8:00		8:00	8:00	8:00
	10	946	65	11	17	11	1	2	5	8	2	2	*	110	1148	43
PM Peak	4:00	6:00	12:00 PM	4:00	3:00	12:00 PM	4:00	4:00	4:00	10:00	4:00	4:00	4:00	4:00	3:00	4:00
	32	943	64	46	19	18	5	12	8	17	6	3	4	293	1197	117

Site Code: ATR501-SB
Station ID:
Location 1: NORTH SOUTH RD (SB Lanes)
Location 2: PLAZA VENEZIA
Location 3:
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Direction: Southbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR501-SOUTH W2019 - RAW
Date Printed: 12/6/2022
Start Date: 3/17/2019
End Date: 3/24/2019

3/20/2019 Time	Motor Cycles	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	3	112	3	0	2	0	0	0	0	0	0	0	0	4	124	2
2:00	1	47	2	0	0	1	0	0	0	0	0	0	0	1	52	1
3:00	0	38	3	0	0	1	0	0	0	0	0	0	0	0	42	1
4:00	2	19	3	0	0	0	0	0	0	0	0	0	0	1	25	0
5:00	0	35	1	0	0	1	0	0	0	0	0	0	0	0	37	1
6:00	0	112	17	0	0	0	0	1	0	0	0	0	0	2	132	1
7:00	0	359	20	1	3	4	0	1	0	1	0	0	0	14	403	10
8:00	7	883	41	6	8	9	0	5	1	2	1	2	0	83	1048	34
9:00	14	957	60	14	8	11	1	6	6	1	0	0	1	68	1147	48
10:00	6	776	47	7	9	12	4	3	1	1	0	0	0	43	909	37
11:00	6	800	62	0	9	9	0	2	1	0	0	0	0	38	927	21
12:00 PM	12	889	57	7	12	12	1	3	0	1	1	0	1	67	1063	38
1:00	13	872	57	29	12	9	0	7	4	1	1	2	1	136	1144	66
2:00	19	838	47	37	10	15	2	6	2	5	1	1	2	191	1176	81
3:00	19	890	56	22	15	15	3	8	4	2	0	0	0	149	1183	69
4:00	62	375	39	61	26	29	0	8	4	2	1	1	6	319	933	138
5:00	36	474	36	66	29	16	1	16	12	3	7	3	3	292	994	156
6:00	35	594	31	34	13	16	3	12	5	7	4	2	6	239	1001	102
7:00	17	880	29	13	4	3	0	3	2	4	0	0	1	72	1028	30
8:00	8	820	32	4	3	4	2	2	1	16	0	1	1	52	946	34
9:00	3	623	25	0	2	2	1	0	2	14	0	0	0	14	686	21
10:00	3	543	18	2	0	2	0	0	4	9	0	0	1	13	595	18
11:00	4	386	11	0	0	0	0	0	1	0	0	0	0	5	407	1
	1	210	6	0	0	2	0	0	0	0	0	0	0	3	222	2
Total	271	12532	703	303	165	173	18	83	50	69	16	12	23	1806	16224	912
Percent	1.7%	77.2%	4.3%	1.9%	1.0%	1.1%	0.1%	0.5%	0.3%	0.4%	0.1%	0.1%	0.1%	11.1%		5.6%
AM Peak	8:00	8:00	10:00	8:00	11:00	9:00	9:00	8:00	8:00	7:00	7:00	7:00	8:00	7:00	8:00	8:00
	14	957	62	14	12	12	4	6	6	2	1	2	1	83	1147	48
PM Peak	3:00	2:00	12:00 PM	4:00	4:00	3:00	2:00	4:00	4:00	7:00	4:00	4:00	3:00	3:00	2:00	4:00
	62	890	57	66	29	29	3	16	12	16	7	3	6	319	1183	156

Site Code: ATR501-SB
Station ID:
Location 1: NORTH SOUTH RD (SB Lanes)
Location 2: PLAZA VENEZIA
Location 3:
Location 4:
Direction: Southbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR501-SOUTH W2019 - RAW
Date Printed: 12/6/2022
Start Date: 3/17/2019
End Date: 3/24/2019

3/21/2019 Time	Motor Cycles	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	2	125	1	0	1	0	0	0	0	0	0	0	0	2	131	1
2:00	0	53	1	0	0	0	0	0	0	0	0	0	0	0	54	0
3:00	1	42	2	0	0	0	0	0	0	0	0	0	0	0	45	0
4:00	0	26	1	0	0	0	0	0	0	0	0	0	0	1	28	0
5:00	3	38	1	0	0	1	0	0	0	0	0	0	0	2	45	1
6:00	0	115	19	0	1	1	0	3	0	0	0	0	0	5	144	5
7:00	0	334	22	1	2	4	0	0	0	0	0	0	0	12	375	7
8:00	7	890	43	10	10	4	0	5	3	1	0	0	0	73	1046	33
9:00	17	945	65	16	13	10	1	5	2	0	0	0	3	85	1162	50
10:00	8	739	64	4	11	15	0	3	2	3	2	2	0	39	892	42
11:00	10	823	71	5	9	8	1	0	1	2	0	0	0	55	985	26
12:00 PM	11	900	80	4	7	9	2	4	5	1	0	0	1	72	1096	33
1:00	10	900	55	27	14	6	1	5	2	2	1	0	0	140	1163	58
2:00	18	780	35	28	18	19	1	13	5	4	0	0	1	225	1147	89
3:00	16	827	42	45	14	12	0	4	8	3	0	0	1	186	1158	87
4:00	21	763	39	37	15	14	2	10	6	2	2	2	5	218	1136	95
5:00	31	604	30	56	13	21	3	8	6	4	4	0	7	282	1069	122
6:00	18	680	20	44	14	17	2	15	8	3	4	1	6	221	1053	114
7:00	9	962	34	3	2	6	1	0	0	1	0	1	0	50	1069	14
8:00	8	889	32	6	1	3	2	5	0	2	1	2	0	31	982	22
9:00	5	627	22	0	2	4	0	0	0	1	0	0	0	16	677	7
10:00	4	580	14	0	0	1	0	0	0	1	0	0	0	10	610	2
11:00	3	375	14	0	1	3	0	0	0	0	0	0	0	15	411	4
	2	241	9	0	0	0	0	0	0	1	0	0	0	1	254	1
Total	204	13258	716	286	148	158	16	80	48	31	14	8	24	1741	16732	813
Percent	1.2%	79.2%	4.3%	1.7%	0.9%	0.9%	0.1%	0.5%	0.3%	0.2%	0.1%	0.0%	0.1%	10.4%		4.9%
AM Peak	8:00	8:00	11:00	8:00	8:00	9:00	11:00	7:00	11:00	9:00	9:00	9:00	8:00	8:00	8:00	8:00
	17	945	80	16	13	15	2	5	5	3	2	2	3	85	1162	50
PM Peak	4:00	6:00	12:00 PM	4:00	1:00	4:00	4:00	5:00	2:00	1:00	4:00	3:00	4:00	4:00	12:00 PM	4:00
	31	962	55	56	18	21	3	15	8	4	4	2	7	282	1163	122

Site Code: ATR501-SB
Station ID:
Location 1: NORTH SOUTH RD (SB Lanes)
Location 2: PLAZA VENEZIA
Location 3:
Location 4:
Direction: Southbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR501-SOUTH W2019 - RAW
Date Printed: 12/6/2022
Start Date: 3/17/2019
End Date: 3/24/2019

3/22/2019 Time	Motor Cycles	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	1	109	5	0	0	0	0	0	0	0	0	0	0	3	118	0
2:00	1	70	6	0	0	2	0	0	0	0	0	0	0	1	80	2
3:00	0	55	2	0	0	0	0	0	0	0	0	0	0	0	57	0
4:00	1	26	2	0	0	0	0	0	0	0	0	0	0	1	30	0
5:00	0	9	1	0	0	0	0	0	0	0	0	0	0	37	47	0
6:00	2	40	5	0	0	1	0	0	0	0	0	0	0	81	129	1
7:00	1	310	22	1	5	6	0	1	0	0	0	0	0	17	363	13
8:00	4	841	34	3	7	7	0	1	1	2	2	0	0	45	947	23
9:00	12	985	44	6	11	10	0	1	2	1	0	0	0	78	1150	31
10:00	10	848	71	6	6	20	0	4	4	1	1	0	0	47	1018	42
11:00	12	804	83	6	14	15	0	2	2	1	0	0	1	78	1018	41
12:00 PM	16	815	57	17	19	13	0	5	4	3	1	1	2	132	1085	65
1:00	18	862	71	12	9	13	0	7	1	3	0	1	0	136	1133	46
2:00	21	818	52	42	21	6	0	7	2	1	3	1	2	187	1163	85
3:00	27	600	48	39	27	18	1	7	2	2	2	1	3	305	1082	102
4:00	37	471	35	52	25	10	3	16	7	4	3	2	6	322	993	128
5:00	42	463	33	70	17	27	2	11	7	7	3	1	4	293	980	149
6:00	39	567	25	56	14	18	1	11	6	4	2	1	5	287	1036	118
7:00	13	875	52	21	10	12	1	3	1	8	0	0	0	110	1106	56
8:00	10	834	36	2	6	2	2	4	1	4	0	0	1	43	945	22
9:00	8	722	26	0	6	2	0	3	1	7	2	1	0	33	811	22
10:00	5	644	35	0	1	2	0	1	0	5	1	0	0	25	719	10
11:00	3	527	32	0	2	1	0	1	3	7	0	0	1	17	594	15
	3	379	16	0	1	0	0	0	1	2	0	0	0	9	411	4
Total	286	12674	793	333	201	185	10	85	45	62	20	9	25	2287	17015	975
Percent	1.7%	74.5%	4.7%	2.0%	1.2%	1.1%	0.1%	0.5%	0.3%	0.4%	0.1%	0.1%	0.1%	13.4%		5.7%
AM Peak	11:00	8:00	10:00	11:00	11:00	9:00		11:00	9:00	11:00	7:00	11:00	11:00	11:00	8:00	11:00
	16	985	83	17	19	20	*	5	4	3	2	1	2	132	1150	65
PM Peak	4:00	6:00	12:00 PM	4:00	2:00	4:00	3:00	3:00	3:00	6:00	1:00	3:00	3:00	3:00	1:00	4:00
	42	875	71	70	27	27	3	16	7	8	3	2	6	322	1163	149

Site Code: ATR501-SB
Station ID:
Location 1: NORTH SOUTH RD (SB Lanes)
Location 2: PLAZA VENEZIA
Location 3:
Location 4:
Direction: Southbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR501-SOUTH W2019 - RAW
Date Printed: 12/6/2022
Start Date: 3/17/2019
End Date: 3/24/2019

3/23/2019 Time	Motor Cycles	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	1	269	15	0	0	1	0	0	0	2	0	0	0	5	293	3
2:00	0	195	9	0	0	2	0	0	2	7	0	0	0	4	219	11
3:00	2	173	11	0	0	3	0	0	2	10	0	0	1	5	207	16
4:00	2	115	7	0	0	0	0	0	1	12	0	0	0	1	138	13
5:00	0	64	10	0	0	0	0	0	0	0	0	0	0	1	75	0
6:00	1	69	6	0	2	1	0	1	0	0	0	0	0	3	83	4
7:00	1	177	20	0	2	4	0	1	0	0	0	0	0	3	208	7
8:00	6	361	42	0	9	1	0	1	0	1	0	0	0	12	433	12
9:00	2	599	42	3	12	5	1	2	4	0	0	0	0	33	703	27
10:00	4	764	61	6	15	7	0	5	3	0	1	0	0	48	914	37
11:00	10	861	73	6	13	6	1	3	3	2	0	0	1	62	1041	35
12:00 PM	6	926	70	11	9	11	0	5	1	2	1	0	0	77	1119	40
1:00	8	951	83	16	13	6	2	5	0	4	0	1	1	119	1209	48
2:00	16	962	67	9	13	8	2	3	0	0	0	0	0	64	1144	35
3:00	9	982	70	13	6	0	3	1	0	2	0	1	2	80	1169	28
4:00	12	924	67	18	13	3	2	2	3	4	5	1	0	109	1163	51
5:00	8	972	74	4	7	3	0	3	2	7	1	0	1	38	1120	28
6:00	13	881	69	3	8	3	0	2	2	5	0	0	1	54	1041	24
7:00	3	855	39	3	2	6	2	1	1	7	1	1	1	42	964	25
8:00	5	744	43	1	6	2	0	0	3	5	0	0	1	35	845	18
9:00	4	663	24	1	5	5	0	2	2	12	0	0	1	27	746	28
10:00	5	707	36	0	4	3	0	0	0	6	0	0	0	21	782	13
11:00	1	547	40	0	1	2	1	2	3	6	0	0	1	17	621	16
	3	387	17	0	2	0	0	0	1	4	0	0	0	11	425	7
Total	122	14148	995	94	142	82	14	39	33	98	9	4	11	871	16662	526
Percent	0.7%	84.9%	6.0%	0.6%	0.9%	0.5%	0.1%	0.2%	0.2%	0.6%	0.1%	0.0%	0.1%	5.2%		3.2%
AM Peak	10:00	11:00	10:00	11:00	9:00	11:00	8:00	9:00	8:00	3:00	9:00		2:00	11:00	11:00	11:00
	10	926	73	11	15	11	1	5	4	12	1	*	1	77	1119	40
PM Peak	1:00	2:00	12:00 PM	3:00	12:00 PM	1:00	2:00	12:00 PM	3:00	8:00	3:00	12:00 PM	2:00	12:00 PM	12:00 PM	3:00
	16	982	83	18	13	8	3	5	3	12	5	1	2	119	1209	51

Site Code: ATR501-SB
Station ID:
Location 1: NORTH SOUTH RD (SB Lanes)
Location 2: PLAZA VENEZIA
Location 3:
Location 4:
Direction: Southbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR501-SOUTH W2019 - RAW
Date Printed: 12/6/2022
Start Date: 3/17/2019
End Date: 3/24/2019

3/24/2019 Time	Motor Cycles	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	3	365	21	0	2	1	0	2	2	5	0	0	0	12	413	12
2:00	1	144	11	0	3	0	0	0	0	12	0	0	0	10	181	15
3:00	0	58	3	0	0	0	0	0	2	13	0	0	0	2	78	15
4:00	0	36	3	0	2	0	0	0	1	8	0	0	0	4	54	11
5:00	0	27	3	0	0	0	0	0	2	7	0	0	1	3	43	10
6:00	1	37	6	1	0	0	0	1	2	6	0	0	0	6	60	10
7:00	1	102	10	0	3	0	0	0	1	7	0	0	1	5	130	12
8:00	3	213	11	0	3	0	0	4	0	0	0	0	0	4	238	7
9:00	1	279	25	0	2	1	0	1	0	0	0	0	0	3	312	4
10:00	4	472	42	0	4	2	0	1	0	0	0	0	0	8	533	7
11:00	2	555	43	0	7	1	1	0	0	0	0	0	0	15	624	9
12:00 PM	4	401	30	1	3	1	0	0	0	1	0	0	0	20	461	6
1:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
2:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
3:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
4:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
5:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
6:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
7:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
8:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
9:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
10:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
11:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
Total	20	2689	208	2	29	6	1	9	10	59	0	0	2	92	3127	118
Percent	0.6%	86.0%	6.7%	0.1%	0.9%	0.2%	0.0%	0.3%	0.3%	1.9%	0.0%	0.0%	0.1%	2.9%		3.8%
AM Peak	9:00	10:00	10:00	5:00	10:00	9:00	10:00	7:00	12:00 AM	2:00			4:00	11:00	10:00	1:00
	4	555	43	1	7	2	1	4	2	13	*	*	1	20	624	15
PM Peak																
	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Grand Total	1374	88376	5137	1482	970	915	108	408	294	542	87	58	125	10125	110001	4989

Site Code: ATR303-EB
Station ID:
Location 1: GODFREY NIXON WAY (EB
Location 2: AT BLDG # 29
Location 3:
Location 4:

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR303-EAST W2019 -
Date Printed: 12/5/2022
Start Date: 4/7/2019
End Date: 4/14/2019

	4/8/2019		Tuesday		Wednesday		Thursday		Friday		Saturday		Sunday		Average Day	
Time	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
12:00	18	171	13	169	6	165	13	161	20	184	43	165	36	*	21	169
12:15	17	187	11	175	9	197	13	154	17	169	22	155	51	*	20	173
12:30	13	163	10	194	14	173	10	189	17	186	35	178	41	*	20	181
12:45	9	168	5	203	4	181	11	196	5	183	27	173	27	*	13	184
1:00	14	191	6	187	8	187	3	189	6	194	26	149	10	*	10	183
1:15	7	193	5	191	9	181	4	182	5	178	32	169	14	*	11	182
1:30	6	179	5	188	12	167	6	169	5	190	25	165	13	*	10	176
1:45	8	182	6	174	3	200	9	180	6	192	23	152	11	*	9	180
2:00	8	169	9	174	7	159	5	179	10	177	24	176	6	*	10	172
2:15	5	161	3	179	3	135	8	140	5	175	38	165	9	*	10	159
2:30	4	197	2	160	4	181	8	151	7	169	21	170	2	*	7	171
2:45	2	139	2	158	8	171	6	154	1	193	26	182	5	*	7	166
3:00	3	155	4	175	3	174	6	165	2	204	19	138	4	*	6	169
3:15	6	149	6	149	5	161	6	154	1	191	24	154	4	*	7	160
3:30	10	161	9	149	6	140	6	162	4	177	17	143	3	*	8	155
3:45	8	149	12	177	8	161	5	154	3	168	17	137	5	*	8	158
4:00	13	160	6	177	2	144	2	166	10	170	11	154	5	*	7	162
4:15	6	176	6	149	3	155	5	158	2	181	7	148	4	*	5	161
4:30	8	146	6	174	6	148	10	149	9	176	14	125	5	*	8	153
4:45	11	163	13	149	15	152	12	157	24	177	25	155	13	*	16	159
5:00	13	203	18	183	18	172	13	161	19	205	15	166	11	*	15	182
5:15	16	171	9	169	14	169	13	150	20	182	11	145	6	*	13	164
5:30	22	162	12	151	18	140	20	134	24	174	27	142	9	*	19	151
5:45	25	144	29	118	34	140	37	128	35	167	18	152	11	*	27	142
6:00	38	121	34	116	35	134	42	129	38	154	33	146	19	*	34	133
6:15	52	135	58	109	49	130	59	110	53	141	40	157	18	*	47	130
6:30	81	125	98	141	98	121	112	105	109	138	57	147	35	*	84	130
6:45	147	145	142	123	140	126	137	110	132	125	97	164	34	*	118	132
7:00	103	137	93	107	133	126	106	121	101	112	74	132	37	*	92	123
7:15	135	128	129	117	140	115	126	112	140	145	76	139	37	*	112	126
7:30	127	121	148	93	142	105	134	116	144	106	96	120	50	*	120	110
7:45	150	113	150	115	144	63	176	110	153	123	110	112	55	*	134	106
8:00	101	99	140	105	144	96	129	84	122	115	105	116	48	*	113	103
8:15	144	83	119	68	133	86	155	93	149	79	96	100	50	*	121	85
8:30	121	95	130	76	126	62	113	100	127	100	127	94	56	*	114	88
8:45	131	92	143	71	136	60	143	97	139	103	144	99	56	*	127	87
9:00	109	69	107	77	138	69	111	77	125	98	125	76	69	*	112	78
9:15	112	73	96	57	106	67	120	64	130	96	119	83	80	*	109	73
9:30	136	73	126	54	95	54	141	69	128	91	160	68	77	*	123	68
9:45	142	47	149	64	124	54	120	66	119	90	134	87	94	*	126	68
10:00	112	60	133	62	127	54	114	57	125	79	172	79	82	*	124	65
10:15	164	43	158	48	125	38	138	53	156	79	161	74	64	*	138	56
10:30	137	47	131	32	128	42	121	43	143	60	137	67	0	*	114	49
10:45	150	32	132	29	150	25	122	38	142	63	176	57	0	*	125	41
11:00	148	38	120	24	126	24	134	20	143	48	172	44	*	*	141	33
11:15	151	15	129	17	144	29	146	29	163	62	173	44	*	*	151	33
11:30	136	23	163	21	149	14	151	19	167	61	182	43	*	*	158	30
11:45	167	15	149	26	157	10	152	14	152	41	148	33	*	*	154	23
Total	3246	5968	3184	5824	3208	5657	3233	5718	3357	6671	3461	6039	1266	0	3080	5980
Day Total	9214		9008		8865		8951		10028		9500		1266		9059	
% Splits	35.2%	64.8%	35.3%	64.7%	36.2%	63.8%	36.1%	63.9%	33.5%	66.5%	36.4%	63.6%	100.0%	0.0%	34.0%	66.0%
Peak	11:00	1:00	9:45	12:30	11:00	12:15	7:30	12:30	11:00	2:45	10:45	2:00	9:15		11:00	12:30
Volume	602	745	571	775	576	738	594	756	625	765	703	693	333		603	729
Peak Factor	0.901	0.965	0.903	0.954	0.917	0.937	0.844	0.964	0.936	0.938	0.966	0.952	0.886		0.954	0.990

ADT ADT: 9,218 AADT: 9,218

Site Code: ATR303-EB
Station ID:
Location 1: GODFREY NIXON WAY (EB Lanes)
Location 2: AT BLDG # 29
Location 3:
Location 4:
Direction: Eastbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR303-EAST W2019 - RAW
Date Printed: 12/6/2022
Start Date: 4/7/2019
End Date: 4/14/2019

4/7/2019 Time	Motor Cycles	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
2:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
3:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
4:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
5:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
6:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
7:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
8:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
9:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
10:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
11:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
12:00 PM	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
1:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
2:00	0	19	3	0	0	0	0	0	0	0	0	0	0	3	25	0
3:00	1	369	17	0	0	1	0	0	0	0	0	0	0	0	388	1
4:00	0	302	16	0	1	1	0	0	0	0	0	0	0	4	324	2
5:00	1	280	14	0	0	3	0	0	1	0	0	0	0	1	300	4
6:00	1	259	8	0	1	14	1	0	2	0	0	0	0	5	291	18
7:00	0	299	14	0	0	16	2	0	3	0	0	0	0	2	336	21
8:00	2	300	10	0	1	15	2	0	3	1	0	0	0	6	340	22
9:00	0	269	14	0	0	12	2	0	3	0	0	0	0	1	301	17
10:00	2	257	11	0	0	0	0	0	1	0	0	0	0	4	275	1
11:00	2	213	8	0	0	1	0	0	0	0	1	0	0	1	226	2
	0	82	1	0	0	0	0	0	0	0	0	0	0	0	83	0
Total	9	2649	116	0	3	63	7	0	13	1	1	0	0	27	2889	88
Percent	0.3%	91.7%	4.0%	0.0%	0.1%	2.2%	0.2%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	0.9%		3.0%
AM Peak																
	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
PM Peak	7:00	2:00	2:00		3:00	6:00	6:00		6:00	7:00	10:00			7:00	2:00	7:00
	2	369	17	*	1	16	2	*	3	1	1	*	*	6	388	22

Site Code: ATR303-EB
Station ID:
Location 1: GODFREY NIXON WAY (EB Lanes)
Location 2: AT BLDG # 29
Location 3:
Location 4:
Direction: Eastbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR303-EAST W2019 - RAW
Date Printed: 12/6/2022
Start Date: 4/7/2019
End Date: 4/14/2019

4/8/2019 Time	Motor Cycles	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	0	55	1	0	0	0	0	0	0	0	0	0	0	1	57	0
2:00	0	32	3	0	0	0	0	0	0	0	0	0	0	0	35	0
3:00	0	18	1	0	0	0	0	0	0	0	0	0	0	0	19	0
4:00	0	27	0	0	0	0	0	0	0	0	0	0	0	0	27	0
5:00	0	34	2	0	0	2	0	0	0	0	0	0	0	0	38	2
6:00	0	72	2	0	1	1	0	0	0	0	0	0	0	0	76	2
7:00	1	282	19	4	2	1	1	1	1	0	0	0	0	5	317	10
8:00	3	452	42	1	1	1	0	0	0	0	1	0	0	14	515	4
9:00	2	449	26	3	2	1	0	0	0	0	1	0	0	12	496	7
10:00	0	447	39	0	3	4	0	1	2	0	0	0	0	3	499	10
11:00	1	496	43	4	4	1	0	4	3	0	0	0	0	7	563	16
12:00 PM	2	512	59	1	12	5	0	0	1	1	2	0	0	7	602	22
1:00	2	608	46	2	4	4	0	1	2	0	0	0	0	18	687	13
2:00	5	649	43	6	4	1	0	4	3	0	1	0	0	28	744	19
3:00	0	595	43	1	8	2	0	3	3	0	0	0	0	10	665	17
4:00	1	556	30	1	6	2	0	2	2	0	1	0	0	13	614	14
5:00	1	543	41	3	5	17	2	3	7	1	2	0	0	15	640	40
6:00	1	600	17	2	4	22	1	2	5	2	0	0	0	17	673	38
7:00	0	453	18	0	1	23	0	0	11	0	0	0	0	14	520	35
8:00	0	457	9	0	0	15	1	0	7	0	1	0	0	9	499	24
9:00	0	337	14	0	0	10	0	0	7	0	0	0	0	1	369	17
10:00	0	234	8	0	0	11	0	0	5	0	0	0	0	4	262	16
11:00	0	160	6	1	2	5	0	0	3	0	0	0	0	2	179	11
	0	80	2	0	0	6	0	0	3	0	0	0	0	0	91	9
Total	19	8148	514	29	59	134	5	21	65	4	9	0	0	180	9187	326
Percent	0.2%	88.7%	5.6%	0.3%	0.6%	1.5%	0.1%	0.2%	0.7%	0.0%	0.1%	0.0%	0.0%	2.0%		3.5%
AM Peak	7:00	11:00	11:00	6:00	11:00	11:00	6:00	10:00	10:00	11:00	11:00			7:00	11:00	11:00
	3	512	59	4	12	5	1	4	3	1	2	*	*	14	602	22
PM Peak	1:00	1:00	12:00 PM	1:00	2:00	6:00	4:00	1:00	6:00	5:00	4:00			1:00	1:00	4:00
	5	649	46	6	8	23	2	4	11	2	2	*	*	28	744	40

Site Code: ATR303-EB
Station ID:
Location 1: GODFREY NIXON WAY (EB Lanes)
Location 2: AT BLDG # 29
Location 3:
Location 4:
Direction: Eastbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR303-EAST W2019 - RAW
Date Printed: 12/6/2022
Start Date: 4/7/2019
End Date: 4/14/2019

4/9/2019 Time	Motor Cycles	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	0	33	0	0	0	5	0	0	1	0	0	0	0	0	39	6
2:00	0	12	0	0	0	6	0	0	4	0	0	0	0	0	22	10
3:00	0	11	1	0	0	3	0	0	1	0	0	0	0	0	16	4
4:00	0	28	2	0	1	0	0	0	0	0	0	0	0	0	31	1
5:00	0	27	0	0	0	2	0	0	0	2	0	0	0	0	31	4
6:00	0	62	2	0	0	3	0	0	1	0	0	0	0	0	68	4
7:00	0	297	21	0	4	3	0	1	1	0	1	0	0	4	332	10
8:00	1	474	31	1	0	2	0	2	0	0	0	0	0	8	519	5
9:00	3	472	39	0	5	3	0	0	2	0	1	0	0	7	532	11
10:00	3	411	36	4	1	5	0	3	3	1	1	1	0	8	477	19
11:00	2	500	42	1	2	0	0	0	3	0	0	0	0	4	554	6
12:00 PM	1	500	42	1	6	3	0	0	1	0	0	0	1	6	561	12
1:00	4	659	43	6	6	2	0	4	1	0	0	0	0	15	740	19
2:00	3	665	38	5	4	3	0	3	0	0	1	0	0	17	739	16
3:00	5	601	42	1	3	1	0	3	1	0	0	0	0	13	670	9
4:00	1	583	37	1	10	0	0	0	2	0	3	0	0	12	649	16
5:00	6	578	36	0	5	3	0	2	6	0	0	0	0	11	647	16
6:00	1	581	21	1	1	1	0	2	2	0	1	0	0	10	621	8
7:00	1	451	22	2	0	2	0	1	0	0	1	0	0	7	487	6
8:00	2	404	20	1	1	0	0	0	0	0	0	0	1	3	432	3
9:00	0	309	8	0	0	1	0	0	0	0	0	0	0	2	320	1
10:00	0	240	7	0	0	1	0	0	1	0	0	0	0	3	252	2
11:00	0	164	6	0	0	0	0	0	0	1	0	0	0	0	171	1
	0	87	1	0	0	0	0	0	0	0	0	0	0	0	88	0
Total	33	8149	497	24	49	49	0	21	30	4	9	1	2	130	8998	189
Percent	0.4%	90.6%	5.5%	0.3%	0.5%	0.5%	0.0%	0.2%	0.3%	0.0%	0.1%	0.0%	0.0%	1.4%		2.1%
AM Peak	8:00	10:00	10:00	9:00	11:00	1:00		9:00	1:00	4:00	6:00	9:00	11:00	7:00	11:00	9:00
	3	500	42	4	6	6	*	3	4	2	1	1	1	8	561	19
PM Peak	4:00	1:00	12:00 PM	12:00 PM	3:00	1:00		12:00 PM	4:00	10:00	3:00		7:00	1:00	12:00 PM	12:00 PM
	6	665	43	6	10	3	*	4	6	1	3	*	1	17	740	19

Site Code: ATR303-EB
Station ID:
Location 1: GODFREY NIXON WAY (EB Lanes)
Location 2: AT BLDG # 29
Location 3:
Location 4:
Direction: Eastbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR303-EAST W2019 - RAW
Date Printed: 12/6/2022
Start Date: 4/7/2019
End Date: 4/14/2019

4/10/2019 Time	Motor Cycles	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	0	33	0	0	0	0	0	0	0	0	0	0	0	0	33	0
2:00	0	29	3	0	0	0	0	0	0	0	0	0	0	0	32	0
3:00	0	21	0	0	1	0	0	0	0	0	0	0	0	0	22	1
4:00	0	19	1	0	0	1	0	0	0	0	0	0	0	1	22	1
5:00	0	25	0	0	0	1	0	0	0	0	0	0	0	0	26	1
6:00	0	76	3	0	0	5	0	0	0	0	0	0	0	0	84	5
7:00	2	292	16	1	2	4	0	0	0	0	1	0	0	3	321	8
8:00	3	492	50	0	2	2	0	1	0	0	1	0	0	6	557	6
9:00	0	478	36	2	7	3	0	0	0	0	1	0	0	11	538	13
10:00	1	403	34	1	5	7	0	3	1	1	0	0	0	7	463	18
11:00	1	470	38	1	5	3	0	1	2	1	0	0	1	7	530	14
12:00 PM	1	518	32	1	5	2	0	0	3	0	2	0	0	10	574	13
1:00	2	625	43	4	5	0	0	1	4	1	3	0	0	25	713	18
2:00	0	606	38	12	4	1	0	4	5	0	1	0	0	60	731	27
3:00	0	572	50	2	2	1	0	0	2	0	0	0	0	17	646	7
4:00	1	563	40	3	8	2	0	1	2	0	4	0	0	12	636	20
5:00	2	535	32	1	6	4	0	0	2	0	2	0	0	15	599	15
6:00	1	570	26	2	5	0	0	0	0	0	3	0	0	13	620	10
7:00	0	486	20	0	1	0	0	0	1	0	0	0	0	2	510	2
8:00	1	344	17	0	0	0	0	0	0	0	0	0	0	27	389	0
9:00	0	283	10	0	1	0	0	0	0	1	0	0	0	8	303	2
10:00	0	240	3	0	0	0	0	0	0	0	0	0	0	1	244	0
11:00	0	151	6	0	1	0	0	0	0	0	0	0	0	1	159	1
	0	72	5	0	0	0	0	0	0	0	0	0	0	0	77	0
Total	15	7903	503	30	60	36	0	11	22	4	18	0	1	226	8829	182
Percent	0.2%	89.5%	5.7%	0.3%	0.7%	0.4%	0.0%	0.1%	0.2%	0.0%	0.2%	0.0%	0.0%	2.6%		2.1%
AM Peak	7:00	11:00	7:00	8:00	8:00	9:00		9:00	11:00	9:00	11:00		10:00	8:00	11:00	9:00
	3	518	50	2	7	7	*	3	3	1	2	*	1	11	574	18
PM Peak	12:00 PM	12:00 PM	2:00	1:00	3:00	4:00		1:00	1:00	12:00 PM	3:00			1:00	1:00	1:00
	2	625	50	12	8	4	*	4	5	1	4	*	*	60	731	27

Site Code: ATR303-EB
Station ID:
Location 1: GODFREY NIXON WAY (EB Lanes)
Location 2: AT BLDG # 29
Location 3:
Location 4:
Direction: Eastbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR303-EAST W2019 - RAW
Date Printed: 12/6/2022
Start Date: 4/7/2019
End Date: 4/14/2019

4/11/2019 Time	Motor Cycles	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	0	44	3	0	0	0	0	0	0	0	0	0	0	0	47	0
2:00	0	22	0	0	0	0	0	0	0	0	0	0	0	0	22	0
3:00	0	24	2	0	0	1	0	0	0	0	0	0	0	0	27	1
4:00	0	21	2	0	0	0	0	0	0	0	0	0	0	0	23	0
5:00	0	27	2	0	0	0	0	0	0	0	0	0	0	0	29	0
6:00	0	74	6	0	1	2	0	0	0	0	0	0	0	0	83	3
7:00	1	312	23	1	2	6	0	0	1	0	0	0	0	3	349	10
8:00	2	482	44	0	2	2	0	0	1	0	1	0	0	8	542	6
9:00	0	496	26	4	3	1	0	3	2	0	0	0	0	5	540	13
10:00	2	433	41	2	5	2	0	1	2	0	1	0	0	3	492	13
11:00	1	445	43	0	1	0	0	0	1	0	0	0	0	4	495	2
12:00 PM	2	514	48	3	4	1	0	0	2	0	1	0	0	8	583	11
1:00	3	624	38	6	4	2	0	1	2	1	1	0	0	18	700	17
2:00	0	590	39	13	7	3	0	3	1	0	1	0	0	58	715	28
3:00	0	552	43	1	6	1	0	1	2	0	1	0	0	16	623	12
4:00	3	568	35	5	6	2	0	2	4	1	1	0	0	7	634	21
5:00	4	564	40	0	5	1	0	0	2	0	1	0	0	12	629	9
6:00	0	541	21	1	5	0	0	0	0	0	0	0	0	5	573	6
7:00	0	428	19	1	1	0	0	0	0	0	1	0	0	4	454	3
8:00	2	434	19	0	0	0	0	0	0	0	0	0	0	4	459	0
9:00	0	355	16	0	1	0	0	0	0	0	0	0	0	2	374	1
10:00	0	268	8	0	0	0	0	0	0	0	0	0	0	0	276	0
11:00	0	182	8	0	1	0	0	0	0	0	0	0	0	0	191	1
	1	78	3	0	0	0	0	0	0	0	0	0	0	0	82	0
Total	21	8078	529	37	54	24	0	11	20	2	9	0	0	157	8942	157
Percent	0.2%	90.3%	5.9%	0.4%	0.6%	0.3%	0.0%	0.1%	0.2%	0.0%	0.1%	0.0%	0.0%	1.8%		1.8%
AM Peak	7:00	11:00	11:00	8:00	9:00	6:00		8:00	8:00		7:00			7:00	11:00	8:00
	2	514	48	4	5	6	*	3	2	*	1	*	*	8	583	13
PM Peak	4:00	12:00 PM	2:00	1:00	1:00	1:00		1:00	3:00	12:00 PM	12:00 PM			1:00	1:00	1:00
	4	624	43	13	7	3	*	3	4	1	1	*	*	58	715	28

Site Code: ATR303-EB
Station ID:
Location 1: GODFREY NIXON WAY (EB Lanes)
Location 2: AT BLDG # 29
Location 3:
Location 4:
Direction: Eastbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR303-EAST W2019 - RAW
Date Printed: 12/6/2022
Start Date: 4/7/2019
End Date: 4/14/2019

4/12/2019 Time	Motor Cycles	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	0	57	1	0	1	0	0	0	0	0	0	0	0	0	59	1
2:00	0	22	0	0	0	0	0	0	0	0	0	0	0	0	22	0
3:00	0	22	0	0	0	0	0	0	0	1	0	0	0	0	23	1
4:00	0	10	0	0	0	0	0	0	0	0	0	0	0	0	10	0
5:00	0	41	1	0	0	1	0	0	0	1	0	0	0	1	45	2
6:00	0	83	7	0	3	4	0	1	0	0	0	0	0	0	98	8
7:00	1	296	24	1	3	5	0	0	0	0	0	0	0	2	332	9
8:00	1	471	51	3	2	4	0	2	2	0	0	0	0	2	538	13
9:00	3	483	30	3	1	4	0	0	2	0	1	0	0	8	535	11
10:00	1	441	40	0	9	2	0	0	2	1	0	0	0	6	502	14
11:00	2	505	48	1	2	3	0	0	0	1	0	0	0	4	566	7
12:00 PM	2	548	46	1	6	5	0	1	3	0	2	0	0	11	625	18
1:00	2	597	42	12	10	2	0	4	1	0	2	0	0	46	718	31
2:00	2	625	54	6	9	2	0	2	3	0	1	0	0	48	752	23
3:00	1	652	36	4	4	2	0	1	3	0	1	0	0	10	714	15
4:00	1	643	51	6	6	6	0	3	3	0	1	0	0	18	738	25
5:00	0	625	40	2	3	4	0	1	3	0	3	1	0	20	702	17
6:00	2	633	26	6	5	5	0	3	1	0	1	0	0	40	722	21
7:00	2	527	19	1	0	0	0	0	2	0	0	0	0	7	558	3
8:00	0	456	18	0	0	0	0	1	0	0	1	0	0	10	486	2
9:00	0	376	11	0	1	1	0	0	2	0	0	0	0	6	397	4
10:00	0	356	11	0	0	0	0	1	0	0	0	0	0	7	375	1
11:00	1	264	13	0	0	0	0	0	0	0	0	0	0	3	281	0
	1	203	7	0	0	0	0	0	0	0	0	0	0	1	212	0
Total	22	8936	576	46	65	50	0	20	27	4	13	1	0	250	10010	226
Percent	0.2%	89.3%	5.8%	0.5%	0.6%	0.5%	0.0%	0.2%	0.3%	0.0%	0.1%	0.0%	0.0%	2.5%		2.3%
AM Peak	8:00	11:00	7:00	7:00	9:00	6:00		7:00	11:00	2:00	11:00			11:00	11:00	11:00
	3	548	51	3	9	5	*	2	3	1	2	*	*	11	625	18
PM Peak	12:00 PM	2:00	1:00	12:00 PM	12:00 PM	3:00		12:00 PM	1:00		4:00	4:00		1:00	1:00	12:00 PM
	2	652	54	12	10	6	*	4	3	*	3	1	*	48	752	31

Site Code: ATR303-EB
Station ID:
Location 1: GODFREY NIXON WAY (EB Lanes)
Location 2: AT BLDG # 29
Location 3:
Location 4:
Direction: Eastbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR303-EAST W2019 - RAW
Date Printed: 12/6/2022
Start Date: 4/7/2019
End Date: 4/14/2019

4/13/2019 Time	Motor Cycles	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	1	120	4	0	1	0	0	1	0	0	0	0	0	0	127	2
2:00	0	102	3	0	0	0	0	0	0	0	0	0	0	1	106	0
3:00	0	101	6	0	1	0	0	0	0	0	0	0	0	1	109	1
4:00	0	70	1	0	0	1	0	0	2	0	0	0	0	2	76	3
5:00	0	54	1	0	0	1	0	0	0	0	0	0	0	1	57	1
6:00	0	69	1	0	1	0	0	0	0	0	0	0	0	0	71	1
7:00	1	209	10	0	0	2	0	0	0	0	0	0	0	5	227	2
8:00	1	318	27	1	3	4	0	1	0	0	0	0	0	1	356	9
9:00	2	423	34	1	4	5	0	0	1	0	0	0	0	2	472	11
10:00	1	474	31	1	3	5	0	1	5	0	1	0	0	14	536	16
11:00	2	584	31	1	4	2	0	0	6	1	0	0	0	14	645	14
12:00 PM	2	547	41	13	4	7	0	2	5	1	0	0	0	49	671	32
1:00	3	480	35	24	3	10	0	7	2	0	1	0	0	95	660	47
2:00	3	556	25	4	4	8	1	0	5	0	1	0	0	25	632	23
3:00	3	614	30	4	5	13	2	0	8	0	1	0	0	13	693	33
4:00	1	497	35	3	4	12	1	0	7	1	1	0	0	9	571	29
5:00	2	536	18	3	2	7	1	3	1	1	1	0	0	6	581	19
6:00	0	560	18	3	0	6	0	1	3	0	0	0	0	12	603	13
7:00	1	560	28	2	3	1	0	0	4	0	0	0	0	11	610	10
8:00	0	469	15	0	1	1	0	0	4	1	2	0	0	9	502	9
9:00	0	384	16	1	0	1	0	0	2	0	0	0	0	3	407	4
10:00	0	295	11	0	0	1	0	0	3	0	0	0	0	4	314	4
11:00	0	261	10	0	0	1	0	0	4	0	0	0	0	1	277	5
	0	150	7	0	1	2	0	0	4	0	0	0	0	0	164	7
Total	23	8433	438	61	44	90	5	16	66	5	8	0	0	278	9467	295
Percent	0.2%	89.1%	4.6%	0.6%	0.5%	1.0%	0.1%	0.2%	0.7%	0.1%	0.1%	0.0%	0.0%	2.9%		3.1%
AM Peak	8:00	10:00	11:00	11:00	8:00	11:00		11:00	10:00	10:00	9:00			11:00	11:00	11:00
	2	584	41	13	4	7	*	2	6	1	1	*	*	49	671	32
PM Peak	12:00 PM	2:00	12:00 PM	12:00 PM	2:00	2:00	2:00	12:00 PM	2:00	3:00	7:00			12:00 PM	2:00	12:00 PM
	3	614	35	24	5	13	2	7	8	1	2	*	*	95	693	47

Site Code: ATR303-EB
Station ID:
Location 1: GODFREY NIXON WAY (EB Lanes)
Location 2: AT BLDG # 29
Location 3:
Location 4:
Direction: Eastbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR303-EAST W2019 - RAW
Date Printed: 12/6/2022
Start Date: 4/7/2019
End Date: 4/14/2019

4/14/2019 Time	Motor Cycles	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	1	150	1	0	1	0	0	0	2	0	0	0	0	0	155	3
2:00	0	43	1	0	0	0	0	0	4	0	0	0	0	0	48	4
3:00	0	17	1	0	0	0	0	0	4	0	0	0	0	0	22	4
4:00	0	13	0	0	0	0	0	0	3	0	0	0	0	0	16	3
5:00	0	22	1	0	0	0	0	0	4	0	0	0	0	0	27	4
6:00	0	32	0	0	0	0	0	0	3	1	0	0	0	1	37	4
7:00	0	97	5	0	0	0	0	0	3	0	0	0	0	1	106	3
8:00	1	163	11	0	0	0	0	0	4	0	0	0	0	0	179	4
9:00	1	185	11	1	1	1	0	0	3	0	1	0	0	3	207	7
10:00	3	294	15	0	2	2	0	0	4	0	0	0	0	0	320	8
11:00	1	131	7	0	1	0	0	0	2	0	0	0	0	3	145	3
12:00 PM	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
1:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
2:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
3:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
4:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
5:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
6:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
7:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
8:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
9:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
10:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
11:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
Total	7	1147	53	1	5	3	0	0	36	1	1	0	0	8	1262	47
Percent	0.6%	90.9%	4.2%	0.1%	0.4%	0.2%	0.0%	0.0%	2.9%	0.1%	0.1%	0.0%	0.0%	0.6%		3.7%
AM Peak	9:00	9:00	9:00	8:00	9:00	9:00			1:00	5:00	8:00			8:00	9:00	9:00
	3	294	15	1	2	2	*	*	4	1	1	*	*	3	320	8
PM Peak																
	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Grand Total	149	53443	3226	228	339	449	17	100	279	25	68	2	3	1256	59584	1510

Site Code: ATR303-WB
Station ID:
Location 1: GODFREY NIXON WAY (WB
Location 2: AT DMS CENTRE
Location 3:
Location 4:

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR303-WEST W2019 -
Date Printed: 12/5/2022
Start Date: 4/7/2019
End Date: 4/14/2019

	4/8/2019		Tuesday		Wednesday		Thursday		Friday		Saturday		Sunday		Average Day	
Time	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
12:00	24	214	11	245	11	213	15	205	13	231	38	212	44	*	22	220
12:15	16	222	14	226	16	211	11	222	16	219	31	206	31	*	19	218
12:30	13	197	13	221	14	233	12	215	9	196	28	214	33	*	17	213
12:45	25	207	8	186	10	191	12	205	18	188	34	186	24	*	19	194
1:00	25	209	11	219	14	169	13	193	13	210	20	211	25	*	17	202
1:15	24	208	8	209	9	209	7	192	14	208	32	233	25	*	17	210
1:30	19	190	14	169	7	202	10	213	14	214	45	234	12	*	17	204
1:45	17	176	12	186	11	163	8	179	5	197	24	195	21	*	14	183
2:00	19	206	20	194	5	183	15	200	17	195	50	209	14	*	20	198
2:15	17	187	10	200	5	184	6	180	18	183	52	226	8	*	17	193
2:30	7	200	4	198	4	179	9	185	4	203	41	211	3	*	10	196
2:45	7	205	2	189	7	190	5	183	8	209	17	212	15	*	9	198
3:00	9	187	2	187	5	180	1	178	3	173	30	218	3	*	8	187
3:15	9	206	4	197	5	171	3	188	2	217	36	205	5	*	9	197
3:30	11	175	5	185	1	168	3	181	4	197	15	180	7	*	7	181
3:45	9	165	3	194	2	179	4	173	6	218	22	236	7	*	8	194
4:00	12	203	6	188	7	198	0	206	6	230	22	204	6	*	8	205
4:15	8	199	8	199	5	164	4	205	4	217	14	208	4	*	7	199
4:30	14	217	9	205	9	192	6	214	5	201	16	233	7	*	9	210
4:45	20	230	19	188	15	222	14	190	17	221	14	199	10	*	16	208
5:00	18	215	15	209	18	198	13	209	14	205	18	210	13	*	16	208
5:15	22	218	17	233	11	219	12	202	18	210	19	200	6	*	15	214
5:30	34	212	17	212	26	198	11	182	31	207	17	179	12	*	21	198
5:45	48	242	30	205	34	186	31	190	40	198	42	176	18	*	35	200
6:00	47	188	41	165	45	186	46	158	47	216	34	185	23	*	40	183
6:15	62	182	60	158	44	207	55	153	54	158	35	155	17	*	47	169
6:30	98	155	100	129	78	168	96	149	96	154	46	143	28	*	77	150
6:45	156	159	105	133	106	147	91	132	121	155	91	133	35	*	101	143
7:00	117	166	128	143	139	147	137	158	137	186	78	176	55	*	113	163
7:15	136	138	136	140	122	128	140	143	132	184	82	163	49	*	114	149
7:30	170	147	167	127	148	130	162	119	173	160	102	166	67	*	141	142
7:45	155	133	163	124	173	94	159	124	167	163	118	146	76	*	144	131
8:00	158	112	166	112	180	107	163	108	160	133	116	147	73	*	145	120
8:15	194	93	180	81	189	78	177	108	183	127	142	130	77	*	163	103
8:30	166	79	159	69	180	69	171	95	186	96	153	110	73	*	155	86
8:45	158	91	169	80	197	59	176	90	163	111	127	104	80	*	153	89
9:00	167	91	183	84	152	76	168	96	173	94	155	107	82	*	154	91
9:15	167	72	155	79	144	59	158	71	164	104	189	91	83	*	151	79
9:30	177	54	129	59	165	53	160	78	141	90	158	86	96	*	147	70
9:45	178	46	172	64	164	47	165	56	170	93	205	79	108	*	166	64
10:00	159	62	190	42	146	38	149	64	179	75	191	81	128	*	163	60
10:15	176	49	161	49	143	34	165	76	175	69	182	88	156	*	165	61
10:30	186	48	169	34	157	29	163	50	175	63	173	70	37	*	151	49
10:45	167	33	160	36	189	27	166	33	184	57	202	66	0	*	153	42
11:00	164	26	163	32	179	35	158	32	166	51	163	52	*	*	166	38
11:15	191	29	198	21	172	28	163	26	204	45	173	50	*	*	184	33
11:30	191	29	178	21	180	30	172	22	190	47	189	44	*	*	183	32
11:45	186	18	182	24	186	21	214	25	193	47	190	44	*	*	192	30
Total	4153	7090	3876	6850	3829	6599	3799	6856	4032	7625	3971	7613	1696	0	3726	7106
Day Total	11243		10726		10428		10655		11657		11584		1696		10831	
% Splits	36.9%	63.1%	36.1%	63.9%	36.7%	63.3%	35.7%	64.3%	34.6%	65.4%	34.3%	65.7%	100.0%	0.0%	34.4%	65.6%
Peak	11:00	5:00	11:00	12:00	8:00	12:00	11:00	12:00	11:00	4:00	9:45	3:45	9:30		11:00	12:00
Volume	732	887	721	878	746	848	707	847	753	869	751	881	488		725	845
Peak Factor	0.958	0.916	0.910	0.896	0.947	0.910	0.826	0.954	0.923	0.945	0.916	0.933	0.782		0.944	0.960

ADT ADT: 10,945 AADT: 10,945

Site Code: ATR303-WB
Station ID:
Location 1: GODFREY NIXON WAY (WB lanes)
Location 2: AT DMS CENTRE
Location 3:
Location 4:
Direction: Westbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR303-WEST W2019 - RAW
Date Printed: 12/6/2022
Start Date: 4/7/2019
End Date: 4/14/2019

4/7/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
2:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
3:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
4:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
5:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
6:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
7:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
8:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
9:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
10:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
11:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
12:00 PM	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
1:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
2:00	1	114	7	1	0	1	0	0	0	0	0	0	0	13	137	2
3:00	2	321	17	0	4	1	0	0	0	0	0	0	0	9	354	5
4:00	2	375	24	0	1	1	0	0	0	0	1	1	0	6	411	4
5:00	5	343	17	1	3	2	0	0	1	0	0	0	0	8	380	7
6:00	0	325	20	1	0	16	0	0	3	0	1	0	1	6	373	22
7:00	4	377	19	0	3	10	0	1	3	1	0	0	0	8	426	18
8:00	5	435	22	1	5	18	0	0	6	0	0	0	1	20	513	31
9:00	1	311	20	0	2	6	0	0	4	0	1	0	0	10	355	13
10:00	0	235	15	0	1	0	0	1	0	0	0	0	0	3	255	2
11:00	0	180	11	0	0	0	0	0	1	0	0	0	0	2	194	1
	1	109	9	0	0	0	0	0	0	0	0	0	0	1	120	0
Total	21	3125	181	4	19	55	0	2	18	1	3	1	2	86	3518	105
Percent	0.6%	88.8%	5.1%	0.1%	0.5%	1.6%	0.0%	0.1%	0.5%	0.0%	0.1%	0.0%	0.1%	2.4%		3.0%
AM Peak																
	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
PM Peak	4:00	7:00	3:00	1:00	7:00	7:00		6:00	7:00	6:00	3:00	3:00	5:00	7:00	7:00	7:00
	5	435	24	1	5	18	*	1	6	1	1	1	1	20	513	31

Site Code: ATR303-WB
Station ID:
Location 1: GODFREY NIXON WAY (WB lanes)
Location 2: AT DMS CENTRE
Location 3:
Location 4:
Direction: Westbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR303-WEST W2019 - RAW
Date Printed: 12/6/2022
Start Date: 4/7/2019
End Date: 4/14/2019

4/8/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	1	72	5	0	0	0	0	0	0	0	0	0	0	0	78	0
2:00	0	77	3	1	1	2	0	0	0	0	0	0	0	1	85	4
3:00	0	49	0	0	0	0	0	0	0	0	0	0	0	1	50	0
4:00	0	35	0	0	0	0	0	0	0	0	0	0	0	3	38	0
5:00	0	46	5	0	0	2	0	0	0	0	0	0	0	1	54	2
6:00	0	102	10	0	2	1	0	0	1	0	0	0	0	6	122	4
7:00	0	301	30	3	6	3	0	1	2	0	0	0	0	17	363	15
8:00	2	491	45	3	12	2	0	0	2	0	0	0	0	21	578	19
9:00	7	559	64	2	7	1	0	3	1	0	4	0	0	28	676	18
10:00	5	543	75	5	12	2	0	4	3	0	2	0	0	38	689	28
11:00	4	562	70	2	11	2	0	1	1	0	4	0	0	31	688	21
12:00 PM	2	592	53	6	6	5	0	4	3	0	3	0	0	58	732	27
1:00	7	603	62	26	11	3	0	10	1	0	1	0	0	116	840	52
2:00	9	632	48	8	10	3	0	0	1	1	3	1	0	67	783	27
3:00	4	673	55	5	6	2	0	3	2	0	3	2	0	43	798	23
4:00	6	624	63	4	5	1	0	3	5	0	1	0	0	21	733	19
5:00	6	650	48	14	11	18	0	6	3	0	2	0	0	91	849	54
6:00	16	552	31	29	8	15	1	6	5	1	0	0	0	223	887	65
7:00	6	590	28	4	3	21	0	2	6	1	1	0	1	21	684	39
8:00	2	490	33	1	4	10	0	1	6	0	2	0	1	34	584	25
9:00	1	335	10	1	3	10	0	0	6	0	0	0	0	9	375	20
10:00	3	228	10	0	1	13	0	0	6	0	0	0	0	2	263	20
11:00	3	168	7	0	2	9	0	0	2	0	0	0	0	1	192	13
	1	87	2	0	1	6	0	0	3	0	0	0	0	2	102	10
Total	85	9061	757	114	122	131	1	44	59	3	26	3	2	835	11243	505
Percent	0.8%	80.6%	6.7%	1.0%	1.1%	1.2%	0.0%	0.4%	0.5%	0.0%	0.2%	0.0%	0.0%	7.4%		4.5%
AM Peak	8:00	11:00	9:00	11:00	7:00	11:00		9:00	9:00		8:00			11:00	11:00	9:00
	7	592	75	6	12	5	*	4	3	*	4	*	*	58	732	28
PM Peak	5:00	2:00	3:00	5:00	12:00 PM	6:00	5:00	12:00 PM	6:00	1:00	1:00	2:00	6:00	5:00	5:00	5:00
	16	673	63	29	11	21	1	10	6	1	3	2	1	223	887	65

Site Code: ATR303-WB
Station ID:
Location 1: GODFREY NIXON WAY (WB lanes)
Location 2: AT DMS CENTRE
Location 3:
Location 4:
Direction: Westbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR303-WEST W2019 - RAW
Date Printed: 12/6/2022
Start Date: 4/7/2019
End Date: 4/14/2019

4/9/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	0	38	0	0	0	5	0	0	3	0	0	0	0	0	46	8
2:00	2	26	2	0	1	7	0	1	3	0	0	0	0	3	45	12
3:00	0	29	2	0	0	4	0	0	0	0	0	0	0	1	36	4
4:00	0	13	0	0	1	0	0	0	0	0	0	0	0	0	14	1
5:00	0	31	5	1	0	1	0	0	0	2	0	0	0	2	42	4
6:00	0	61	11	1	1	0	0	1	1	0	0	0	0	3	79	4
7:00	1	260	22	3	4	3	0	1	1	0	0	0	0	11	306	12
8:00	3	491	71	3	9	3	0	2	1	0	0	0	0	11	594	18
9:00	5	554	49	4	18	3	0	4	2	0	3	0	0	32	674	34
10:00	5	526	54	3	11	4	0	1	4	0	2	0	0	29	639	25
11:00	2	586	61	4	5	3	0	4	0	0	0	0	0	15	680	16
12:00 PM	8	606	62	1	12	1	0	1	2	0	1	0	0	27	721	18
1:00	8	640	52	22	9	2	0	12	3	0	1	0	0	129	878	49
2:00	4	664	60	4	10	0	0	6	2	0	1	0	0	32	783	23
3:00	6	614	58	10	11	5	0	4	4	0	1	0	0	68	781	35
4:00	2	622	54	6	13	2	0	3	1	2	0	0	0	58	763	27
5:00	7	681	46	0	4	0	0	5	1	0	3	0	0	33	780	13
6:00	8	600	43	22	12	3	0	5	3	0	2	0	0	161	859	47
7:00	2	531	21	1	4	3	0	0	1	0	1	0	0	21	585	10
8:00	1	475	31	1	2	1	0	1	0	0	0	0	0	22	534	5
9:00	2	318	14	0	3	0	0	0	0	0	0	0	0	5	342	3
10:00	1	267	11	0	0	0	0	0	0	0	0	0	0	7	286	0
11:00	0	151	4	0	0	0	0	0	0	0	0	0	0	6	161	0
	0	93	4	0	0	0	0	0	0	0	0	0	0	1	98	0
Total	67	8877	737	86	130	50	0	51	32	4	15	0	0	677	10726	368
Percent	0.6%	82.8%	6.9%	0.8%	1.2%	0.5%	0.0%	0.5%	0.3%	0.0%	0.1%	0.0%	0.0%	6.3%		3.4%
AM Peak	11:00	11:00	7:00	8:00	8:00	1:00		8:00	9:00	4:00	8:00			8:00	11:00	8:00
	8	606	71	4	18	7	*	4	4	2	3	*	*	32	721	34
PM Peak	12:00 PM	4:00	1:00	12:00 PM	3:00	2:00		12:00 PM	2:00	3:00	4:00			5:00	12:00 PM	12:00 PM
	8	681	60	22	13	5	*	12	4	2	3	*	*	161	878	49

Site Code: ATR303-WB
Station ID:
Location 1: GODFREY NIXON WAY (WB lanes)
Location 2: AT DMS CENTRE
Location 3:
Location 4:
Direction: Westbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR303-WEST W2019 - RAW
Date Printed: 12/6/2022
Start Date: 4/7/2019
End Date: 4/14/2019

4/10/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	1	50	0	0	0	0	0	0	0	0	0	0	0	0	51	0
2:00	1	36	3	1	0	0	0	0	0	0	0	0	0	0	41	1
3:00	0	16	3	0	1	1	0	0	0	0	0	0	0	0	21	2
4:00	0	12	0	0	0	1	0	0	0	0	0	0	0	0	13	1
5:00	0	28	3	1	0	1	0	0	0	0	0	0	0	3	36	2
6:00	0	75	5	2	0	5	0	0	0	0	0	0	0	2	89	7
7:00	1	228	30	0	3	4	0	0	0	0	0	0	0	7	273	7
8:00	1	499	34	5	11	4	0	6	0	0	1	0	0	21	582	27
9:00	3	631	67	4	13	4	0	3	1	0	1	1	0	18	746	27
10:00	2	532	57	3	7	1	0	1	4	1	1	0	1	15	625	19
11:00	6	543	61	3	8	2	0	1	2	0	0	0	0	9	635	16
12:00 PM	2	595	61	3	9	2	0	4	3	0	1	0	0	37	717	22
1:00	8	642	69	8	9	2	0	8	2	0	4	0	0	96	848	33
2:00	4	574	52	16	14	0	0	4	2	0	2	0	0	75	743	38
3:00	3	611	68	6	9	1	0	3	2	1	0	0	0	32	736	22
4:00	1	598	56	3	5	3	0	3	4	0	2	0	0	23	698	20
5:00	4	574	46	16	5	2	0	4	4	0	0	0	0	121	776	31
6:00	14	366	23	22	11	2	0	5	0	0	1	0	0	357	801	41
7:00	5	534	31	9	4	2	0	1	0	1	0	0	0	121	708	17
8:00	0	448	29	0	1	0	0	1	1	0	0	0	0	19	499	3
9:00	0	279	17	0	1	0	0	0	0	0	1	0	0	15	313	2
10:00	0	224	7	0	0	0	0	0	0	0	0	0	0	4	235	0
11:00	0	113	10	0	2	0	0	0	0	0	0	0	0	3	128	2
	0	106	7	0	0	0	0	0	0	0	0	0	0	1	114	0
Total	56	8314	739	102	113	37	0	44	25	3	14	1	1	979	10428	340
Percent	0.5%	79.7%	7.1%	1.0%	1.1%	0.4%	0.0%	0.4%	0.2%	0.0%	0.1%	0.0%	0.0%	9.4%		3.3%
AM Peak	10:00	8:00	8:00	7:00	8:00	5:00		7:00	9:00	9:00	7:00	8:00	9:00	11:00	8:00	7:00
	6	631	67	5	13	5	*	6	4	1	1	1	1	37	746	27
PM Peak	5:00	12:00 PM	12:00 PM	5:00	1:00	3:00		12:00 PM	3:00	2:00	12:00 PM			5:00	12:00 PM	5:00
	14	642	69	22	14	3	*	8	4	1	4	*	*	357	848	41

Site Code: ATR303-WB
Station ID:
Location 1: GODFREY NIXON WAY (WB lanes)
Location 2: AT DMS CENTRE
Location 3:
Location 4:
Direction: Westbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR303-WEST W2019 - RAW
Date Printed: 12/6/2022
Start Date: 4/7/2019
End Date: 4/14/2019

4/11/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	0	49	1	0	0	0	0	0	0	0	0	0	0	0	50	0
2:00	0	35	1	0	0	0	0	0	0	0	0	0	0	2	38	0
3:00	0	27	3	0	0	2	0	0	1	0	0	0	0	2	35	3
4:00	0	10	0	0	0	0	0	0	1	0	0	0	0	0	11	1
5:00	0	18	4	0	0	1	0	0	0	0	0	0	0	1	24	1
6:00	0	54	8	1	2	0	0	0	0	0	0	0	0	2	67	3
7:00	1	244	26	0	1	6	0	0	0	0	1	0	0	9	288	8
8:00	2	511	52	3	8	4	0	0	1	0	1	0	0	16	598	17
9:00	9	582	50	5	14	2	0	1	0	0	0	0	0	24	687	22
10:00	1	556	64	0	10	1	1	3	1	1	1	0	0	12	651	18
11:00	3	523	70	2	12	1	0	3	3	1	3	1	0	21	643	26
12:00 PM	5	608	55	2	9	1	0	0	3	0	1	0	0	23	707	16
1:00	6	667	58	15	11	4	0	5	2	0	3	0	0	76	847	40
2:00	5	614	64	8	9	2	0	4	4	0	0	0	0	67	777	27
3:00	3	613	63	4	12	2	0	4	1	0	0	0	0	46	748	23
4:00	3	582	56	12	7	4	0	1	2	0	1	0	0	52	720	27
5:00	5	671	55	10	7	0	0	4	1	0	3	0	0	59	815	25
6:00	5	669	39	8	5	1	0	3	2	0	0	0	0	51	783	19
7:00	4	516	35	0	5	1	0	1	2	0	2	0	0	26	592	11
8:00	0	489	23	0	3	0	0	0	0	0	5	1	0	23	544	9
9:00	2	366	22	0	1	0	0	1	0	0	0	0	0	9	401	2
10:00	0	283	9	0	1	0	0	1	0	0	0	0	0	7	301	2
11:00	1	207	9	0	1	0	0	1	0	0	1	0	0	3	223	3
	1	99	4	0	1	0	0	0	0	0	0	0	0	0	105	1
Total	56	8993	771	70	119	32	1	32	24	2	22	2	0	531	10655	304
Percent	0.5%	84.4%	7.2%	0.7%	1.1%	0.3%	0.0%	0.3%	0.2%	0.0%	0.2%	0.0%	0.0%	5.0%		2.9%
AM Peak	8:00	11:00	10:00	8:00	8:00	6:00	9:00	9:00	10:00	9:00	10:00	10:00		8:00	11:00	10:00
	9	608	70	5	14	6	1	3	3	1	3	1	*	24	707	26
PM Peak	12:00 PM	4:00	1:00	12:00 PM	2:00	12:00 PM		12:00 PM	1:00		7:00	7:00		12:00 PM	12:00 PM	12:00 PM
	6	671	64	15	12	4	*	5	4	*	5	1	*	76	847	40

Site Code: ATR303-WB
Station ID:
Location 1: GODFREY NIXON WAY (WB lanes)
Location 2: AT DMS CENTRE
Location 3:
Location 4:
Direction: Westbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR303-WEST W2019 - RAW
Date Printed: 12/6/2022
Start Date: 4/7/2019
End Date: 4/14/2019

4/12/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	0	54	2	0	0	0	0	0	0	0	0	0	0	0	56	0
2:00	1	42	2	1	0	0	0	0	0	0	0	0	0	0	46	1
3:00	0	43	2	0	0	1	0	0	0	0	0	0	0	1	47	1
4:00	0	14	1	0	0	0	0	0	0	0	0	0	0	0	15	0
5:00	0	27	2	0	1	1	0	1	0	0	0	0	0	0	32	3
6:00	0	75	14	1	3	6	0	1	1	0	0	0	0	2	103	12
7:00	1	267	30	0	6	4	0	0	0	0	0	0	0	10	318	10
8:00	1	522	48	2	11	2	0	2	0	0	0	0	0	21	609	17
9:00	5	576	61	9	8	1	0	3	3	0	3	0	0	23	692	27
10:00	5	543	56	1	17	2	0	1	0	0	2	1	0	20	648	24
11:00	2	599	67	2	7	3	0	3	3	0	1	1	0	25	713	20
12:00 PM	3	612	64	6	8	3	0	2	2	1	2	0	0	50	753	24
1:00	5	678	60	10	8	1	0	3	9	0	1	0	0	59	834	32
2:00	4	630	63	12	11	4	0	4	2	0	1	0	0	98	829	34
3:00	4	631	66	13	14	1	0	3	4	0	4	1	0	49	790	40
4:00	2	661	46	11	10	2	0	5	3	0	1	0	0	64	805	32
5:00	5	675	49	13	9	2	0	5	3	0	2	0	0	106	869	34
6:00	11	489	28	27	6	3	0	6	0	0	0	0	0	250	820	42
7:00	8	572	25	7	5	3	0	2	0	0	0	0	0	61	683	17
8:00	5	596	34	5	7	0	0	4	1	0	1	0	0	40	693	18
9:00	2	431	26	0	1	1	0	0	1	0	0	0	0	5	467	3
10:00	1	350	16	0	6	0	0	0	1	0	0	0	0	7	381	7
11:00	0	243	15	0	0	1	0	0	1	0	1	0	0	3	264	3
	0	176	10	0	1	0	0	1	0	0	0	0	0	2	190	2
Total	65	9506	787	120	139	41	0	46	34	1	19	3	0	896	11657	403
Percent	0.6%	81.5%	6.8%	1.0%	1.2%	0.4%	0.0%	0.4%	0.3%	0.0%	0.2%	0.0%	0.0%	7.7%		3.5%
AM Peak	8:00	11:00	10:00	8:00	9:00	5:00		8:00	8:00	11:00	8:00	9:00		11:00	11:00	8:00
	5	612	67	9	17	6	*	3	3	1	3	1	*	50	753	27
PM Peak	5:00	12:00 PM	2:00	5:00	2:00	1:00		5:00	12:00 PM		2:00	2:00		5:00	4:00	5:00
	11	678	66	27	14	4	*	6	9	*	4	1	*	250	869	42

Site Code: ATR303-WB
Station ID:
Location 1: GODFREY NIXON WAY (WB lanes)
Location 2: AT DMS CENTRE
Location 3:
Location 4:
Direction: Westbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR303-WEST W2019 - RAW
Date Printed: 12/6/2022
Start Date: 4/7/2019
End Date: 4/14/2019

4/13/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	0	127	4	0	0	0	0	0	0	0	0	0	0	0	131	0
2:00	2	113	5	0	0	0	0	0	0	0	0	0	0	1	121	0
3:00	1	147	10	0	0	0	0	0	0	0	1	0	0	1	160	1
4:00	0	91	5	0	2	0	0	0	2	0	0	0	0	3	103	4
5:00	1	52	7	0	1	3	0	0	0	0	0	0	0	2	66	4
6:00	0	88	2	0	1	1	0	0	1	0	0	0	0	3	96	3
7:00	0	177	17	0	4	4	0	0	1	0	0	0	0	3	206	9
8:00	3	324	30	1	6	4	0	2	1	0	0	0	0	9	380	14
9:00	2	435	54	2	9	3	0	5	3	0	2	0	0	23	538	24
10:00	1	582	52	10	8	6	0	6	1	0	2	0	0	39	707	33
11:00	3	595	51	11	13	7	0	3	6	0	1	0	0	58	748	41
12:00 PM	6	604	49	8	4	6	0	5	3	1	0	0	0	29	715	27
1:00	8	624	42	19	4	3	0	5	5	0	1	0	0	107	818	37
2:00	9	638	42	23	6	7	0	8	3	1	3	0	1	132	873	52
3:00	10	696	41	14	12	11	0	8	3	0	1	0	0	62	858	49
4:00	14	669	41	12	3	10	0	3	7	0	1	1	0	78	839	37
5:00	7	668	51	14	4	7	0	5	5	0	2	0	0	81	844	37
6:00	4	646	51	5	4	3	1	2	4	1	1	0	0	43	765	21
7:00	2	534	32	7	7	1	0	2	1	0	1	0	0	29	616	19
8:00	0	582	31	2	5	1	0	1	5	0	1	0	0	23	651	15
9:00	0	456	23	1	2	0	0	0	4	0	0	0	0	5	491	7
10:00	0	323	19	0	1	0	0	2	5	0	1	0	0	12	363	9
11:00	0	283	9	0	1	1	0	0	5	0	0	0	0	6	305	7
	1	168	13	0	0	0	0	1	4	0	0	0	0	3	190	5
Total	74	9622	681	129	97	78	1	58	69	3	18	1	1	752	11584	455
Percent	0.6%	83.1%	5.9%	1.1%	0.8%	0.7%	0.0%	0.5%	0.6%	0.0%	0.2%	0.0%	0.0%	6.5%		3.9%
AM Peak	11:00	11:00	8:00	10:00	10:00	10:00		9:00	10:00	11:00	8:00			10:00	10:00	10:00
	6	604	54	11	13	7	*	6	6	1	2	*	*	58	748	41
PM Peak	3:00	2:00	4:00	1:00	2:00	2:00	5:00	1:00	3:00	1:00	1:00	3:00	1:00	1:00	1:00	1:00
	14	696	51	23	12	11	1	8	7	1	3	1	1	132	873	52

Site Code: ATR303-WB
Station ID:
Location 1: GODFREY NIXON WAY (WB lanes)
Location 2: AT DMS CENTRE
Location 3:
Location 4:
Direction: Westbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR303-WEST W2019 - RAW
Date Printed: 12/6/2022
Start Date: 4/7/2019
End Date: 4/14/2019

4/14/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	1	120	6	0	0	0	0	0	5	0	0	0	0	0	132	5
2:00	1	74	0	0	0	0	0	0	3	0	0	0	0	5	83	3
3:00	1	32	3	0	0	0	0	0	3	0	0	0	0	1	40	3
4:00	1	14	1	0	0	0	0	0	4	0	0	0	0	2	22	4
5:00	0	18	2	0	1	0	0	0	3	0	0	0	0	3	27	4
6:00	0	40	2	0	0	0	0	1	5	0	0	0	0	1	49	6
7:00	0	89	5	0	1	0	0	0	5	0	0	0	0	3	103	6
8:00	0	210	21	0	8	1	0	0	2	0	0	0	1	4	247	12
9:00	0	259	31	0	3	1	0	0	3	1	0	0	0	5	303	8
10:00	0	326	26	0	6	3	0	1	0	0	1	0	0	6	369	11
11:00	1	270	19	2	3	0	0	0	4	0	1	0	0	21	321	10
12:00 PM	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
1:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
2:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
3:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
4:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
5:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
6:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
7:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
8:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
9:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
10:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
11:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
Total	5	1452	116	2	22	5	0	2	37	1	2	0	1	51	1696	72
Percent	0.3%	85.6%	6.8%	0.1%	1.3%	0.3%	0.0%	0.1%	2.2%	0.1%	0.1%	0.0%	0.1%	3.0%		4.2%
AM Peak	12:00 AM	9:00	8:00	10:00	7:00	9:00		5:00	12:00 AM	8:00	9:00		7:00	10:00	9:00	7:00
	1	326	31	2	8	3	*	1	5	1	1	*	1	21	369	12
PM Peak																
	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Grand Total	429	58950	4769	627	761	429	3	279	298	18	119	11	7	4807	71507	2552

Site Code: WEST BAY RD
Station ID: ATR316
Location 1: West Bay Road
Location 2: north of Shadow Ln
Location 3: by BAY TOWN PLAZA
Location 4:

National Roads Authority
(Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR316 W2019 - RAW
Date Printed: 12/3/2022
Start Date: 4/7/2019
End Date: 4/11/2019

4/7/2019		NB		SB		Combined		4/8/19	NB		SB		Combined	
Time	Sun	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	Mon	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
12:00		*	*	*	*	*	*		20	218	30	205	50	423
12:15		*	*	*	*	*	*		19	205	25	206	44	411
12:30		*	*	*	*	*	*		8	176	24	223	32	399
12:45		*	*	*	*	*	*		15	211	22	225	37	436
01:00		*	*	*	*	*	*		10	195	15	239	25	434
01:15		*	*	*	*	*	*		13	197	17	210	30	407
01:30		*	*	*	*	*	*		12	188	8	195	20	383
01:45		*	*	*	*	*	*		8	189	7	212	15	401
02:00		*	*	*	*	*	*		10	189	9	201	19	390
02:15		*	*	*	*	*	*		4	159	13	226	17	385
02:30		*	*	*	*	*	*		4	205	7	175	11	380
02:45		*	*	*	*	*	*		5	181	2	185	7	366
03:00		*	0	*	0	*	0		4	210	6	174	10	384
03:15		*	0	*	0	*	0		4	197	5	196	9	393
03:30		*	0	*	0	*	0		6	199	6	189	12	388
03:45		*	64	*	58	*	122		5	201	6	182	11	383
04:00		*	137	*	117	*	254		7	199	5	193	12	392
04:15		*	107	*	122	*	229		7	179	5	199	12	378
04:30		*	129	*	132	*	261		18	186	7	223	25	409
04:45		*	116	*	141	*	257		29	197	5	244	34	441
05:00		*	150	*	158	*	308		31	237	15	218	46	455
05:15		*	135	*	126	*	261		33	216	15	232	48	448
05:30		*	126	*	148	*	274		30	216	26	201	56	417
05:45		*	131	*	154	*	285		66	213	38	183	104	396
06:00		*	146	*	153	*	299		74	200	42	186	116	386
06:15		*	124	*	165	*	289		94	217	72	175	166	392
06:30		*	120	*	145	*	265		112	212	80	192	192	404
06:45		*	136	*	144	*	280		156	176	130	190	286	366
07:00		*	133	*	163	*	296		145	149	146	193	291	342
07:15		*	140	*	150	*	290		167	173	215	169	382	342
07:30		*	147	*	134	*	281		189	141	191	148	380	289
07:45		*	130	*	148	*	278		210	135	211	136	421	271
08:00		*	107	*	118	*	225		214	122	230	146	444	268
08:15		*	87	*	102	*	189		169	134	281	122	450	256
08:30		*	103	*	105	*	208		227	83	211	110	438	193
08:45		*	96	*	97	*	193		211	116	186	132	397	248
09:00		*	101	*	110	*	211		157	101	167	125	324	226
09:15		*	74	*	113	*	187		175	89	126	97	301	186
09:30		*	69	*	102	*	171		175	86	149	89	324	175
09:45		*	75	*	80	*	155		175	69	171	93	346	162
10:00		*	59	*	113	*	172		181	64	157	88	338	152
10:15		*	50	*	69	*	119		181	63	160	61	341	124
10:30		*	52	*	63	*	115		192	50	133	62	325	112
10:45		*	42	*	57	*	99		199	49	182	54	381	103
11:00		*	36	*	44	*	80		158	30	185	47	343	77
11:15		*	33	*	44	*	77		186	25	191	38	377	63
11:30		*	27	*	30	*	57		197	29	162	42	359	71
11:45		*	24	*	31	*	55		204	18	213	43	417	61
Total		0	3206	0	3636	0	6842		4516	7294	4309	7674	8825	14968
Day Total		3206		3636		6842			11810		11983		23793	
% Total		0.0%	46.9%	0.0%	53.1%				19.0%	30.7%	18.1%	32.3%		
Peak														
Volume														
Int. Time														
Int. Vol.														
Peak Factor														

Site Code: WEST BAY RD
Station ID: ATR316
Location 1: West Bay Road
Location 2: north of Shadow Ln
Location 3: by BAY TOWN PLAZA
Location 4:

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR316 W2019 - RAW
Date Printed: 12/3/2022
Start Date: 4/7/2019
End Date: 4/11/2019

4/9/2019		NB		SB		Combined		4/10/19	NB		SB		Combined	
Time	Tue	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	Wed	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
12:00		16	197	27	211	43	408		30	217	34	199	64	416
12:15		14	226	26	225	40	451		17	208	22	217	39	425
12:30		13	213	17	187	30	400		18	201	26	220	44	421
12:45		8	197	13	202	21	399		8	209	21	201	29	410
01:00		9	169	15	248	24	417		13	209	16	189	29	398
01:15		3	159	8	215	11	374		13	180	13	195	26	375
01:30		7	176	6	216	13	392		7	199	9	207	16	406
01:45		12	181	4	220	16	401		3	205	13	194	16	399
02:00		2	156	12	237	14	393		7	195	6	209	13	404
02:15		5	158	5	213	10	371		2	166	7	238	9	404
02:30		6	202	4	182	10	384		3	163	1	210	4	373
02:45		1	225	1	193	2	418		4	159	5	215	9	374
03:00		9	198	5	196	14	394		3	178	5	219	8	397
03:15		3	208	6	187	9	395		6	191	3	241	9	432
03:30		4	211	3	194	7	405		3	212	3	183	6	395
03:45		3	198	8	189	11	387		1	156	2	211	3	367
04:00		6	190	1	207	7	397		7	189	3	208	10	397
04:15		10	203	4	197	14	400		8	182	4	230	12	412
04:30		23	207	7	203	30	410		20	196	8	214	28	410
04:45		31	193	14	233	45	426		38	209	11	200	49	409
05:00		28	239	13	225	41	464		24	196	27	194	51	390
05:15		30	262	15	179	45	441		25	192	22	165	47	357
05:30		33	222	28	187	61	409		34	218	28	185	62	403
05:45		60	229	37	197	97	426		72	195	47	209	119	404
06:00		66	206	44	189	110	395		62	222	40	192	102	414
06:15		84	201	69	192	153	393		94	195	73	175	167	370
06:30		153	171	65	213	218	384		129	205	75	194	204	399
06:45		149	178	124	173	273	351		130	189	112	173	242	362
07:00		132	186	160	188	292	374		159	175	137	188	296	363
07:15		166	169	204	191	370	360		160	157	215	180	375	337
07:30		216	140	190	141	406	281		213	157	203	147	416	304
07:45		236	154	198	155	434	309		226	140	198	136	424	276
08:00		189	110	248	165	437	275		212	133	244	132	456	265
08:15		195	111	246	135	441	246		192	81	236	129	428	210
08:30		192	135	199	116	391	251		202	79	192	127	394	206
08:45		185	103	187	103	372	206		193	93	191	100	384	193
09:00		221	103	161	122	382	225		160	90	147	114	307	204
09:15		203	83	155	117	358	200		177	102	176	106	353	208
09:30		192	83	166	117	358	200		195	101	161	100	356	201
09:45		182	88	209	116	391	204		196	68	155	85	351	153
10:00		181	77	158	115	339	192		180	56	153	97	333	153
10:15		177	74	166	100	343	174		180	59	164	101	344	160
10:30		169	62	163	83	332	145		160	54	172	61	332	115
10:45		177	54	194	64	371	118		205	36	190	66	395	102
11:00		195	44	157	69	352	113		196	45	183	58	379	103
11:15		193	30	176	48	369	78		173	34	202	46	375	80
11:30		178	32	193	53	371	85		224	22	164	36	388	58
11:45		200	32	182	34	382	66		198	25	206	25	404	50
Total		4567	7445	4293	7942	8860	15387		4582	7143	4325	7721	8907	14864
Day Total		12012		12235		24247			11725		12046		23771	
% Total		18.8%	30.7%	17.7%	32.8%				19.3%	30.0%	18.2%	32.5%		
Peak														
Volume														
Int. Time														
Int. Vol.														
Peak Factor														

Site Code: WEST BAY RD
Station ID: ATR316
Location 1: West Bay Road
Location 2: north of Shadow Ln
Location 3: by BAY TOWN PLAZA
Location 4:

National Roads Authority
(Cayman Islands)
Use Preferences to Define
Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR316 W2019 -
Date Printed: 12/3/2022
Start Date: 4/7/2019
End Date: 4/11/2019

4/11/2019		NB		SB		Combined		4/12/19	NB		SB		Combined	
Time	Thu	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	Fri	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
12:00		23	183	45	202	68	385		*	*	*	*	*	*
12:15		19	192	32	187	51	379		*	*	*	*	*	*
12:30		8	216	17	182	25	398		*	*	*	*	*	*
12:45		10	201	21	226	31	427		*	*	*	*	*	*
01:00		10	210	12	211	22	421		*	*	*	*	*	*
01:15		4	183	11	228	15	411		*	*	*	*	*	*
01:30		9	199	10	207	19	406		*	*	*	*	*	*
01:45		6	202	15	245	21	447		*	*	*	*	*	*
02:00		8	178	11	233	19	411		*	*	*	*	*	*
02:15		6	184	7	202	13	386		*	*	*	*	*	*
02:30		5	182	7	184	12	366		*	*	*	*	*	*
02:45		6	204	6	200	12	404		*	*	*	*	*	*
03:00		2	197	9	182	11	379		*	*	*	*	*	*
03:15		4	163	6	207	10	370		*	*	*	*	*	*
03:30		9	214	6	196	15	410		*	*	*	*	*	*
03:45		2	183	5	190	7	373		*	*	*	*	*	*
04:00		6	212	5	188	11	400		*	*	*	*	*	*
04:15		13	212	8	176	21	388		*	*	*	*	*	*
04:30		22	215	7	224	29	439		*	*	*	*	*	*
04:45		27	192	15	221	42	413		*	*	*	*	*	*
05:00		27	258	6	200	33	458		*	*	*	*	*	*
05:15		22	2	18	3	40	5		*	*	*	*	*	*
05:30		27	0	25	0	52	0		*	*	*	*	*	*
05:45		67	0	45	0	112	0		*	*	*	*	*	*
06:00		66	*	45	*	111	*		*	*	*	*	*	*
06:15		81	*	79	*	160	*		*	*	*	*	*	*
06:30		142	*	75	*	217	*		*	*	*	*	*	*
06:45		155	*	117	*	272	*		*	*	*	*	*	*
07:00		156	*	140	*	296	*		*	*	*	*	*	*
07:15		182	*	209	*	391	*		*	*	*	*	*	*
07:30		187	*	209	*	396	*		*	*	*	*	*	*
07:45		227	*	208	*	435	*		*	*	*	*	*	*
08:00		161	*	231	*	392	*		*	*	*	*	*	*
08:15		212	*	230	*	442	*		*	*	*	*	*	*
08:30		190	*	212	*	402	*		*	*	*	*	*	*
08:45		200	*	190	*	390	*		*	*	*	*	*	*
09:00		168	*	158	*	326	*		*	*	*	*	*	*
09:15		195	*	166	*	361	*		*	*	*	*	*	*
09:30		188	*	172	*	360	*		*	*	*	*	*	*
09:45		182	*	163	*	345	*		*	*	*	*	*	*
10:00		178	*	146	*	324	*		*	*	*	*	*	*
10:15		152	*	160	*	312	*		*	*	*	*	*	*
10:30		170	*	136	*	306	*		*	*	*	*	*	*
10:45		204	*	181	*	385	*		*	*	*	*	*	*
11:00		177	*	164	*	341	*		*	*	*	*	*	*
11:15		181	*	174	*	355	*		*	*	*	*	*	*
11:30		191	*	177	*	368	*		*	*	*	*	*	*
11:45		189	*	216	*	405	*		*	*	*	*	*	*
Total		4476	4182	4307	4294	8783	8476		0	0	0	0	0	0
Day Total		8658		8601		17259			0		0		0	
% Total		25.9%	24.2%	25.0%	24.9%				*	*	*	*		
Peak														
Volume														
Int. Time														
Int. Vol.														
Peak Factor														
ADT	ADT: 22,255 AADT: 22,255													

Site Code: WEST BAY RD
Station ID: ATR316
Location 1: West Bay Road
Location 2: north of Shadow Ln
Location 3: by BAY TOWN PLAZA
Location 4:
Direction: NB, A to B

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR316 W2019 - RAW
Date Printed: 12/6/2022
Start Date: 4/7/2019
End Date: 4/11/2019

4/7/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
2:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
3:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
4:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
5:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
6:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
7:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
8:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
9:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
10:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
11:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
12:00 PM	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
1:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
2:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
3:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
4:00	0	60	1	0	0	0	0	0	0	0	0	0	0	3	64	0
5:00	10	433	3	8	1	0	0	0	0	0	0	1	0	33	489	10
6:00	13	469	7	4	2	0	0	0	0	0	0	0	0	47	542	6
7:00	8	468	8	6	1	1	0	0	0	0	0	0	0	34	526	8
8:00	7	491	3	4	4	2	0	0	0	0	0	0	0	39	550	10
9:00	5	362	3	2	0	2	0	0	0	0	0	0	0	19	393	4
10:00	7	286	5	4	1	0	0	1	0	0	0	0	0	15	319	6
11:00	5	178	6	0	0	0	0	0	1	0	0	0	0	13	203	1
	3	107	1	0	0	0	0	0	0	0	0	0	0	9	120	0
Total	58	2854	37	28	9	5	0	1	1	0	0	1	0	212	3206	45
Percent	1.8%	89.0%	1.2%	0.9%	0.3%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	6.6%		1.4%
AM Peak																
	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
PM Peak	5:00	7:00	6:00	4:00	7:00	7:00		9:00	10:00			4:00		5:00	7:00	4:00
	13	491	8	8	4	2	*	1	1	*	*	1	*	47	550	10

Site Code: WEST BAY RD
Station ID: ATR316
Location 1: West Bay Road
Location 2: north of Shadow Ln
Location 3: by BAY TOWN PLAZA
Location 4:
Direction: NB, A to B

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR316 W2019 - RAW
Date Printed: 12/6/2022
Start Date: 4/7/2019
End Date: 4/11/2019

4/8/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	0	60	1	0	0	0	0	0	0	0	0	0	0	1	62	0
2:00	0	39	1	0	1	1	0	0	0	0	0	0	0	1	43	2
3:00	0	23	0	0	0	0	0	0	0	0	0	0	0	0	23	0
4:00	0	15	0	0	0	0	0	0	0	0	0	0	0	4	19	0
5:00	2	53	0	0	0	0	1	0	0	0	0	0	0	5	61	1
6:00	2	136	2	0	2	0	0	0	0	0	0	0	0	18	160	2
7:00	14	338	8	2	4	3	0	0	1	0	0	0	0	66	436	10
8:00	13	566	24	8	4	0	1	2	0	0	1	0	0	92	711	16
9:00	12	666	25	10	8	5	0	2	1	0	0	0	0	92	821	26
10:00	14	546	28	9	13	3	0	1	2	0	0	0	0	66	682	28
11:00	9	593	37	16	8	2	0	0	0	0	0	1	0	87	753	27
12:00 PM	14	596	26	20	6	3	0	2	0	1	0	0	0	77	745	32
1:00	17	614	21	16	21	4	0	8	1	1	0	0	0	107	810	51
2:00	5	612	31	11	2	5	0	4	2	1	0	0	0	96	769	25
3:00	13	571	18	17	8	2	0	3	0	1	0	1	0	100	734	32
4:00	18	647	18	11	21	1	0	1	0	0	0	0	0	90	807	34
5:00	18	629	12	12	8	1	0	4	1	0	0	0	0	76	761	26
6:00	27	643	17	31	7	2	0	8	3	0	1	0	0	143	882	52
7:00	17	654	9	21	6	2	0	5	1	0	0	0	0	90	805	35
8:00	10	494	13	11	3	1	0	1	2	0	0	0	0	63	598	18
9:00	3	407	6	6	1	0	0	1	0	0	0	0	0	31	455	8
10:00	6	314	9	1	1	0	0	0	0	0	0	0	0	14	345	2
11:00	4	200	2	2	1	0	0	0	0	0	0	0	0	17	226	3
	2	96	1	0	0	0	0	0	0	0	0	0	0	3	102	0
Total	220	9512	309	204	125	35	2	42	14	4	2	2	0	1339	11810	430
Percent	1.9%	80.5%	2.6%	1.7%	1.1%	0.3%	0.0%	0.4%	0.1%	0.0%	0.0%	0.0%	0.0%	11.3%		3.6%
AM Peak	6:00	8:00	10:00	11:00	9:00	8:00	4:00	7:00	9:00	11:00	7:00	10:00		7:00	8:00	11:00
	14	666	37	20	13	5	1	2	2	1	1	1	*	92	821	32
PM Peak	5:00	6:00	1:00	5:00	12:00 PM	1:00		12:00 PM	5:00	12:00 PM	5:00	2:00		5:00	5:00	5:00
	27	654	31	31	21	5	*	8	3	1	1	1	*	143	882	52

Site Code: WEST BAY RD
Station ID: ATR316
Location 1: West Bay Road
Location 2: north of Shadow Ln
Location 3: by BAY TOWN PLAZA
Location 4:
Direction: NB, A to B

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR316 W2019 - RAW
Date Printed: 12/6/2022
Start Date: 4/7/2019
End Date: 4/11/2019

4/9/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	1	47	1	0	0	0	0	0	0	0	0	0	0	2	51	0
2:00	1	28	1	0	0	1	0	0	0	0	0	0	0	0	31	1
3:00	0	14	0	0	0	0	0	0	0	0	0	0	0	0	14	0
4:00	0	17	0	0	0	0	0	0	0	0	0	0	0	2	19	0
5:00	2	58	0	1	0	0	0	0	0	0	0	0	0	9	70	1
6:00	6	131	0	0	0	0	0	0	0	0	0	0	0	14	151	0
7:00	12	393	10	0	3	1	0	1	0	1	0	0	0	31	452	6
8:00	15	573	20	21	8	2	0	2	0	0	0	0	0	109	750	33
9:00	18	542	30	25	9	4	0	2	1	0	1	0	0	129	761	42
10:00	10	607	61	13	10	1	0	6	2	0	0	1	0	87	798	33
11:00	12	526	56	6	7	5	0	2	1	0	0	1	0	88	704	22
12:00 PM	14	585	40	15	12	1	0	0	1	0	0	1	0	97	766	30
1:00	16	556	27	19	15	4	1	2	2	0	1	0	0	190	833	44
2:00	13	406	33	29	12	4	0	7	2	2	0	0	0	177	685	56
3:00	17	495	29	21	16	1	0	2	1	0	1	0	0	158	741	42
4:00	16	648	29	12	17	2	0	0	2	0	0	0	0	89	815	33
5:00	18	651	18	8	6	0	0	4	1	0	1	0	0	86	793	20
6:00	14	758	8	23	6	2	0	1	1	0	3	0	0	136	952	36
7:00	11	609	13	17	6	1	0	3	1	0	1	0	0	94	756	29
8:00	3	519	13	13	5	0	0	3	0	0	1	0	1	91	649	23
9:00	2	417	5	1	4	0	0	0	1	0	0	0	0	29	459	6
10:00	4	315	5	3	1	1	0	0	2	0	0	0	0	26	357	7
11:00	4	231	6	2	0	1	0	0	0	0	0	0	0	23	267	3
	4	128	1	0	0	0	0	0	0	0	0	0	0	5	138	0
Total	213	9254	406	229	137	31	1	35	18	3	9	3	1	1672	12012	467
Percent	1.8%	77.0%	3.4%	1.9%	1.1%	0.3%	0.0%	0.3%	0.1%	0.0%	0.1%	0.0%	0.0%	13.9%		3.9%
AM Peak	8:00	9:00	9:00	8:00	11:00	10:00		9:00	9:00	6:00	8:00	9:00		8:00	9:00	8:00
	18	607	61	25	12	5	*	6	2	1	1	1	*	129	798	42
PM Peak	4:00	5:00	1:00	1:00	3:00	12:00 PM	12:00 PM	1:00	12:00 PM	1:00	5:00		7:00	12:00 PM	5:00	1:00
	18	758	33	29	17	4	1	7	2	2	3	*	1	190	952	56

Site Code: WEST BAY RD
Station ID: ATR316
Location 1: West Bay Road
Location 2: north of Shadow Ln
Location 3: by BAY TOWN PLAZA
Location 4:
Direction: NB, A to B

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR316 W2019 - RAW
Date Printed: 12/6/2022
Start Date: 4/7/2019
End Date: 4/11/2019

4/10/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	2	69	1	0	0	0	0	0	0	0	0	0	0	1	73	0
2:00	0	32	3	0	0	0	0	0	0	0	0	0	0	1	36	0
3:00	1	14	0	0	0	1	0	0	0	0	0	0	0	0	16	1
4:00	1	12	0	0	0	0	0	0	0	0	0	0	0	0	13	0
5:00	1	60	1	0	0	0	1	0	0	0	0	0	0	10	73	1
6:00	3	136	3	0	0	2	0	0	0	0	0	0	0	11	155	2
7:00	7	364	7	4	3	2	0	0	0	1	0	0	0	27	415	10
8:00	14	604	21	17	12	4	0	8	3	0	1	0	0	74	758	45
9:00	12	598	24	26	11	0	0	4	0	0	0	0	0	124	799	41
10:00	8	550	55	8	9	0	1	0	0	1	0	1	0	95	728	20
11:00	15	568	41	7	9	0	0	3	0	0	0	0	0	82	725	19
12:00 PM	15	621	45	6	7	2	0	1	1	1	1	0	0	91	791	19
1:00	10	585	54	14	11	2	0	8	2	0	1	0	1	147	835	39
2:00	21	457	28	31	18	2	0	10	1	0	0	0	1	224	793	63
3:00	12	468	28	22	16	4	0	3	1	0	0	0	0	129	683	46
4:00	14	528	23	14	20	5	1	2	2	0	1	0	0	127	737	45
5:00	13	557	22	20	11	4	0	5	0	0	0	0	0	144	776	40
6:00	20	488	18	26	21	6	0	6	1	0	2	0	0	213	801	62
7:00	12	635	11	18	7	0	1	3	1	0	0	0	0	123	811	30
8:00	7	550	6	6	4	0	1	1	1	0	0	0	0	53	629	13
9:00	1	349	5	4	1	1	0	1	0	0	0	0	0	24	386	7
10:00	6	313	6	4	2	1	0	0	1	0	0	0	0	28	361	8
11:00	6	181	11	0	0	0	0	0	0	0	0	0	0	7	205	0
	1	107	8	0	0	0	0	0	0	0	0	0	0	10	126	0
Total	202	8846	421	227	162	36	5	55	14	3	6	1	2	1745	11725	511
Percent	1.7%	75.4%	3.6%	1.9%	1.4%	0.3%	0.0%	0.5%	0.1%	0.0%	0.1%	0.0%	0.0%	14.9%		4.4%
AM Peak	10:00	11:00	9:00	8:00	7:00	7:00	4:00	7:00	7:00	6:00	7:00	9:00		8:00	8:00	7:00
	15	621	55	26	12	4	1	8	3	1	1	1	*	124	799	45
PM Peak	1:00	6:00	12:00 PM	1:00	5:00	5:00	3:00	1:00	12:00 PM		5:00		12:00 PM	1:00	12:00 PM	1:00
	21	635	54	31	21	6	1	10	2	*	2	*	1	224	835	63

Site Code: WEST BAY RD
Station ID: ATR316
Location 1: West Bay Road
Location 2: north of Shadow Ln
Location 3: by BAY TOWN PLAZA
Location 4:
Direction: NB, A to B

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR316 W2019 - RAW
Date Printed: 12/6/2022
Start Date: 4/7/2019
End Date: 4/11/2019

4/11/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	1	57	1	0	0	0	0	0	0	0	0	0	0	1	60	0
2:00	0	28	0	0	0	0	0	0	0	0	0	0	0	1	29	0
3:00	0	24	0	0	0	0	0	0	0	0	0	0	0	1	25	0
4:00	1	15	0	0	0	0	0	0	0	0	0	0	0	1	17	0
5:00	2	62	0	0	0	1	0	0	0	0	0	0	0	3	68	1
6:00	4	127	2	0	0	1	0	0	0	0	0	0	0	9	143	1
7:00	12	389	7	3	3	3	0	0	0	0	0	0	0	27	444	9
8:00	12	613	22	16	4	2	0	0	2	0	0	0	0	81	752	24
9:00	10	562	32	15	10	3	0	4	2	0	1	0	1	123	763	36
10:00	19	568	52	9	10	0	0	2	1	0	0	0	0	72	733	22
11:00	19	573	38	8	8	2	1	1	0	0	0	1	0	53	704	21
12:00 PM	11	580	46	9	4	3	0	4	0	1	0	0	0	80	738	21
1:00	7	595	44	9	10	5	0	3	1	2	0	0	0	116	792	30
2:00	13	546	28	27	13	1	0	9	2	0	1	0	0	154	794	53
3:00	10	586	30	13	7	2	0	2	4	1	0	0	0	93	748	29
4:00	12	566	20	24	19	5	0	5	0	0	0	0	1	105	757	54
5:00	6	665	22	25	4	2	1	3	1	1	0	0	0	101	831	37
6:00	4	205	5	3	1	2	3	2	1	0	1	0	0	33	260	13
7:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	*
8:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	*
9:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	*
10:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	*
11:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	*
	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	*
Total	143	6761	349	161	93	32	5	35	14	5	3	1	2	1054	8658	351
Percent	1.7%	78.1%	4.0%	1.9%	1.1%	0.4%	0.1%	0.4%	0.2%	0.1%	0.0%	0.0%	0.0%	12.2%		4.1%
AM Peak	9:00	7:00	9:00	7:00	8:00	6:00	10:00	8:00	7:00	11:00	8:00	10:00	8:00	8:00	8:00	8:00
	19	613	52	16	10	3	1	4	2	1	1	1	1	123	763	36
PM Peak	1:00	4:00	12:00 PM	1:00	3:00	12:00 PM	5:00	1:00	2:00	12:00 PM	1:00		3:00	1:00	4:00	3:00
	13	665	44	27	19	5	3	9	4	2	1	*	1	154	831	54
Grand Total	836	37227	1522	849	526	139	13	168	61	15	20	8	5	6022	47411	1804

Site Code: WEST BAY RD
Station ID: ATR316
Location 1: West Bay Road
Location 2: north of Shadow Ln
Location 3: by BAY TOWN PLAZA
Location 4:
Direction: SB, B to A

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR316 W2019 - RAW
Date Printed: 12/6/2022
Start Date: 4/7/2019
End Date: 4/11/2019

4/7/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
2:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
3:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
4:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
5:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
6:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
7:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
8:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
9:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
10:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
11:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
12:00 PM	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
1:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
2:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
3:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
4:00	0	52	4	0	0	0	0	0	0	0	0	0	0	2	58	0
5:00	1	433	41	2	3	1	0	0	0	0	1	0	0	30	512	7
6:00	4	489	34	4	5	1	0	2	0	0	1	0	0	46	586	13
7:00	4	525	22	6	5	0	0	1	0	0	0	0	0	44	607	12
8:00	3	524	24	6	4	1	0	3	1	0	0	0	0	29	595	15
9:00	2	358	29	6	2	0	0	1	1	0	0	0	0	23	422	10
10:00	2	356	27	0	2	1	0	2	0	0	0	0	0	15	405	5
11:00	1	268	17	1	2	0	0	1	0	0	0	0	0	12	302	4
	1	132	12	0	2	0	0	1	0	0	0	0	0	1	149	3
Total	18	3137	210	25	25	4	0	11	2	0	2	0	0	202	3636	69
Percent	0.5%	86.3%	5.8%	0.7%	0.7%	0.1%	0.0%	0.3%	0.1%	0.0%	0.1%	0.0%	0.0%	5.6%		1.9%
AM Peak																
	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
PM Peak	5:00	6:00	4:00	6:00	5:00	4:00		7:00	7:00		4:00			5:00	6:00	7:00
	4	525	41	6	5	1	*	3	1	*	1	*	*	46	607	15

Site Code: WEST BAY RD
Station ID: ATR316
Location 1: West Bay Road
Location 2: north of Shadow Ln
Location 3: by BAY TOWN PLAZA
Location 4:
Direction: SB, B to A

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR316 W2019 - RAW
Date Printed: 12/6/2022
Start Date: 4/7/2019
End Date: 4/11/2019

4/8/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	1	91	8	0	0	0	0	0	0	0	0	0	0	1	101	0
2:00	0	40	7	0	0	0	0	0	0	0	0	0	0	0	47	0
3:00	0	29	2	0	0	0	0	0	0	0	0	0	0	0	31	0
4:00	0	17	3	0	1	0	0	0	0	0	0	0	0	2	23	1
5:00	1	16	3	1	0	0	0	0	0	0	0	0	0	1	22	1
6:00	0	67	23	0	0	1	0	0	0	0	0	0	0	3	94	1
7:00	2	232	43	3	12	1	0	0	1	0	0	0	0	30	324	17
8:00	11	581	51	16	17	2	0	1	0	0	1	1	0	82	763	38
9:00	9	680	63	15	19	0	0	2	0	0	0	0	0	120	908	36
10:00	4	444	69	12	19	1	0	2	0	0	1	0	0	61	613	35
11:00	6	464	69	5	10	2	0	4	0	2	0	0	0	70	632	23
12:00 PM	1	550	84	12	22	2	0	4	0	0	0	0	0	76	751	40
1:00	9	568	61	25	27	8	0	4	2	1	0	0	0	154	859	67
2:00	9	619	65	25	18	0	0	4	2	1	2	1	0	110	856	53
3:00	8	575	53	17	9	3	0	5	1	0	1	0	2	113	787	38
4:00	7	545	56	19	10	1	0	3	0	0	0	0	0	100	741	33
5:00	5	660	75	15	11	2	0	2	0	0	0	1	0	88	859	31
6:00	8	598	47	25	15	3	0	4	1	0	2	0	0	131	834	50
7:00	8	572	60	12	9	1	0	3	1	1	0	0	0	76	743	27
8:00	4	520	42	14	3	0	0	3	3	0	1	0	0	56	646	24
9:00	2	440	25	3	4	0	0	2	1	1	1	0	0	31	510	12
10:00	3	355	23	0	8	1	0	0	0	0	0	0	0	14	404	9
11:00	2	241	16	1	1	0	0	0	0	0	0	0	0	4	265	2
	0	162	6	0	1	0	0	1	0	0	0	0	0	0	170	2
Total	100	9066	954	220	216	28	0	44	12	6	9	3	2	1323	11983	540
Percent	0.8%	75.7%	8.0%	1.8%	1.8%	0.2%	0.0%	0.4%	0.1%	0.1%	0.1%	0.0%	0.0%	11.0%		4.5%
AM Peak	7:00	8:00	11:00	7:00	11:00	7:00		10:00	6:00	10:00	7:00	7:00		8:00	8:00	11:00
	11	680	84	16	22	2	*	4	1	2	1	1	*	120	908	40
PM Peak	12:00 PM	4:00	4:00	12:00 PM	12:00 PM	12:00 PM		2:00	7:00	12:00 PM	1:00	1:00	2:00	12:00 PM	12:00 PM	12:00 PM
	9	660	75	25	27	8	*	5	3	1	2	1	2	154	859	67

Site Code: WEST BAY RD
Station ID: ATR316
Location 1: West Bay Road
Location 2: north of Shadow Ln
Location 3: by BAY TOWN PLAZA
Location 4:
Direction: SB, B to A

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR316 W2019 - RAW
Date Printed: 12/6/2022
Start Date: 4/7/2019
End Date: 4/11/2019

4/9/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	1	74	7	1	0	0	0	0	0	0	0	0	0	0	83	1
2:00	0	29	3	0	0	1	0	0	0	0	0	0	0	0	33	1
3:00	0	18	3	0	0	0	0	0	0	0	0	0	0	1	22	0
4:00	0	20	2	0	0	0	0	0	0	0	0	0	0	0	22	0
5:00	0	20	2	1	0	0	0	0	0	0	0	0	0	3	26	1
6:00	0	67	21	0	1	0	0	0	0	0	0	0	0	4	93	1
7:00	2	248	38	0	4	0	0	1	0	0	0	0	0	9	302	5
8:00	4	536	47	28	13	0	0	1	0	1	0	0	0	122	752	43
9:00	9	611	70	25	24	2	0	3	1	0	1	0	1	133	880	57
10:00	6	458	74	18	36	2	0	6	1	0	1	1	0	88	691	65
11:00	5	456	98	15	23	0	0	4	0	0	2	0	0	78	681	44
12:00 PM	7	496	58	14	22	3	0	2	0	0	1	0	0	105	708	42
1:00	15	500	59	42	17	6	0	8	5	0	1	0	0	172	825	79
2:00	18	496	46	48	21	10	0	13	4	0	5	1	1	236	899	103
3:00	11	493	59	36	29	7	0	9	2	1	3	1	1	173	825	89
4:00	4	568	71	15	16	0	0	3	0	1	0	0	0	88	766	35
5:00	5	640	65	13	7	1	0	5	1	0	3	0	1	99	840	31
6:00	8	575	37	21	9	2	0	5	0	1	3	0	1	126	788	42
7:00	4	579	43	19	11	2	0	3	0	0	0	0	0	106	767	35
8:00	2	548	29	15	9	3	0	4	0	0	0	0	0	65	675	31
9:00	2	438	30	3	7	1	0	1	0	0	1	0	0	36	519	13
10:00	5	394	31	6	3	0	0	1	0	0	0	0	0	32	472	10
11:00	2	322	17	2	2	0	0	2	0	0	0	0	0	15	362	6
	2	187	11	0	0	0	0	0	0	0	0	0	0	4	204	0
Total	112	8773	921	322	254	40	0	71	14	4	21	3	5	1695	12235	734
Percent	0.9%	71.7%	7.5%	2.6%	2.1%	0.3%	0.0%	0.6%	0.1%	0.0%	0.2%	0.0%	0.0%	13.9%		6.0%
AM Peak	8:00	8:00	10:00	7:00	9:00	11:00		9:00	8:00	7:00	10:00	9:00	8:00	8:00	8:00	9:00
	9	611	98	28	36	3	*	6	1	1	2	1	1	133	880	65
PM Peak	1:00	4:00	3:00	1:00	2:00	1:00		1:00	12:00 PM	2:00	1:00	1:00	1:00	1:00	1:00	1:00
	18	640	71	48	29	10	*	13	5	1	5	1	1	236	899	103

Site Code: WEST BAY RD
Station ID: ATR316
Location 1: West Bay Road
Location 2: north of Shadow Ln
Location 3: by BAY TOWN PLAZA
Location 4:
Direction: SB, B to A

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR316 W2019 - RAW
Date Printed: 12/6/2022
Start Date: 4/7/2019
End Date: 4/11/2019

4/10/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	1	92	8	0	2	0	0	0	0	0	0	0	0	0	103	2
2:00	0	46	5	0	0	0	0	0	0	0	0	0	0	0	51	0
3:00	0	17	2	0	0	0	0	0	0	0	0	0	0	0	19	0
4:00	0	10	2	1	0	0	0	0	0	0	0	0	0	0	13	1
5:00	0	21	5	0	0	0	0	0	0	0	0	0	0	0	26	0
6:00	1	92	23	1	3	2	0	0	0	0	0	0	0	2	124	6
7:00	6	239	33	0	5	0	0	3	0	0	0	0	0	14	300	8
8:00	6	554	60	18	15	2	0	1	0	0	0	0	0	97	753	36
9:00	7	620	65	21	16	1	1	8	0	0	0	0	0	124	863	47
10:00	5	422	89	15	29	1	0	1	0	1	0	0	0	76	639	47
11:00	4	473	75	10	32	2	0	5	0	0	0	0	0	78	679	49
12:00 PM	7	540	78	11	23	1	0	3	0	0	0	0	1	91	755	39
1:00	11	529	70	21	30	3	0	12	0	0	1	0	0	160	837	67
2:00	14	452	53	36	15	4	1	7	0	1	0	0	0	202	785	64
3:00	12	563	45	39	18	3	0	15	1	0	2	1	0	173	872	79
4:00	11	545	56	34	32	6	0	7	0	1	1	0	0	161	854	81
5:00	9	578	60	28	29	7	0	4	1	0	1	0	0	135	852	70
6:00	19	392	21	53	18	5	2	14	5	2	4	0	0	218	753	103
7:00	5	523	41	21	11	1	0	4	1	0	1	0	0	126	734	39
8:00	3	532	40	10	2	1	0	2	0	0	1	0	0	60	651	16
9:00	5	417	27	5	4	0	0	0	1	0	1	0	0	28	488	11
10:00	5	363	18	0	4	0	0	0	0	0	0	0	0	15	405	4
11:00	3	293	12	1	7	0	0	0	0	0	1	0	0	8	325	9
	0	140	12	1	7	0	0	0	0	0	0	0	0	5	165	8
Total	134	8453	900	326	302	39	4	86	9	5	13	1	1	1773	12046	786
Percent	1.1%	70.2%	7.5%	2.7%	2.5%	0.3%	0.0%	0.7%	0.1%	0.0%	0.1%	0.0%	0.0%	14.7%		6.5%
AM Peak	8:00	8:00	9:00	8:00	10:00	5:00	8:00	8:00		9:00			11:00	8:00	8:00	10:00
	7	620	89	21	32	2	1	8	*	1	*	*	1	124	863	49
PM Peak	5:00	4:00	12:00 PM	5:00	3:00	4:00	5:00	2:00	5:00	5:00	5:00	2:00		5:00	2:00	5:00
	19	578	70	53	32	7	2	15	5	2	4	1	*	218	872	103

Site Code: WEST BAY RD
Station ID: ATR316
Location 1: West Bay Road
Location 2: north of Shadow Ln
Location 3: by BAY TOWN PLAZA
Location 4:
Direction: SB, B to A

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR316 W2019 - RAW
Date Printed: 12/6/2022
Start Date: 4/7/2019
End Date: 4/11/2019

4/11/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	0	105	9	0	0	0	0	0	0	0	0	0	0	1	115	0
2:00	1	45	2	0	0	0	0	0	0	0	0	0	0	0	48	0
3:00	0	29	2	0	0	0	0	0	0	0	0	0	0	0	31	0
4:00	1	23	2	0	0	0	0	0	0	0	0	0	0	0	26	0
5:00	0	30	3	0	0	0	0	0	0	0	0	0	0	2	35	0
6:00	0	64	23	0	3	1	0	1	0	0	0	0	0	2	94	5
7:00	2	250	36	2	4	0	0	1	0	0	1	0	0	20	316	8
8:00	5	561	51	26	18	0	0	3	1	1	1	0	0	99	766	50
9:00	11	631	52	14	15	2	0	9	1	0	3	0	0	125	863	44
10:00	3	489	71	5	18	0	0	2	0	0	1	0	1	69	659	27
11:00	2	453	72	9	22	2	0	3	0	0	0	0	0	60	623	36
12:00 PM	5	518	68	12	28	0	0	5	0	0	0	0	0	95	731	45
1:00	7	544	54	26	18	1	0	5	4	0	1	0	1	136	797	56
2:00	9	591	50	31	20	5	0	5	2	0	1	0	0	177	891	64
3:00	9	561	65	26	27	1	1	5	3	0	1	0	0	120	819	64
4:00	5	531	57	15	22	3	0	4	1	1	1	0	0	135	775	47
5:00	5	615	52	16	14	1	0	5	0	1	1	0	0	99	809	38
6:00	1	138	4	3	4	1	0	3	0	0	0	0	0	49	203	11
7:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	*
8:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	*
9:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	*
10:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	*
11:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	*
	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	*
Total	66	6178	673	185	213	17	1	51	12	3	11	0	2	1189	8601	495
Percent	0.8%	71.8%	7.8%	2.2%	2.5%	0.2%	0.0%	0.6%	0.1%	0.0%	0.1%	0.0%	0.0%	13.8%		5.8%
AM Peak	8:00	8:00	10:00	7:00	11:00	8:00		8:00	7:00	7:00	8:00		9:00	8:00	8:00	7:00
	11	631	72	26	28	2	*	9	1	1	3	*	1	125	863	50
PM Peak	1:00	4:00	2:00	1:00	2:00	1:00	2:00	12:00 PM	12:00 PM	3:00	12:00 PM		12:00 PM	1:00	1:00	1:00
	9	615	65	31	27	5	1	5	4	1	1	*	1	177	891	64
Grand Total	430	35607	3658	1078	1010	128	5	263	49	18	56	7	10	6182	48501	2624
Percent	0.9%	73.4%	7.5%	2.2%	2.1%	0.3%	0.0%	0.5%	0.1%	0.0%	0.1%	0.0%	0.0%	12.7%		5.4%

Site Code: WEST BAY RD
Station ID: ATR316
Location 1: West Bay Road
Location 2: north of Shadow Ln
Location 3: by BAY TOWN PLAZA
Location 4:
Direction: Combined

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR316 W2019 - RAW
Date Printed: 12/6/2022
Start Date: 4/7/2019
End Date: 4/11/2019

4/7/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
2:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
3:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
4:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
5:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
6:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
7:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
8:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
9:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
10:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
11:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
12:00 PM	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
1:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
2:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
3:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
4:00	0	112	5	0	0	0	0	0	0	0	0	0	0	5	122	0
5:00	11	866	44	10	4	1	0	0	0	0	1	1	0	63	1001	17
6:00	17	958	41	8	7	1	0	2	0	0	1	0	0	93	1128	19
7:00	12	993	30	12	6	1	0	1	0	0	0	0	0	78	1133	20
8:00	10	1015	27	10	8	3	0	3	1	0	0	0	0	68	1145	25
9:00	7	720	32	8	2	2	0	1	1	0	0	0	0	42	815	14
10:00	9	642	32	4	3	1	0	3	0	0	0	0	0	30	724	11
11:00	6	446	23	1	2	0	0	1	1	0	0	0	0	25	505	5
	4	239	13	0	2	0	0	1	0	0	0	0	0	10	269	3
Total	76	5991	247	53	34	9	0	12	3	0	2	1	0	414	6842	114
Percent	1.1%	87.6%	3.6%	0.8%	0.5%	0.1%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	6.1%		1.7%
AM Peak																
	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
PM Peak	5:00	7:00	4:00	6:00	7:00	7:00		7:00	7:00		4:00	4:00		5:00	7:00	7:00
	17	1015	44	12	8	3	*	3	1	*	1	1	*	93	1145	25

Site Code: WEST BAY RD
Station ID: ATR316
Location 1: West Bay Road
Location 2: north of Shadow Ln
Location 3: by BAY TOWN PLAZA
Location 4:
Direction: Combined

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR316 W2019 - RAW
Date Printed: 12/6/2022
Start Date: 4/7/2019
End Date: 4/11/2019

4/8/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	1	151	9	0	0	0	0	0	0	0	0	0	0	2	163	0
2:00	0	79	8	0	1	1	0	0	0	0	0	0	0	1	90	2
3:00	0	52	2	0	0	0	0	0	0	0	0	0	0	0	54	0
4:00	0	32	3	0	1	0	0	0	0	0	0	0	0	6	42	1
5:00	3	69	3	1	0	0	1	0	0	0	0	0	0	6	83	2
6:00	2	203	25	0	2	1	0	0	0	0	0	0	0	21	254	3
7:00	16	570	51	5	16	4	0	0	2	0	0	0	0	96	760	27
8:00	24	1147	75	24	21	2	1	3	0	0	2	1	0	174	1474	54
9:00	21	1346	88	25	27	5	0	4	1	0	0	0	0	212	1729	62
10:00	18	990	97	21	32	4	0	3	2	0	1	0	0	127	1295	63
11:00	15	1057	106	21	18	4	0	4	0	2	0	1	0	157	1385	50
12:00 PM	15	1146	110	32	28	5	0	6	0	1	0	0	0	153	1496	72
1:00	26	1182	82	41	48	12	0	12	3	2	0	0	0	261	1669	118
2:00	14	1231	96	36	20	5	0	8	4	2	2	1	0	206	1625	78
3:00	21	1146	71	34	17	5	0	8	1	1	1	1	2	213	1521	70
4:00	25	1192	74	30	31	2	0	4	0	0	0	0	0	190	1548	67
5:00	23	1289	87	27	19	3	0	6	1	0	0	1	0	164	1620	57
6:00	35	1241	64	56	22	5	0	12	4	0	3	0	0	274	1716	102
7:00	25	1226	69	33	15	3	0	8	2	1	0	0	0	166	1548	62
8:00	14	1014	55	25	6	1	0	4	5	0	1	0	0	119	1244	42
9:00	5	847	31	9	5	0	0	3	1	1	1	0	0	62	965	20
10:00	9	669	32	1	9	1	0	0	0	0	0	0	0	28	749	11
11:00	6	441	18	3	2	0	0	0	0	0	0	0	0	21	491	5
	2	258	7	0	1	0	0	1	0	0	0	0	0	3	272	2
Total	320	18578	1263	424	341	63	2	86	26	10	11	5	2	2662	23793	970
Percent	1.3%	78.1%	5.3%	1.8%	1.4%	0.3%	0.0%	0.4%	0.1%	0.0%	0.0%	0.0%	0.0%	11.2%		4.1%
AM Peak	7:00	8:00	11:00	11:00	9:00	8:00	4:00	11:00	6:00	10:00	7:00	7:00	*	8:00	8:00	11:00
	24	1346	110	32	32	5	1	6	2	2	2	1	*	212	1729	72
PM Peak	5:00	4:00	1:00	5:00	12:00 PM	12:00 PM		12:00 PM	7:00	12:00 PM	5:00	1:00	2:00	5:00	5:00	12:00 PM
	35	1289	96	56	48	12	*	12	5	2	3	1	2	274	1716	118

Site Code: WEST BAY RD
Station ID: ATR316
Location 1: West Bay Road
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Location 3: by BAY TOWN PLAZA
Location 4:
Direction: Combined

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR316 W2019 - RAW
Date Printed: 12/6/2022
Start Date: 4/7/2019
End Date: 4/11/2019

4/9/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	2	121	8	1	0	0	0	0	0	0	0	0	0	2	134	1
2:00	1	57	4	0	0	2	0	0	0	0	0	0	0	0	64	2
3:00	0	32	3	0	0	0	0	0	0	0	0	0	0	1	36	0
4:00	0	37	2	0	0	0	0	0	0	0	0	0	0	2	41	0
5:00	2	78	2	2	0	0	0	0	0	0	0	0	0	12	96	2
6:00	6	198	21	0	1	0	0	0	0	0	0	0	0	18	244	1
7:00	14	641	48	0	7	1	0	2	0	1	0	0	0	40	754	11
8:00	19	1109	67	49	21	2	0	3	0	1	0	0	0	231	1502	76
9:00	27	1153	100	50	33	6	0	5	2	0	2	0	1	262	1641	99
10:00	16	1065	135	31	46	3	0	12	3	0	1	2	0	175	1489	98
11:00	17	982	154	21	30	5	0	6	1	0	2	1	0	166	1385	66
12:00 PM	21	1081	98	29	34	4	0	2	1	0	1	1	0	202	1474	72
1:00	31	1056	86	61	32	10	1	10	7	0	2	0	0	362	1658	123
2:00	31	902	79	77	33	14	0	20	6	2	5	1	1	413	1584	159
3:00	28	988	88	57	45	8	0	11	3	1	4	1	1	331	1566	131
4:00	20	1216	100	27	33	2	0	3	2	1	0	0	0	177	1581	68
5:00	23	1291	83	21	13	1	0	9	2	0	4	0	1	185	1633	51
6:00	22	1333	45	44	15	4	0	6	1	1	6	0	1	262	1740	78
7:00	15	1188	56	36	17	3	0	6	1	0	1	0	0	200	1523	64
8:00	5	1067	42	28	14	3	0	7	0	0	1	0	1	156	1324	54
9:00	4	855	35	4	11	1	0	1	1	0	1	0	0	65	978	19
10:00	9	709	36	9	4	1	0	1	2	0	0	0	0	58	829	17
11:00	6	553	23	4	2	1	0	2	0	0	0	0	0	38	629	9
	6	315	12	0	0	0	0	0	0	0	0	0	0	9	342	0
Total	325	18027	1327	551	391	71	1	106	32	7	30	6	6	3367	24247	1201
Percent	1.3%	74.3%	5.5%	2.3%	1.6%	0.3%	0.0%	0.4%	0.1%	0.0%	0.1%	0.0%	0.0%	13.9%		5.0%
AM Peak	8:00	8:00	10:00	8:00	9:00	8:00	*	9:00	9:00	6:00	8:00	9:00	8:00	8:00	8:00	8:00
	27	1153	154	50	46	6		12	3	1	2	2	1	262	1641	99
PM Peak	12:00 PM	5:00	3:00	1:00	2:00	1:00	12:00 PM	1:00	12:00 PM	1:00	5:00	1:00	1:00	1:00	5:00	1:00
	31	1333	100	77	45	14	1	20	7	2	6	1	1	413	1740	159

Site Code: WEST BAY RD
Station ID: ATR316
Location 1: West Bay Road
Location 2: north of Shadow Ln
Location 3: by BAY TOWN PLAZA
Location 4:
Direction: Combined

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR316 W2019 - RAW
Date Printed: 12/6/2022
Start Date: 4/7/2019
End Date: 4/11/2019

4/10/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	3	161	9	0	2	0	0	0	0	0	0	0	0	1	176	2
2:00	0	78	8	0	0	0	0	0	0	0	0	0	0	1	87	0
3:00	1	31	2	0	0	1	0	0	0	0	0	0	0	0	35	1
4:00	1	22	2	1	0	0	0	0	0	0	0	0	0	0	26	1
5:00	1	81	6	0	0	0	1	0	0	0	0	0	0	10	99	1
6:00	4	228	26	1	3	4	0	0	0	0	0	0	0	13	279	8
7:00	13	603	40	4	8	2	0	3	0	1	0	0	0	41	715	18
8:00	20	1158	81	35	27	6	0	9	3	0	1	0	0	171	1511	81
9:00	19	1218	89	47	27	1	1	12	0	0	0	0	0	248	1662	88
10:00	13	972	144	23	38	1	1	1	0	2	0	1	0	171	1367	67
11:00	19	1041	116	17	41	2	0	8	0	0	0	0	0	160	1404	68
12:00 PM	22	1161	123	17	30	3	0	4	1	1	1	0	1	182	1546	58
1:00	21	1114	124	35	41	5	0	20	2	0	2	0	1	307	1672	106
2:00	35	909	81	67	33	6	1	17	1	1	0	0	1	426	1578	127
3:00	24	1031	73	61	34	7	0	18	2	0	2	1	0	302	1555	125
4:00	25	1073	79	48	52	11	1	9	2	1	2	0	0	288	1591	126
5:00	22	1135	82	48	40	11	0	9	1	0	1	0	0	279	1628	110
6:00	39	880	39	79	39	11	2	20	6	2	6	0	0	431	1554	165
7:00	17	1158	52	39	18	1	1	7	2	0	1	0	0	249	1545	69
8:00	10	1082	46	16	6	1	1	3	1	0	1	0	0	113	1280	29
9:00	6	766	32	9	5	1	0	1	1	0	1	0	0	52	874	18
10:00	11	676	24	4	6	1	0	0	1	0	0	0	0	43	766	12
11:00	9	474	23	1	7	0	0	0	0	0	1	0	0	15	530	9
	1	247	20	1	7	0	0	0	0	0	0	0	0	15	291	8
Total	336	17299	1321	553	464	75	9	141	23	8	19	2	3	3518	23771	1297
Percent	1.4%	72.8%	5.6%	2.3%	2.0%	0.3%	0.0%	0.6%	0.1%	0.0%	0.1%	0.0%	0.0%	14.8%		5.5%
AM Peak	11:00	8:00	9:00	8:00	10:00	7:00	4:00	8:00	7:00	9:00	7:00	9:00	11:00	8:00	8:00	8:00
	22	1218	144	47	41	6	1	12	3	2	1	1	1	248	1662	88
PM Peak	5:00	6:00	12:00 PM	5:00	3:00	3:00	5:00	12:00 PM	5:00	5:00	5:00	2:00	12:00 PM	5:00	12:00 PM	5:00
	39	1158	124	79	52	11	2	20	6	2	6	1	1	431	1672	165

Site Code: WEST BAY RD
Station ID: ATR316
Location 1: West Bay Road
Location 2: north of Shadow Ln
Location 3: by BAY TOWN PLAZA
Location 4:
Direction: Combined

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR316 W2019 - RAW
Date Printed: 12/6/2022
Start Date: 4/7/2019
End Date: 4/11/2019

4/11/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	1	162	10	0	0	0	0	0	0	0	0	0	0	2	175	0
2:00	1	73	2	0	0	0	0	0	0	0	0	0	0	1	77	0
3:00	0	53	2	0	0	0	0	0	0	0	0	0	0	1	56	0
4:00	2	38	2	0	0	0	0	0	0	0	0	0	0	1	43	0
5:00	2	92	3	0	0	1	0	0	0	0	0	0	0	5	103	1
6:00	4	191	25	0	3	2	0	1	0	0	0	0	0	11	237	6
7:00	14	639	43	5	7	3	0	1	0	0	1	0	0	47	760	17
8:00	17	1174	73	42	22	2	0	3	3	1	1	0	0	180	1518	74
9:00	21	1193	84	29	25	5	0	13	3	0	4	0	1	248	1626	80
10:00	22	1057	123	14	28	0	0	4	1	0	1	0	1	141	1392	49
11:00	21	1026	110	17	30	4	1	4	0	0	0	1	0	113	1327	57
12:00 PM	16	1098	114	21	32	3	0	9	0	1	0	0	0	175	1469	66
1:00	14	1139	98	35	28	6	0	8	5	2	1	0	1	252	1589	86
2:00	22	1137	78	58	33	6	0	14	4	0	2	0	0	331	1685	117
3:00	19	1147	95	39	34	3	1	7	7	1	1	0	0	213	1567	93
4:00	17	1097	77	39	41	8	0	9	1	1	1	0	1	240	1532	101
5:00	11	1280	74	41	18	3	1	8	1	2	1	0	0	200	1640	75
6:00	5	343	9	6	5	3	3	5	1	0	1	0	0	82	463	24
7:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	*
8:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	*
9:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	*
10:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	*
11:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	*
	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	*
Total	209	12939	1022	346	306	49	6	86	26	8	14	1	4	2243	17259	846
Percent	1.2%	75.0%	5.9%	2.0%	1.8%	0.3%	0.0%	0.5%	0.2%	0.0%	0.1%	0.0%	0.0%	13.0%		4.9%
AM Peak	9:00	8:00	9:00	7:00	11:00	8:00	10:00	8:00	7:00	7:00	8:00	10:00	8:00	8:00	8:00	8:00
	22	1193	123	42	32	5	1	13	3	1	4	1	1	248	1626	80
PM Peak	1:00	4:00	12:00 PM	1:00	3:00	3:00	5:00	1:00	2:00	12:00 PM	1:00		12:00 PM	1:00	1:00	1:00
	22	1280	98	58	41	8	3	14	7	2	2	*	1	331	1685	117
Grand Total	1266	72834	5180	1927	1536	267	18	431	110	33	76	15	15	12204	95912	4428

Site Code: ATR312 NB
Station ID:
Location 1: ETH NB Traffic
Location 2: BY UNITED PENTECOSTAL
Location 3:
Location 4:

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: atr312-north w2019 -
Date Printed: 12/5/2022
Start Date: 4/6/2019
End Date: 4/13/2019

	4/8/2019		Tuesday		Wednesday		Thursday		Friday		Saturday		Sunday		Average Day	
Time	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
12:00	25	248	28	308	24	320	24	293	37	326	62	*	*	*	33	299
12:15	23	295	14	329	13	324	18	325	28	321	48	*	*	*	24	319
12:30	15	309	18	266	16	292	14	339	18	311	34	*	*	*	19	303
12:45	15	269	8	269	9	335	10	324	18	353	25	*	*	*	14	310
1:00	12	265	14	288	11	306	3	295	18	358	43	*	*	*	17	302
1:15	8	276	5	263	11	285	12	272	16	302	27	*	*	*	13	280
1:30	13	256	6	275	5	277	8	263	7	299	23	*	*	*	10	274
1:45	4	261	10	275	5	268	12	278	9	296	16	*	*	*	9	276
2:00	15	241	10	280	9	251	14	268	11	261	17	*	*	*	13	260
2:15	4	234	7	250	2	239	4	286	10	267	24	*	*	*	9	255
2:30	8	315	4	279	7	283	6	269	4	284	8	*	*	*	6	286
2:45	3	303	7	256	12	267	6	276	3	302	17	*	*	*	8	281
3:00	5	233	1	273	3	258	4	229	3	269	18	*	*	*	6	252
3:15	6	256	7	254	4	288	6	289	5	267	19	*	*	*	8	271
3:30	7	268	6	271	5	263	4	288	2	239	11	*	*	*	6	266
3:45	9	231	4	295	3	257	4	291	3	250	14	*	*	*	6	265
4:00	8	292	9	285	4	290	11	272	11	282	12	*	*	*	9	284
4:15	5	257	14	269	11	280	14	263	15	310	14	*	*	*	12	276
4:30	13	267	13	309	27	293	28	315	12	326	19	*	*	*	19	302
4:45	40	300	31	313	34	316	33	336	39	330	32	*	*	*	35	319
5:00	34	394	27	414	30	346	39	410	36	391	26	*	*	*	32	391
5:15	42	353	39	381	38	333	45	376	46	351	28	*	*	*	40	359
5:30	41	338	38	379	52	278	41	334	52	362	31	*	*	*	43	338
5:45	57	356	73	300	60	281	68	308	63	311	54	*	*	*	63	311
6:00	87	248	76	294	79	356	85	292	73	334	58	*	*	*	76	305
6:15	113	223	140	230	128	343	131	244	147	261	76	*	*	*	123	260
6:30	187	199	209	226	203	233	196	246	219	217	132	*	*	*	191	224
6:45	213	234	269	235	246	194	241	208	231	255	179	*	*	*	230	225
7:00	224	197	229	180	249	184	215	223	251	217	141	*	*	*	218	200
7:15	253	182	262	169	226	173	264	162	253	185	137	*	*	*	233	174
7:30	285	152	317	182	328	152	282	176	297	172	157	*	*	*	278	167
7:45	321	155	325	132	347	109	364	158	317	164	193	*	*	*	311	144
8:00	297	112	348	139	334	112	304	129	307	141	162	*	*	*	292	127
8:15	294	122	281	137	300	116	288	116	272	131	180	*	*	*	269	124
8:30	288	112	269	104	280	105	308	129	303	144	228	*	*	*	279	119
8:45	302	114	294	94	275	88	276	139	290	126	256	*	*	*	282	112
9:00	230	110	245	114	259	114	251	135	261	135	231	*	*	*	246	122
9:15	227	90	242	95	230	108	244	113	238	136	248	*	*	*	238	108
9:30	227	78	249	105	249	101	235	91	248	109	262	*	*	*	245	97
9:45	221	68	243	105	234	72	225	76	239	101	303	*	*	*	244	84
10:00	222	63	221	100	212	82	225	80	222	94	293	*	*	*	233	84
10:15	225	64	227	66	232	53	226	60	219	89	283	*	*	*	235	66
10:30	236	67	226	48	226	55	240	48	233	89	47	*	*	*	201	61
10:45	247	49	222	53	233	51	207	55	229	81	0	*	*	*	190	58
11:00	205	41	233	27	228	42	226	46	233	76	*	*	*	*	225	46
11:15	248	35	225	27	226	30	238	29	248	61	*	*	*	*	237	36
11:30	257	24	256	29	279	37	281	41	262	72	*	*	*	*	267	41
11:45	276	33	291	33	320	30	305	46	295	56	*	*	*	*	297	40
Total	6097	9589	6292	10005	6318	9870	6285	10241	6353	10814	4188	0	0	0	6093	10104
Day Total	15686		16297		16188		16526		17167		4188		0		16197	
% Splits	38.9%	61.1%	38.6%	61.4%	39.0%	61.0%	38.0%	62.0%	37.0%	63.0%	100.0%	0.0%	*	*	37.6%	62.4%
Peak	7:45	5:00	7:30	4:45	7:30	4:30	7:45	4:45	7:45	4:45	9:30				7:45	4:45
Volume	1200	1441	1271	1487	1309	1288	1264	1456	1199	1434	1141				1151	1407
Peak Factor	0.935	0.914	0.913	0.898	0.943	0.931	0.868	0.888	0.946	0.917	0.941				0.925	0.900

ADT ADT: 16,380 AADT: 16,380

Site Code: ATR312 NB
Station ID:
Location 1: ETH NB Traffic
Location 2: BY UNITED PENTECOSTAL CHURCH
Location 3:
Location 4:
Direction: Northbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: atr312-north w2019 - raw
Date Printed: 12/6/2022
Start Date: 4/6/2019
End Date: 4/13/2019

4/6/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
2:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
3:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
4:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
5:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
6:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
7:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
8:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
9:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
10:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
11:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
12:00 PM	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
1:00	5	659	27	2	6	3	0	2	4	0	0	0	1	59	768	18
2:00	11	1011	24	4	5	9	1	2	1	0	0	0	1	75	1144	23
3:00	26	867	30	6	9	10	1	3	2	1	1	0	0	158	1114	33
4:00	11	943	33	1	1	10	0	1	1	0	2	0	1	68	1072	17
5:00	14	999	27	3	5	2	0	1	2	1	1	0	0	92	1147	15
6:00	12	967	29	6	5	6	0	1	1	2	1	0	0	100	1130	22
7:00	12	871	23	5	0	7	0	2	4	0	0	0	1	101	1026	19
8:00	4	727	23	3	2	2	0	1	3	0	0	0	0	75	840	11
9:00	4	581	20	1	0	4	0	1	0	0	1	0	0	35	647	7
10:00	2	431	14	0	0	3	0	1	1	0	0	0	0	25	477	5
11:00	2	314	7	0	0	0	0	0	0	0	0	0	0	13	336	0
	0	77	1	0	0	0	0	0	0	0	0	0	0	157	235	0
Total	103	8447	258	31	33	56	2	15	19	4	6	0	4	958	9936	170
Percent	1.0%	85.0%	2.6%	0.3%	0.3%	0.6%	0.0%	0.2%	0.2%	0.0%	0.1%	0.0%	0.0%	9.6%		1.7%
AM Peak	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
PM Peak	2:00	1:00	3:00	2:00	2:00	2:00	1:00	2:00	12:00 PM	5:00	3:00		12:00 PM	2:00	4:00	2:00
	26	1011	33	6	9	10	1	3	4	2	2	*	1	158	1147	33

Site Code: ATR312 NB
Station ID:
Location 1: ETH NB Traffic
Location 2: BY UNITED PENTECOSTAL CHURCH
Location 3:
Location 4:
Direction: Northbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: atr312-north w2019 - raw
Date Printed: 12/6/2022
Start Date: 4/6/2019
End Date: 4/13/2019

4/7/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	0	0	0	0	0	0	0	0	0	0	0	0	0	195	195	0
2:00	0	0	0	0	0	0	0	0	0	0	0	0	0	92	92	0
3:00	0	0	0	0	0	0	0	0	0	0	0	0	0	49	49	0
4:00	0	0	0	0	0	0	0	0	0	0	0	0	0	32	32	0
5:00	0	0	0	0	0	0	0	0	0	0	0	0	0	80	80	0
6:00	0	0	0	0	0	0	0	0	0	0	0	0	0	118	118	0
7:00	0	0	0	0	0	0	0	0	0	0	0	0	0	179	179	0
8:00	3	226	6	0	1	1	0	0	0	0	0	0	0	67	304	2
9:00	7	369	9	1	1	2	0	2	0	0	0	1	0	34	426	7
10:00	7	488	16	7	2	2	1	1	0	0	0	0	1	75	600	14
11:00	3	512	24	2	1	4	0	3	0	0	1	1	0	107	658	12
12:00 PM	2	541	27	0	1	1	0	0	1	0	0	0	0	75	648	3
1:00	2	642	26	2	1	3	0	2	1	0	1	0	3	97	780	13
2:00	3	648	26	1	0	4	0	1	2	0	0	0	0	73	758	8
3:00	3	547	33	3	2	1	0	0	0	0	0	0	0	56	645	6
4:00	1	575	8	4	4	4	0	0	0	0	0	0	0	72	668	12
5:00	5	527	25	4	0	1	0	1	0	0	0	0	0	57	620	6
6:00	3	536	13	3	3	0	0	2	0	0	2	0	0	65	627	10
7:00	3	492	25	1	0	4	0	0	0	0	0	0	0	85	610	5
8:00	1	438	16	2	0	1	0	1	0	0	0	1	0	77	537	5
9:00	0	360	7	0	1	2	0	1	0	0	0	0	0	40	411	4
10:00	0	296	12	0	1	1	0	0	0	0	0	0	0	26	336	2
11:00	1	204	5	0	1	1	0	0	0	0	0	0	0	21	233	2
	1	137	3	1	0	0	0	0	0	0	0	0	0	12	154	1
Total	45	7538	281	31	19	32	1	14	4	0	4	3	4	1784	9760	112
Percent	0.5%	77.2%	2.9%	0.3%	0.2%	0.3%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	18.3%		1.1%
AM Peak	8:00	11:00	11:00	9:00	9:00	10:00	9:00	10:00	11:00		10:00	8:00	9:00	12:00 AM	10:00	9:00
	7	541	27	7	2	4	1	3	1	*	1	1	1	195	658	14
PM Peak	4:00	1:00	2:00	3:00	3:00	1:00		12:00 PM	1:00		5:00	7:00	12:00 PM	12:00 PM	12:00 PM	12:00 PM
	5	648	33	4	4	4	*	2	2	*	2	1	3	97	780	13

Site Code: ATR312 NB
Station ID:
Location 1: ETH NB Traffic
Location 2: BY UNITED PENTECOSTAL CHURCH
Location 3:
Location 4:
Direction: Northbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: atr312-north w2019 - raw
Date Printed: 12/6/2022
Start Date: 4/6/2019
End Date: 4/13/2019

4/8/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	0	73	2	0	0	0	0	0	0	0	0	0	0	3	78	0
2:00	0	31	1	0	2	3	0	0	0	0	0	0	0	0	37	5
3:00	0	28	0	0	0	0	0	0	0	0	0	0	0	2	30	0
4:00	0	12	1	0	0	0	0	1	0	0	0	0	0	13	27	1
5:00	0	59	2	0	0	0	0	2	0	0	0	0	0	3	66	2
6:00	0	155	7	0	3	0	0	1	0	0	0	0	0	8	174	4
7:00	2	398	17	2	3	2	0	2	1	0	0	0	0	171	598	10
8:00	6	830	46	5	9	8	0	1	3	1	1	0	1	164	1075	29
9:00	5	904	42	4	5	14	0	2	3	2	0	0	0	184	1165	30
10:00	3	668	57	5	7	11	1	0	1	2	0	0	0	150	905	27
11:00	8	645	59	5	11	10	0	3	1	2	0	0	0	180	924	32
12:00 PM	8	677	62	5	3	8	0	3	2	0	0	0	0	200	968	21
1:00	5	802	40	5	6	9	0	1	3	0	1	0	0	241	1113	25
2:00	5	750	49	4	8	10	0	0	0	1	0	0	0	229	1056	23
3:00	9	755	45	6	8	8	0	3	3	1	0	0	0	251	1089	29
4:00	9	720	35	3	6	8	0	4	1	1	1	0	0	196	984	24
5:00	6	821	42	5	8	3	0	2	1	0	1	0	0	219	1108	20
6:00	12	1035	25	11	5	9	0	3	1	1	1	0	0	332	1435	31
7:00	4	615	22	5	1	5	0	2	1	0	1	0	0	244	900	15
8:00	6	499	13	1	0	4	0	2	0	0	0	0	0	157	682	7
9:00	3	362	6	1	0	2	0	1	0	0	0	0	0	85	460	4
10:00	1	290	8	0	1	0	0	0	0	0	0	0	0	46	346	1
11:00	0	214	5	0	0	0	0	0	0	0	0	0	0	24	243	0
	1	114	3	0	0	2	0	0	0	0	0	0	0	13	133	2
Total	93	11457	589	67	86	116	1	33	21	11	6	0	1	3115	15596	342
Percent	0.6%	73.5%	3.8%	0.4%	0.6%	0.7%	0.0%	0.2%	0.1%	0.1%	0.0%	0.0%	0.0%	20.0%		2.2%
AM Peak	10:00	8:00	11:00	7:00	10:00	8:00	9:00	10:00	7:00	8:00	7:00		7:00	11:00	8:00	10:00
	8	904	62	5	11	14	1	3	3	2	1	*	1	200	1165	32
PM Peak	5:00	5:00	1:00	5:00	1:00	1:00		3:00	12:00 PM	1:00	12:00 PM			5:00	5:00	5:00
	12	1035	49	11	8	10	*	4	3	1	1	*	*	332	1435	31

Site Code: ATR312 NB
Station ID:
Location 1: ETH NB Traffic
Location 2: BY UNITED PENTECOSTAL CHURCH
Location 3:
Location 4:
Direction: Northbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: atr312-north w2019 - raw
Date Printed: 12/6/2022
Start Date: 4/6/2019
End Date: 4/13/2019

4/9/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	0	60	0	0	0	0	0	0	0	0	0	0	0	8	68	0
2:00	0	27	0	0	0	0	0	0	0	0	0	0	0	8	35	0
3:00	0	28	0	0	0	0	0	0	0	0	0	0	0	0	28	0
4:00	0	14	1	0	0	0	0	1	0	0	0	0	0	2	18	1
5:00	0	59	1	0	0	0	0	3	0	0	0	0	0	4	67	3
6:00	1	145	5	1	3	1	0	2	0	0	0	0	0	19	177	7
7:00	6	470	36	5	4	8	0	1	1	1	0	0	0	154	686	20
8:00	6	787	34	10	7	10	0	4	2	0	1	0	0	270	1131	34
9:00	5	809	37	7	3	13	0	4	0	0	2	0	0	302	1182	29
10:00	2	633	58	3	7	14	0	5	2	1	1	0	0	247	973	33
11:00	1	572	50	5	13	10	0	4	1	1	0	0	0	235	892	34
12:00 PM	7	665	55	6	11	11	0	5	2	2	0	1	2	234	1001	40
1:00	7	793	48	6	6	13	0	4	1	1	1	0	0	282	1162	32
2:00	5	804	54	3	2	9	0	4	0	0	0	0	0	214	1095	18
3:00	5	759	41	10	5	7	0	5	6	1	1	0	0	223	1063	35
4:00	9	802	53	4	5	13	0	5	5	2	1	0	0	190	1089	35
5:00	11	799	48	11	4	5	0	1	5	1	2	0	0	273	1160	29
6:00	12	1047	31	12	3	7	0	6	1	1	1	0	0	349	1470	31
7:00	5	733	17	5	1	4	0	1	0	0	0	0	0	215	981	11
8:00	3	510	12	4	1	5	0	0	0	1	0	0	0	127	663	11
9:00	0	356	13	4	1	2	0	0	0	0	0	0	0	92	468	7
10:00	3	351	7	0	1	1	0	1	0	0	0	0	0	53	417	3
11:00	1	220	8	0	1	0	0	0	0	0	0	0	0	37	267	1
	1	104	2	0	0	0	0	0	0	0	0	0	0	9	116	0
Total	90	11547	611	96	78	133	0	56	26	12	10	1	2	3547	16209	414
Percent	0.6%	71.2%	3.8%	0.6%	0.5%	0.8%	0.0%	0.3%	0.2%	0.1%	0.1%	0.0%	0.0%	21.9%		2.6%
AM Peak	11:00	8:00	9:00	7:00	10:00	9:00		9:00	7:00	11:00	8:00	11:00	11:00	8:00	8:00	11:00
	7	809	58	10	13	14	*	5	2	2	2	1	2	302	1182	40
PM Peak	5:00	5:00	1:00	5:00	12:00 PM	12:00 PM		5:00	2:00	3:00	4:00			5:00	5:00	2:00
	12	1047	54	12	6	13	*	6	6	2	2	*	*	349	1470	35

Site Code: ATR312 NB
Station ID:
Location 1: ETH NB Traffic
Location 2: BY UNITED PENTECOSTAL CHURCH
Location 3:
Location 4:
Direction: Northbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: atr312-north w2019 - raw
Date Printed: 12/6/2022
Start Date: 4/6/2019
End Date: 4/13/2019

4/10/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	0	54	2	0	0	0	0	1	0	0	0	0	0	5	62	1
2:00	0	30	0	0	0	0	0	0	0	0	0	0	0	2	32	0
3:00	0	25	1	0	0	0	0	0	0	0	0	0	0	4	30	0
4:00	0	12	0	0	0	0	0	1	0	0	0	0	0	2	15	1
5:00	0	67	2	0	0	1	0	2	0	0	0	0	0	4	76	3
6:00	0	153	7	0	3	1	0	1	1	0	0	0	0	14	180	6
7:00	3	477	25	4	5	5	0	1	0	1	1	0	0	134	656	17
8:00	5	794	52	7	9	8	0	4	2	1	0	0	0	256	1138	31
9:00	7	791	43	7	9	11	0	4	2	0	1	0	0	310	1185	34
10:00	3	651	51	7	10	17	1	5	2	1	0	0	0	220	968	43
11:00	5	597	38	6	15	13	0	6	3	0	0	0	1	215	899	44
12:00 PM	2	701	46	9	11	16	0	6	1	1	1	0	1	252	1047	46
1:00	4	834	42	15	9	12	0	5	1	0	2	0	0	333	1257	44
2:00	9	743	47	11	5	8	1	1	3	0	0	0	0	296	1124	29
3:00	1	691	63	6	9	9	0	3	0	0	0	0	1	251	1034	28
4:00	4	678	39	6	7	10	0	6	1	1	0	0	0	312	1064	31
5:00	11	732	58	5	5	2	0	3	0	1	0	0	0	354	1171	16
6:00	5	834	38	3	5	4	0	3	2	0	1	0	0	335	1230	18
7:00	5	781	24	2	4	7	1	3	0	0	0	0	0	295	1122	17
8:00	5	478	20	1	1	0	0	1	0	0	0	0	0	106	612	3
9:00	0	336	13	0	2	0	0	0	1	0	0	0	0	67	419	3
10:00	0	300	5	0	0	2	0	0	0	0	0	0	0	84	391	2
11:00	1	203	5	1	0	1	0	0	0	0	0	0	0	30	241	2
	1	101	6	0	1	0	0	0	0	0	0	0	0	30	139	1
Total	71	11063	627	90	110	127	3	56	19	6	6	0	3	3911	16092	420
Percent	0.4%	68.7%	3.9%	0.6%	0.7%	0.8%	0.0%	0.3%	0.1%	0.0%	0.0%	0.0%	0.0%	24.3%		2.6%
AM Peak	8:00	7:00	7:00	11:00	10:00	9:00	9:00	10:00	10:00	6:00	6:00		10:00	8:00	8:00	11:00
	7	794	52	9	15	17	1	6	3	1	1	*	1	310	1185	46
PM Peak	4:00	12:00 PM	2:00	12:00 PM	12:00 PM	12:00 PM	1:00	3:00	1:00	3:00	12:00 PM		2:00	4:00	12:00 PM	12:00 PM
	11	834	63	15	9	12	1	6	3	1	2	*	1	354	1257	44

Site Code: ATR312 NB
Station ID:
Location 1: ETH NB Traffic
Location 2: BY UNITED PENTECOSTAL CHURCH
Location 3:
Location 4:
Direction: Northbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: atr312-north w2019 - raw
Date Printed: 12/6/2022
Start Date: 4/6/2019
End Date: 4/13/2019

4/11/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	0	57	2	0	0	0	0	0	0	0	0	0	0	7	66	0
2:00	0	31	0	0	0	0	0	0	0	0	0	0	0	4	35	0
3:00	0	22	2	0	0	0	0	1	0	0	0	0	0	5	30	1
4:00	0	13	0	0	0	0	0	0	0	0	0	0	0	5	18	0
5:00	0	64	6	0	0	2	0	0	0	0	0	0	0	14	86	2
6:00	1	157	3	0	2	2	0	2	0	0	0	0	0	26	193	6
7:00	3	446	28	6	5	4	0	3	0	1	0	0	0	155	651	19
8:00	4	726	38	4	6	8	0	3	1	0	0	1	0	318	1109	23
9:00	6	766	37	2	7	16	0	1	2	1	0	1	1	328	1168	31
10:00	3	595	41	4	8	9	0	2	2	0	0	0	0	287	951	25
11:00	5	539	53	0	7	17	0	1	2	0	1	0	0	271	896	28
12:00 PM	6	660	55	1	7	10	0	1	1	0	1	0	1	299	1042	22
1:00	9	827	54	4	9	9	0	1	1	0	0	0	0	361	1275	24
2:00	7	696	49	5	9	11	0	2	0	0	1	0	2	320	1102	30
3:00	8	684	50	4	6	12	0	6	3	0	0	0	0	312	1085	31
4:00	2	680	43	6	4	4	0	6	2	0	0	0	0	338	1085	22
5:00	6	767	38	3	6	6	0	2	0	0	0	0	0	352	1180	17
6:00	10	929	42	2	5	3	0	2	1	0	0	2	0	426	1422	15
7:00	7	649	14	5	3	1	0	0	0	0	0	0	0	305	984	9
8:00	2	511	16	2	1	2	0	0	1	0	0	0	0	184	719	6
9:00	4	356	7	3	0	0	0	1	0	0	0	0	0	140	511	4
10:00	2	299	10	0	0	1	0	0	0	0	0	0	0	101	413	1
11:00	1	187	4	0	3	0	0	0	0	0	0	0	0	48	243	3
	1	123	7	1	0	0	0	0	0	0	0	0	0	30	162	1
Total	87	10784	599	52	88	117	0	34	16	2	3	4	4	4636	16426	320
Percent	0.5%	65.7%	3.6%	0.3%	0.5%	0.7%	0.0%	0.2%	0.1%	0.0%	0.0%	0.0%	0.0%	28.2%		1.9%
AM Peak	8:00	8:00	11:00	6:00	9:00	10:00		6:00	8:00	6:00	10:00	7:00	8:00	8:00	8:00	8:00
	6	766	55	6	8	17	*	3	2	1	1	1	1	328	1168	31
PM Peak	5:00	5:00	12:00 PM	3:00	12:00 PM	2:00		2:00	2:00		1:00	5:00	1:00	5:00	5:00	2:00
	10	929	54	6	9	12	*	6	3	*	1	2	2	426	1422	31

Site Code: ATR312 NB
Station ID:
Location 1: ETH NB Traffic
Location 2: BY UNITED PENTECOSTAL CHURCH
Location 3:
Location 4:
Direction: Northbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: atr312-north w2019 - raw
Date Printed: 12/6/2022
Start Date: 4/6/2019
End Date: 4/13/2019

4/12/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	0	79	2	0	0	0	0	0	0	0	0	0	0	20	101	0
2:00	0	38	0	0	0	0	0	0	0	0	0	0	0	10	48	0
3:00	0	18	0	0	0	0	0	0	0	0	0	0	0	10	28	0
4:00	0	9	0	0	0	0	0	0	0	0	0	0	0	4	13	0
5:00	0	58	4	0	0	2	0	2	0	0	0	0	0	11	77	4
6:00	0	145	7	0	3	1	0	2	0	2	0	0	0	37	197	8
7:00	4	424	23	2	3	2	0	1	0	0	0	0	0	207	666	8
8:00	5	732	33	3	10	6	0	1	5	1	0	0	0	316	1112	26
9:00	4	731	37	3	7	17	0	2	0	0	0	1	0	350	1152	30
10:00	8	565	45	2	7	14	0	3	2	0	0	0	0	336	982	28
11:00	5	530	44	3	12	15	1	1	0	1	0	0	0	289	901	33
12:00 PM	2	655	31	3	12	7	0	3	1	1	0	1	0	318	1034	28
1:00	3	806	34	6	5	13	1	3	0	1	0	0	0	433	1305	29
2:00	3	784	29	7	8	6	0	4	0	0	0	0	0	402	1243	25
3:00	5	698	32	3	3	4	0	2	1	0	0	0	0	362	1110	13
4:00	5	581	29	5	6	7	0	0	0	2	1	0	0	385	1021	21
5:00	6	724	32	7	9	4	0	1	2	0	0	0	0	447	1232	23
6:00	8	851	31	4	5	2	0	2	1	0	0	0	0	503	1407	14
7:00	9	663	24	3	1	2	0	3	0	0	0	0	0	354	1059	9
8:00	5	469	17	1	5	3	0	0	1	0	1	0	0	236	738	11
9:00	1	374	9	0	1	1	0	1	0	0	0	0	0	151	538	3
10:00	2	328	7	0	3	1	0	0	0	0	0	0	0	140	481	4
11:00	2	234	7	1	1	1	0	0	0	0	1	0	0	102	349	4
	2	173	4	0	1	1	0	0	0	0	0	0	0	84	265	2
Total	79	10669	481	53	102	109	2	31	13	8	3	2	0	5507	17059	323
Percent	0.5%	62.5%	2.8%	0.3%	0.6%	0.6%	0.0%	0.2%	0.1%	0.0%	0.0%	0.0%	0.0%	32.3%		1.9%
AM Peak	9:00	7:00	9:00	7:00	10:00	8:00	10:00	9:00	7:00	5:00		8:00		8:00	8:00	10:00
	8	732	45	3	12	17	1	3	5	2	*	1	*	350	1152	33
PM Peak	6:00	5:00	12:00 PM	1:00	4:00	12:00 PM	12:00 PM	1:00	4:00	3:00	3:00			5:00	5:00	12:00 PM
	9	851	34	7	9	13	1	4	2	2	1	*	*	503	1407	29

Site Code: ATR312 NB
Station ID:
Location 1: ETH NB Traffic
Location 2: BY UNITED PENTECOSTAL CHURCH
Location 3:
Location 4:
Direction: Northbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: atr312-north w2019 - raw
Date Printed: 12/6/2022
Start Date: 4/6/2019
End Date: 4/13/2019

4/13/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	0	115	3	0	0	0	0	0	0	0	0	0	0	51	169	0
2:00	0	76	5	0	0	1	0	0	0	0	0	0	0	27	109	1
3:00	0	41	3	0	0	0	0	0	0	0	0	0	0	22	66	0
4:00	0	36	1	1	0	0	0	0	0	0	0	0	0	24	62	1
5:00	0	54	2	0	0	3	0	1	0	0	0	0	0	17	77	4
6:00	0	91	5	0	2	6	0	1	0	0	0	0	0	34	139	9
7:00	2	263	13	1	4	6	0	0	0	1	0	0	0	149	439	12
8:00	0	363	26	1	7	3	0	1	0	0	0	0	0	227	628	12
9:00	4	473	35	1	6	5	0	1	1	0	0	0	0	298	824	14
10:00	4	660	31	7	3	4	0	1	2	1	0	0	0	321	1034	18
11:00	7	340	19	1	6	3	0	0	0	0	1	0	0	238	615	11
12:00 PM	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	*
1:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	*
2:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	*
3:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	*
4:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	*
5:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	*
6:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	*
7:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	*
8:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	*
9:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	*
10:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	*
11:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	*
	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	*
Total	17	2512	143	12	28	31	0	5	3	2	1	0	0	1408	4162	82
Percent	0.4%	60.4%	3.4%	0.3%	0.7%	0.7%	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	33.8%		2.0%
AM Peak	10:00	9:00	8:00	9:00	7:00	5:00		4:00	9:00	6:00	10:00			9:00	9:00	9:00
	7	660	35	7	7	6	*	1	2	1	1	*	*	321	1034	18
PM Peak																
	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Grand Total	585	74017	3589	432	544	721	9	244	121	45	39	10	18	24866	105240	2183

Site Code: ATR312-SB
Station ID:
Location 1: ETH
Location 2: BY UNITED
Location 3:
Location 4:

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR312-SOUTH W2019 -
Date Printed: 12/5/2022
Start Date: 4/6/2019
End Date: 4/13/2019

	4/1/2019		Tuesday		Wednesd		Thursday		Friday		Saturday		Sunday		Average Day	
Time	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
12:00	*	*	*	*	*	*	*	*	*	*	*	*	131	175	131	175
12:15	*	*	*	*	*	*	*	*	*	*	*	*	81	150	81	150
12:30	*	*	*	*	*	*	*	*	*	*	*	*	66	177	66	177
12:45	*	*	*	*	*	*	*	*	*	*	*	*	35	160	35	160
1:00	*	*	*	*	*	*	*	*	*	*	*	201	28	181	28	191
1:15	*	*	*	*	*	*	*	*	*	*	*	265	35	155	35	210
1:30	*	*	*	*	*	*	*	*	*	*	*	241	30	138	30	190
1:45	*	*	*	*	*	*	*	*	*	*	*	301	16	150	16	226
2:00	*	*	*	*	*	*	*	*	*	*	*	248	18	168	18	208
2:15	*	*	*	*	*	*	*	*	*	*	*	229	14	141	14	185
2:30	*	*	*	*	*	*	*	*	*	*	*	283	9	153	9	218
2:45	*	*	*	*	*	*	*	*	*	*	*	257	8	167	8	212
3:00	*	*	*	*	*	*	*	*	*	*	*	276	13	134	13	205
3:15	*	*	*	*	*	*	*	*	*	*	*	270	11	128	11	199
3:30	*	*	*	*	*	*	*	*	*	*	*	245	5	158	5	202
3:45	*	*	*	*	*	*	*	*	*	*	*	254	7	130	7	192
4:00	*	*	*	*	*	*	*	*	*	*	*	221	7	137	7	179
4:15	*	*	*	*	*	*	*	*	*	*	*	229	10	143	10	186
4:30	*	*	*	*	*	*	*	*	*	*	*	214	14	172	14	193
4:45	*	*	*	*	*	*	*	*	*	*	*	223	20	138	20	181
5:00	*	*	*	*	*	*	*	*	*	*	*	202	32	149	32	176
5:15	*	*	*	*	*	*	*	*	*	*	*	232	23	170	23	201
5:30	*	*	*	*	*	*	*	*	*	*	*	183	27	136	27	160
5:45	*	*	*	*	*	*	*	*	*	*	*	185	30	156	30	171
6:00	*	*	*	*	*	*	*	*	*	*	*	184	39	163	39	174
6:15	*	*	*	*	*	*	*	*	*	*	*	195	37	177	37	186
6:30	*	*	*	*	*	*	*	*	*	*	*	176	30	156	30	166
6:45	*	*	*	*	*	*	*	*	*	*	*	205	49	153	49	179
7:00	*	*	*	*	*	*	*	*	*	*	*	226	45	186	45	206
7:15	*	*	*	*	*	*	*	*	*	*	*	184	43	195	43	190
7:30	*	*	*	*	*	*	*	*	*	*	*	179	52	147	52	163
7:45	*	*	*	*	*	*	*	*	*	*	*	180	71	140	71	160
8:00	*	*	*	*	*	*	*	*	*	*	*	142	66	118	66	130
8:15	*	*	*	*	*	*	*	*	*	*	*	163	70	133	70	148
8:30	*	*	*	*	*	*	*	*	*	*	*	134	69	110	69	122
8:45	*	*	*	*	*	*	*	*	*	*	*	175	123	115	123	145
9:00	*	*	*	*	*	*	*	*	*	*	*	187	97	131	97	159
9:15	*	*	*	*	*	*	*	*	*	*	*	185	117	105	117	145
9:30	*	*	*	*	*	*	*	*	*	*	*	171	142	110	142	141
9:45	*	*	*	*	*	*	*	*	*	*	*	174	162	66	162	120
10:00	*	*	*	*	*	*	*	*	*	*	*	156	221	71	221	114
10:15	*	*	*	*	*	*	*	*	*	*	*	177	189	59	189	118
10:30	*	*	*	*	*	*	*	*	*	*	*	176	176	50	176	113
10:45	*	*	*	*	*	*	*	*	*	*	*	167	183	40	183	104
11:00	*	*	*	*	*	*	*	*	*	*	*	144	178	37	178	91
11:15	*	*	*	*	*	*	*	*	*	*	*	139	186	39	186	89
11:30	*	*	*	*	*	*	*	*	*	*	*	130	169	39	169	85
11:45	*	*	*	*	*	*	*	*	*	*	*	195	185	28	185	112
Total	0	0	0	0	0	0	0	0	0	0	0	8903	3369	6234	3369	7900
Day Total	0		0		0		0		0		8903		9603		11269	
% Splits	*	*	*	*	*	*	*	*	*	*	0.0%	100.0%	35.1%	64.9%	29.9%	70.1%
Peak												2:30	10:00	6:30	10:00	1:45
Volume												1086	769	690	769	837
Peak Factor												0.959	0.870	0.885	0.870	0.926

Site Code: ATR312-SB
Station ID:
Location 1: ETH
Location 2: BY UNITED PENTECOSTAL
Location 3:
Location 4:

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR312-SOUTH W2019 -
Date Printed: 12/5/2022
Start Date: 4/6/2019
End Date: 4/13/2019

	4/8/2019		Tuesday		Wednesday		Thursday		Friday		Saturday		Sunday		Average Day	
Time	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
12:00	39	294	30	301	22	294	35	295	29	304	52	*	131	175	48	277
12:15	19	242	11	272	24	316	22	280	21	268	54	*	81	150	33	255
12:30	17	218	19	275	22	283	21	272	15	271	47	*	66	177	30	249
12:45	51	244	12	299	11	260	14	288	16	302	33	*	35	160	25	259
1:00	18	281	14	288	14	293	13	290	13	263	42	201	28	181	20	257
1:15	10	263	13	287	7	285	16	279	8	298	27	265	35	155	17	262
1:30	9	269	7	241	2	285	8	250	12	297	35	241	30	138	15	246
1:45	10	259	5	285	11	325	12	281	8	286	33	301	16	150	14	270
2:00	6	243	4	258	5	308	4	276	12	265	38	248	18	168	12	252
2:15	13	235	8	284	2	275	8	292	6	288	21	229	14	141	10	249
2:30	4	276	6	229	3	290	5	248	8	251	17	283	9	153	7	247
2:45	9	235	2	252	1	271	1	280	4	268	16	257	8	167	6	247
3:00	4	270	3	285	5	287	4	264	5	296	15	276	13	134	7	259
3:15	1	277	3	291	6	250	5	264	5	301	14	270	11	128	6	254
3:30	6	282	5	284	8	240	5	250	3	269	14	245	5	158	7	247
3:45	6	272	9	236	6	272	7	297	5	262	17	254	7	130	8	246
4:00	5	255	7	260	12	260	4	283	4	271	14	221	7	137	8	241
4:15	4	298	8	269	2	278	6	305	9	276	11	229	10	143	7	257
4:30	10	326	13	342	12	365	12	339	10	315	12	214	14	172	12	296
4:45	22	285	19	260	13	308	29	293	17	307	26	223	20	138	21	259
5:00	23	342	23	329	30	357	31	308	42	278	32	202	32	149	30	281
5:15	36	273	33	269	42	228	24	292	44	258	24	232	23	170	32	246
5:30	44	256	39	260	54	311	54	252	49	241	37	183	27	136	43	234
5:45	62	202	73	223	57	272	70	225	66	209	56	185	30	156	59	210
6:00	72	245	72	225	55	181	75	217	79	221	47	184	39	163	63	205
6:15	100	220	102	206	92	187	92	189	96	193	58	195	37	177	82	195
6:30	118	180	151	222	143	200	143	218	150	208	93	176	30	156	118	194
6:45	184	184	190	218	163	192	201	198	172	193	104	205	49	153	152	192
7:00	197	201	222	196	231	168	237	249	204	218	101	226	45	186	177	206
7:15	298	188	299	216	271	155	280	206	272	172	104	184	43	195	224	188
7:30	347	158	334	169	354	168	358	195	341	155	135	179	52	147	274	167
7:45	354	135	365	129	354	126	336	130	359	145	170	180	71	140	287	141
8:00	342	128	361	153	358	111	306	126	330	142	163	142	66	118	275	131
8:15	410	125	361	106	384	115	375	137	330	118	177	163	70	133	301	128
8:30	286	102	283	139	294	115	247	136	278	136	190	134	69	110	235	125
8:45	254	77	280	126	252	91	275	111	280	127	233	175	123	115	242	117
9:00	216	125	209	99	190	104	217	135	215	118	230	187	97	131	196	128
9:15	195	96	207	92	195	114	213	97	210	146	230	185	117	105	195	119
9:30	196	78	216	89	211	92	210	118	238	116	222	171	142	110	205	111
9:45	213	64	224	85	212	80	207	93	238	100	284	174	162	66	220	95
10:00	190	75	206	83	225	74	225	115	233	141	265	156	221	71	224	102
10:15	193	53	201	84	235	59	232	78	229	122	320	177	189	59	228	90
10:30	236	38	229	48	213	54	211	59	235	89	32	176	176	50	190	73
10:45	210	51	239	50	243	51	212	74	208	95	0	167	183	40	185	75
11:00	215	41	230	41	232	46	196	48	230	87	*	144	178	37	214	63
11:15	240	42	239	48	217	48	239	51	263	94	*	139	186	39	231	66
11:30	259	42	243	35	258	35	273	46	284	76	*	130	169	39	248	58
11:45	225	34	279	36	272	36	270	41	330	80	*	195	185	28	260	64
Total	5978	9079	6108	9474	6025	9515	6040	9770	6215	9936	3845	8903	3369	6234	5505	9136
Day Total	15057		15582		15540		15810		16151		12748		9603		14640	
% Splits	39.7%	60.3%	39.2%	60.8%	38.8%	61.2%	38.2%	61.8%	38.5%	61.5%	30.2%	69.8%	35.1%	64.9%	37.6%	62.4%
Peak	7:30	4:15	7:30	4:15	7:30	4:15	7:30	4:15	7:30	4:15	9:30		10:00	6:30	7:30	4:15
Volume	1453	1251	1421	1200	1450	1308	1375	1245	1360	1176	1091		769	690	1285	1236
Peak Factor	0.886	0.914	0.973	0.877	0.944	0.896	0.917	0.918	0.947	0.933	0.852		0.870	0.885	0.945	0.917

ADT ADT: 15,631 AADT: 15,631

Site Code: ATR312
Station ID: ETH SB
Location 1: ETH
Location 2: BY UNITED PENTECOSTAL CHURCH
Location 3:
Location 4:
Direction: Southbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR312 SB - PER VEH
Date Printed: 12/6/2022
Start Date: 4/6/2019
End Date: 4/13/2019

4/6/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
2:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
3:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
4:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
5:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
6:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
7:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
8:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
9:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
10:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
11:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
12:00 PM	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
1:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
2:00	13	854	72	2	5	5	2	2	1	0	0	0	0	16	972	17
3:00	20	869	76	1	10	7	0	2	1	0	1	0	0	7	994	22
4:00	14	917	66	1	18	3	2	4	1	0	0	0	0	13	1039	29
5:00	18	766	68	0	14	2	0	0	2	0	1	0	0	11	882	19
6:00	9	716	54	1	9	4	0	1	0	0	0	0	0	5	799	15
7:00	7	688	48	1	4	4	0	0	0	0	0	0	0	9	761	9
8:00	8	704	34	2	4	3	1	0	0	0	0	0	0	5	761	10
9:00	3	553	34	1	3	0	0	0	0	0	1	0	0	5	600	5
10:00	6	660	31	1	2	1	0	1	0	0	0	0	0	5	707	5
11:00	4	622	27	0	3	4	2	0	0	0	0	0	1	3	666	10
	3	563	17	0	2	1	0	0	0	0	0	0	0	4	590	3
Total	105	7912	527	10	74	34	7	10	5	0	3	0	1	83	8771	144
Percent	1.2%	90.2%	6.0%	0.1%	0.8%	0.4%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.9%		1.6%
AM Peak																
	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
PM Peak	2:00	3:00	2:00	1:00	3:00	2:00	1:00	3:00	4:00		2:00		10:00	1:00	3:00	3:00
	20	917	76	2	18	7	2	4	2	*	1	*	1	16	1039	29

Site Code: ATR312
Station ID: ETH SB
Location 1: ETH
Location 2: BY UNITED PENTECOSTAL CHURCH
Location 3:
Location 4:
Direction: Southbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR312 SB - PER VEH
Date Printed: 12/6/2022
Start Date: 4/6/2019
End Date: 4/13/2019

4/7/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	5	282	19	0	1	2	0	0	1	0	0	0	0	2	312	4
2:00	0	108	1	0	0	0	0	0	0	0	0	0	0	0	109	0
3:00	0	44	2	0	0	0	0	0	0	0	0	0	0	1	47	0
4:00	0	35	1	0	0	0	0	0	0	0	0	0	0	0	36	0
5:00	0	49	2	0	0	0	0	0	0	0	0	0	0	0	51	0
6:00	0	102	11	0	0	0	0	0	0	0	0	0	0	0	113	0
7:00	0	140	13	0	2	0	0	0	0	0	0	0	0	0	155	2
8:00	3	188	15	0	4	1	0	0	0	0	0	0	0	1	212	5
9:00	4	297	24	0	7	1	0	0	0	0	0	0	0	0	333	8
10:00	4	458	49	1	3	2	0	2	0	0	0	1	0	2	522	9
11:00	12	666	64	0	11	4	1	0	0	0	0	0	0	7	765	16
12:00 PM	19	623	53	1	13	2	0	1	1	0	0	0	0	7	720	18
1:00	2	580	42	0	13	2	0	0	0	0	0	0	2	10	651	17
2:00	6	550	44	1	10	1	1	1	0	0	0	0	0	7	621	14
3:00	2	566	42	0	8	1	0	0	3	0	0	0	0	3	625	12
4:00	8	486	26	0	2	3	0	0	0	0	0	0	0	3	528	5
5:00	3	528	34	1	8	1	0	2	2	0	0	0	0	5	584	14
6:00	9	552	28	0	5	1	0	0	0	0	0	0	0	7	602	6
7:00	6	605	30	1	3	1	0	0	0	0	0	0	0	3	649	5
8:00	14	598	41	0	2	1	1	1	0	0	1	0	0	6	665	6
9:00	2	445	23	0	3	0	1	0	1	0	0	0	0	2	477	5
10:00	4	373	26	0	2	0	0	0	0	0	0	0	0	2	407	2
11:00	1	207	9	0	1	0	1	0	0	0	0	0	0	0	219	2
	0	132	9	0	3	0	0	0	0	0	0	0	0	0	144	3
Total	104	8614	608	5	101	23	5	7	8	0	1	1	2	68	9547	153
Percent	1.1%	90.2%	6.4%	0.1%	1.1%	0.2%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.7%		1.6%
AM Peak	11:00	10:00	10:00	9:00	11:00	10:00	10:00	9:00	12:00 AM			9:00		10:00	10:00	11:00
	19	666	64	1	13	4	1	2	1	*	*	1	*	7	765	18
PM Peak	7:00	6:00	1:00	1:00	12:00 PM	3:00	1:00	4:00	2:00		7:00		12:00 PM	12:00 PM	7:00	12:00 PM
	14	605	44	1	13	3	1	2	3	*	1	*	2	10	665	17

Site Code: ATR312
Station ID: ETH SB
Location 1: ETH
Location 2: BY UNITED PENTECOSTAL CHURCH
Location 3:
Location 4:
Direction: Southbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR312 SB - PER VEH
Date Printed: 12/6/2022
Start Date: 4/6/2019
End Date: 4/13/2019

4/8/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	2	120	3	0	1	0	0	0	0	0	0	0	0	0	126	1
2:00	0	44	1	0	2	0	0	0	0	0	0	0	0	0	47	2
3:00	0	31	2	0	0	0	0	0	0	0	0	0	0	0	33	0
4:00	0	15	2	0	0	0	0	1	0	0	0	0	0	0	18	1
5:00	0	37	2	0	1	1	0	0	0	0	0	0	0	0	41	2
6:00	1	143	11	0	3	1	0	3	0	0	0	0	0	3	165	7
7:00	3	414	39	0	4	6	0	0	0	0	0	0	0	3	469	10
8:00	14	1038	82	0	2	9	1	0	3	1	1	0	0	10	1161	17
9:00	22	966	84	1	7	11	1	2	0	1	2	0	1	21	1119	26
10:00	10	659	81	3	19	9	1	1	0	0	1	0	1	11	796	35
11:00	14	688	85	0	18	12	0	0	1	0	0	0	0	4	822	31
12:00 PM	22	771	83	3	18	13	2	1	3	0	2	0	0	5	923	42
1:00	15	834	81	4	23	7	0	0	4	0	0	0	0	18	986	38
2:00	14	911	92	2	19	9	1	0	2	1	0	0	1	11	1063	35
3:00	17	824	101	3	15	12	2	0	2	0	1	0	0	9	986	35
4:00	16	921	86	2	18	9	2	1	6	0	0	0	0	16	1077	38
5:00	13	992	87	3	7	15	3	1	2	0	0	0	1	18	1142	32
6:00	25	935	72	5	7	11	0	1	1	0	2	0	0	10	1069	27
7:00	11	750	47	5	4	4	0	0	1	0	0	0	0	8	830	14
8:00	7	620	47	0	4	0	0	0	1	0	0	0	0	3	682	5
9:00	4	406	10	0	1	1	0	0	0	0	0	0	0	2	424	2
10:00	3	324	26	0	5	1	0	0	0	0	1	0	0	1	361	7
11:00	1	203	12	0	0	0	0	0	0	0	0	0	0	0	216	0
	1	152	3	0	1	0	0	0	0	0	0	0	0	1	158	1
Total	215	12798	1139	31	179	131	13	11	26	3	10	0	4	154	14714	408
Percent	1.5%	87.0%	7.7%	0.2%	1.2%	0.9%	0.1%	0.1%	0.2%	0.0%	0.1%	0.0%	0.0%	1.0%		2.8%
AM Peak	8:00	7:00	10:00	9:00	9:00	11:00	11:00	5:00	7:00	7:00	8:00		8:00	8:00	7:00	11:00
	22	1038	85	3	19	13	2	3	3	1	2	*	1	21	1161	42
PM Peak	5:00	4:00	2:00	5:00	12:00 PM	4:00	4:00	3:00	3:00	1:00	5:00		1:00	12:00 PM	4:00	12:00 PM
	25	992	101	5	23	15	3	1	6	1	2	*	1	18	1142	38

Site Code: ATR312
Station ID: ETH SB
Location 1: ETH
Location 2: BY UNITED PENTECOSTAL CHURCH
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Location 4:
Direction: Southbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR312 SB - PER VEH
Date Printed: 12/6/2022
Start Date: 4/6/2019
End Date: 4/13/2019

4/9/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	0	70	1	1	0	0	0	0	0	0	0	0	0	0	72	1
2:00	1	37	1	0	0	0	0	0	0	0	0	0	0	0	39	0
3:00	0	20	0	0	0	0	0	0	0	0	0	0	0	0	20	0
4:00	0	19	1	0	1	0	0	0	0	0	0	0	0	0	21	1
5:00	0	40	1	0	2	1	0	1	0	0	0	0	0	0	45	4
6:00	1	140	23	0	3	0	0	0	0	0	0	0	0	0	167	3
7:00	4	441	51	1	6	3	0	2	0	0	0	0	0	2	510	12
8:00	21	1065	87	2	13	7	1	4	0	0	0	0	1	10	1211	28
9:00	25	1135	89	5	7	9	1	3	4	0	0	0	1	7	1286	30
10:00	7	723	77	3	20	13	0	4	2	0	0	0	0	4	853	42
11:00	9	689	98	5	21	10	6	4	1	0	0	0	1	8	852	48
12:00 PM	16	811	98	1	24	15	2	3	2	0	0	0	0	18	990	47
1:00	11	945	94	2	13	13	1	2	4	0	0	0	1	14	1100	36
2:00	14	900	101	1	22	14	1	3	0	0	1	0	0	13	1070	42
3:00	13	865	88	4	20	15	0	2	3	0	0	0	0	13	1023	44
4:00	20	930	110	2	19	11	1	1	3	0	0	0	1	9	1107	38
5:00	26	931	103	2	18	15	1	0	3	0	1	1	2	17	1120	43
6:00	22	957	73	3	7	2	1	2	3	0	0	0	0	12	1082	18
7:00	19	758	53	2	4	4	2	2	2	1	2	0	1	9	859	20
8:00	5	632	31	1	6	4	0	1	0	0	0	0	1	9	690	13
9:00	5	476	33	0	2	2	1	0	0	0	0	0	0	2	521	5
10:00	2	346	13	0	0	0	0	0	0	0	0	0	0	2	363	0
11:00	3	244	7	0	9	1	0	0	0	0	0	0	0	1	265	10
	2	151	5	0	1	0	0	1	0	0	0	0	0	0	160	2
Total	226	13325	1238	35	218	139	18	35	27	1	4	1	9	150	15426	487
Percent	1.5%	86.4%	8.0%	0.2%	1.4%	0.9%	0.1%	0.2%	0.2%	0.0%	0.0%	0.0%	0.1%	1.0%		3.2%
AM Peak	8:00	8:00	10:00	8:00	11:00	11:00	10:00	7:00	8:00				7:00	11:00	8:00	10:00
	25	1135	98	5	24	15	6	4	4	*	*	*	1	18	1286	48
PM Peak	4:00	5:00	3:00	2:00	1:00	2:00	6:00	1:00	12:00 PM	6:00	6:00	4:00	4:00	4:00	4:00	2:00
	26	957	110	4	22	15	2	3	4	1	2	1	2	17	1120	44

Site Code: ATR312
Station ID: ETH SB
Location 1: ETH
Location 2: BY UNITED PENTECOSTAL CHURCH
Location 3:
Location 4:
Direction: Southbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR312 SB - PER VEH
Date Printed: 12/6/2022
Start Date: 4/6/2019
End Date: 4/13/2019

4/10/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	0	73	3	0	0	0	0	0	0	0	0	0	0	1	77	0
2:00	1	32	1	0	0	0	0	0	0	0	0	0	0	0	34	0
3:00	0	10	1	0	0	0	0	0	0	0	0	0	0	0	11	0
4:00	0	22	1	0	2	0	0	0	0	0	0	0	0	0	25	2
5:00	0	34	3	0	0	1	0	1	0	0	0	0	0	0	39	2
6:00	2	154	21	0	6	0	0	1	0	0	0	0	0	2	186	7
7:00	5	400	38	1	4	3	1	1	0	0	0	0	0	1	454	10
8:00	25	1080	80	0	4	9	1	1	1	0	0	0	0	7	1208	16
9:00	32	1073	101	4	13	15	4	4	2	0	1	0	0	16	1265	43
10:00	11	691	71	0	13	7	1	1	2	0	0	0	0	7	804	24
11:00	17	754	92	1	12	26	1	2	0	0	1	0	0	8	914	43
12:00 PM	14	804	99	3	24	15	0	2	3	0	0	0	0	14	978	47
1:00	15	974	104	2	18	15	1	2	4	0	1	0	1	8	1145	44
2:00	19	995	101	1	21	13	2	1	2	0	0	0	0	13	1168	40
3:00	17	693	74	3	14	8	1	2	4	0	0	0	0	38	854	32
4:00	8	894	100	1	15	13	0	1	0	0	0	0	0	14	1046	30
5:00	15	1047	99	3	15	15	3	3	2	0	0	0	2	11	1215	43
6:00	12	494	40	5	6	6	2	1	2	1	0	1	0	65	635	24
7:00	16	682	50	0	2	4	2	0	1	0	0	0	0	3	760	9
8:00	11	539	26	0	2	1	0	1	0	0	0	0	0	4	584	4
9:00	4	392	19	0	3	1	0	0	0	0	0	0	0	5	424	4
10:00	5	359	27	0	4	0	0	0	0	0	0	0	0	1	396	4
11:00	0	226	5	0	1	0	0	1	0	0	0	0	0	1	234	2
	0	149	11	0	5	0	0	0	0	0	0	0	0	0	165	5
Total	229	12571	1167	24	184	152	19	25	23	1	3	1	3	219	14621	435
Percent	1.6%	86.0%	8.0%	0.2%	1.3%	1.0%	0.1%	0.2%	0.2%	0.0%	0.0%	0.0%	0.0%	1.5%		3.0%
AM Peak	8:00	7:00	8:00	8:00	11:00	10:00	8:00	8:00	11:00		8:00			8:00	8:00	11:00
	32	1080	101	4	24	26	4	4	3	*	1	*	*	16	1265	47
PM Peak	1:00	4:00	12:00 PM	5:00	1:00	12:00 PM	4:00	4:00	12:00 PM	5:00	12:00 PM	5:00	4:00	5:00	4:00	12:00 PM
	19	1047	104	5	21	15	3	3	4	1	1	1	2	65	1215	44

Site Code: ATR312
Station ID: ETH SB
Location 1: ETH
Location 2: BY UNITED PENTECOSTAL CHURCH
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Direction: Southbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR312 SB - PER VEH
Date Printed: 12/6/2022
Start Date: 4/6/2019
End Date: 4/13/2019

4/11/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	0	89	3	0	0	0	0	0	0	0	0	0	0	0	92	0
2:00	1	47	2	0	0	0	0	0	0	0	0	0	0	0	50	0
3:00	0	18	0	0	0	0	0	0	0	0	0	0	0	0	18	0
4:00	0	20	1	0	0	0	0	0	0	0	0	0	0	0	21	0
5:00	0	48	2	0	0	1	0	0	0	0	0	0	0	0	51	1
6:00	2	145	21	0	7	1	0	2	0	0	0	0	0	1	179	10
7:00	3	429	42	1	3	3	1	0	2	0	0	0	0	4	488	10
8:00	23	1070	61	3	4	8	1	0	2	0	0	0	1	14	1187	19
9:00	41	998	83	10	12	12	7	1	1	0	0	0	0	18	1183	43
10:00	8	709	89	0	18	16	1	1	4	0	1	0	0	6	853	41
11:00	11	710	95	5	19	13	1	8	5	0	0	0	1	11	879	52
12:00 PM	19	787	79	1	18	30	0	2	4	0	0	0	0	10	950	55
1:00	16	987	100	3	18	10	0	1	2	0	0	0	1	11	1149	35
2:00	17	911	101	1	11	13	3	1	3	0	0	0	1	10	1072	33
3:00	19	893	95	3	24	15	1	2	5	1	1	0	0	14	1073	52
4:00	18	924	86	2	21	15	2	1	2	0	0	0	1	10	1082	44
5:00	21	1036	90	4	19	15	3	3	3	0	0	0	1	15	1210	48
6:00	12	979	72	2	6	4	2	1	1	0	2	0	0	8	1089	18
7:00	3	754	41	1	8	2	0	0	0	0	0	0	0	6	815	11
8:00	14	715	33	0	4	0	1	2	0	0	0	0	0	6	775	7
9:00	9	472	26	0	2	1	0	0	0	0	0	0	0	0	510	3
10:00	5	380	23	0	4	4	0	1	0	0	0	0	0	3	420	9
11:00	4	302	17	0	3	1	0	0	0	0	0	0	0	1	328	4
	3	172	9	1	1	0	0	0	0	0	0	0	0	0	186	2
Total	249	13595	1171	37	202	164	23	26	34	1	4	0	6	148	15660	497
Percent	1.6%	86.8%	7.5%	0.2%	1.3%	1.0%	0.1%	0.2%	0.2%	0.0%	0.0%	0.0%	0.0%	0.9%		3.2%
AM Peak	8:00	7:00	10:00	8:00	10:00	11:00	8:00	10:00	10:00		9:00		7:00	8:00	7:00	11:00
	41	1070	95	10	19	30	7	8	5	*	1	*	1	18	1187	55
PM Peak	4:00	4:00	1:00	4:00	2:00	2:00	1:00	4:00	2:00	2:00	5:00		12:00 PM	4:00	4:00	2:00
	21	1036	101	4	24	15	3	3	5	1	2	*	1	15	1210	52

Site Code: ATR312
Station ID: ETH SB
Location 1: ETH
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National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR312 SB - PER VEH
Date Printed: 12/6/2022
Start Date: 4/6/2019
End Date: 4/13/2019

4/12/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	0	75	5	0	1	0	0	0	0	0	0	0	0	0	81	1
2:00	1	40	1	0	0	0	0	0	0	0	0	0	0	0	42	0
3:00	1	26	3	0	0	0	0	0	0	0	0	0	0	0	30	0
4:00	0	15	3	0	0	0	0	0	0	0	0	0	0	0	18	0
5:00	0	37	1	0	0	0	0	1	0	0	0	0	0	1	40	1
6:00	0	182	14	1	4	0	0	1	0	0	0	0	0	0	202	6
7:00	5	441	40	0	1	3	1	1	0	0	0	0	0	2	494	6
8:00	27	1010	71	4	11	6	2	2	4	0	0	0	0	16	1153	29
9:00	20	1073	83	3	15	13	2	1	2	0	0	0	1	8	1221	37
10:00	7	746	82	2	17	17	3	3	5	0	0	0	1	11	894	48
11:00	13	736	102	1	17	15	1	3	1	0	0	0	0	11	900	38
12:00 PM	19	896	113	1	19	13	2	0	7	1	0	0	1	16	1088	44
1:00	12	958	101	3	17	11	2	2	4	0	2	0	0	15	1127	41
2:00	18	968	106	4	17	17	0	2	2	0	1	0	0	16	1151	43
3:00	14	820	80	1	10	9	2	0	3	0	0	0	0	30	969	25
4:00	20	934	99	2	10	3	0	3	1	1	0	0	0	15	1088	20
5:00	18	1022	86	3	13	7	0	3	0	0	1	0	1	15	1169	28
6:00	15	871	74	5	11	5	0	1	2	0	2	0	1	11	998	27
7:00	13	715	47	0	6	2	0	0	0	0	1	0	0	10	794	9
8:00	8	620	37	0	6	5	0	0	1	0	0	0	1	4	682	13
9:00	5	469	30	0	5	2	0	1	0	0	0	0	0	5	517	8
10:00	4	450	26	0	2	2	0	0	0	0	0	0	0	0	484	4
11:00	4	423	16	0	2	0	1	0	0	0	0	0	0	1	447	3
	1	320	9	0	3	0	1	0	1	0	0	0	0	3	338	5
Total	225	13847	1229	30	187	130	17	24	33	2	7	0	6	190	15927	436
Percent	1.4%	86.9%	7.7%	0.2%	1.2%	0.8%	0.1%	0.2%	0.2%	0.0%	0.0%	0.0%	0.0%	1.2%		2.7%
AM Peak	7:00	8:00	11:00	7:00	11:00	9:00	9:00	9:00	11:00	11:00			8:00	7:00	8:00	9:00
	27	1073	113	4	19	17	3	3	7	1	*	*	1	16	1221	48
PM Peak	3:00	4:00	1:00	5:00	12:00 PM	1:00	12:00 PM	3:00	12:00 PM	3:00	12:00 PM		4:00	2:00	4:00	1:00
	20	1022	106	5	17	17	2	3	4	1	2	*	1	30	1169	43

Site Code: ATR312
Station ID: ETH SB
Location 1: ETH
Location 2: BY UNITED PENTECOSTAL CHURCH
Location 3:
Location 4:
Direction: Southbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR312 SB - PER VEH
Date Printed: 12/6/2022
Start Date: 4/6/2019
End Date: 4/13/2019

4/13/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	0	174	7	0	1	1	0	0	0	0	0	0	0	0	183	2
2:00	3	126	8	0	1	0	0	0	0	0	0	0	0	0	138	1
3:00	0	88	3	0	1	0	0	0	0	0	0	0	0	0	92	1
4:00	1	58	1	0	0	0	0	0	0	0	0	0	0	0	60	0
5:00	2	54	8	0	1	0	0	0	0	0	0	0	0	0	65	1
6:00	0	131	8	0	5	5	0	0	0	0	0	0	0	0	149	10
7:00	5	262	24	0	5	9	0	0	0	0	0	0	0	0	305	14
8:00	6	438	45	0	6	6	0	1	0	0	0	0	0	5	507	13
9:00	10	657	70	1	12	5	0	0	0	0	0	0	0	6	761	18
10:00	11	824	91	0	15	11	0	2	2	0	0	0	1	8	965	31
11:00	10	532	46	0	7	4	1	1	0	1	0	0	0	9	611	14
12:00 PM	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
1:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
2:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
3:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
4:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
5:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
6:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
7:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
8:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
9:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
10:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
11:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
Total	48	3344	311	1	54	41	1	4	2	1	0	0	1	28	3836	105
Percent	1.3%	87.2%	8.1%	0.0%	1.4%	1.1%	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.7%		2.7%
AM Peak	9:00	9:00	9:00	8:00	9:00	9:00	10:00	9:00	9:00	10:00			9:00	10:00	9:00	9:00
	11	824	91	1	15	11	1	2	2	1	*	*	1	9	965	31
PM Peak																
	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Grand Total	1401	86006	7390	173	1199	814	103	142	158	9	32	3	32	1040	98502	2665

Site Code: ATR306-NB
Station ID:
Location 1: ETH
Location 2: NORTH of NATIONAL
Location 3:
Location 4:

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: atr306-north w2019 - raw
Date Printed: 12/5/2022
Start Date: 4/6/2019
End Date: 4/13/2019

	4/1/2019		Tuesday		Wednesd		Thursday		Friday		Saturday		Sunday		Average Day	
Time	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
12:00	*	*	*	*	*	*	*	*	*	*	*	0	57	178	57	89
12:15	*	*	*	*	*	*	*	*	*	*	*	0	53	221	53	111
12:30	*	*	*	*	*	*	*	*	*	*	*	108	52	199	52	154
12:45	*	*	*	*	*	*	*	*	*	*	*	333	43	177	43	255
1:00	*	*	*	*	*	*	*	*	*	*	*	255	29	196	29	226
1:15	*	*	*	*	*	*	*	*	*	*	*	265	28	196	28	231
1:30	*	*	*	*	*	*	*	*	*	*	*	312	21	169	21	241
1:45	*	*	*	*	*	*	*	*	*	*	*	277	15	157	15	217
2:00	*	*	*	*	*	*	*	*	*	*	*	251	20	166	20	209
2:15	*	*	*	*	*	*	*	*	*	*	*	295	18	143	18	219
2:30	*	*	*	*	*	*	*	*	*	*	*	274	6	153	6	214
2:45	*	*	*	*	*	*	*	*	*	*	*	269	8	154	8	212
3:00	*	*	*	*	*	*	*	*	*	*	*	246	6	152	6	199
3:15	*	*	*	*	*	*	*	*	*	*	*	247	6	147	6	197
3:30	*	*	*	*	*	*	*	*	*	*	*	270	4	173	4	222
3:45	*	*	*	*	*	*	*	*	*	*	*	277	10	152	10	215
4:00	*	*	*	*	*	*	*	*	*	*	*	271	8	149	8	210
4:15	*	*	*	*	*	*	*	*	*	*	*	262	17	147	17	205
4:30	*	*	*	*	*	*	*	*	*	*	*	278	35	153	35	216
4:45	*	*	*	*	*	*	*	*	*	*	*	297	23	143	23	220
5:00	*	*	*	*	*	*	*	*	*	*	*	261	30	157	30	209
5:15	*	*	*	*	*	*	*	*	*	*	*	266	24	145	24	206
5:30	*	*	*	*	*	*	*	*	*	*	*	281	35	151	35	216
5:45	*	*	*	*	*	*	*	*	*	*	*	288	31	151	31	220
6:00	*	*	*	*	*	*	*	*	*	*	*	292	27	134	27	213
6:15	*	*	*	*	*	*	*	*	*	*	*	251	35	145	35	198
6:30	*	*	*	*	*	*	*	*	*	*	*	239	57	148	57	194
6:45	*	*	*	*	*	*	*	*	*	*	*	234	68	136	68	185
7:00	*	*	*	*	*	*	*	*	*	*	*	217	66	126	66	172
7:15	*	*	*	*	*	*	*	*	*	*	*	248	58	138	58	193
7:30	*	*	*	*	*	*	*	*	*	*	*	214	72	127	72	171
7:45	*	*	*	*	*	*	*	*	*	*	*	188	102	128	102	158
8:00	*	*	*	*	*	*	*	*	*	*	*	167	89	106	89	137
8:15	*	*	*	*	*	*	*	*	*	*	*	174	94	98	94	136
8:30	*	*	*	*	*	*	*	*	*	*	*	150	95	93	95	122
8:45	*	*	*	*	*	*	*	*	*	*	*	162	107	94	107	128
9:00	*	*	*	*	*	*	*	*	*	*	*	137	116	115	116	126
9:15	*	*	*	*	*	*	*	*	*	*	*	130	133	85	133	108
9:30	*	*	*	*	*	*	*	*	*	*	*	122	142	72	142	97
9:45	*	*	*	*	*	*	*	*	*	*	*	92	188	58	188	75
10:00	*	*	*	*	*	*	*	*	*	*	*	102	146	62	146	82
10:15	*	*	*	*	*	*	*	*	*	*	*	83	185	56	185	70
10:30	*	*	*	*	*	*	*	*	*	*	*	100	173	61	173	81
10:45	*	*	*	*	*	*	*	*	*	*	*	66	161	38	161	52
11:00	*	*	*	*	*	*	*	*	*	*	*	72	130	40	130	56
11:15	*	*	*	*	*	*	*	*	*	*	*	69	147	46	147	58
11:30	*	*	*	*	*	*	*	*	*	*	*	50	178	23	178	37
11:45	*	*	*	*	*	*	*	*	*	*	*	61	185	30	185	46
Total	0	0	0	0	0	0	0	0	0	0	0	9503	3333	6088	3333	7796
Day Total	0		0		0		0		0		9503		9421		11129	
% Splits	*	*	*	*	*	*	*	*	*	*	0.0%	100.0%	35.4%	64.6%	30.0%	70.0%
Peak												12:45	9:45	12:15	9:45	12:45
Volume												1165	692	793	692	951
Peak Factor												0.875	0.920	0.897	0.920	0.932

Site Code: ATR306-NB
Station ID:
Location 1: ETH
Location 2: NORTH of NATIONAL
Location 3:
Location 4:

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: atr306-north w2019 -
Date Printed: 12/5/2022
Start Date: 4/6/2019
End Date: 4/13/2019

	4/8/2019		Tuesday		Wednesday		Thursday		Friday		Saturday		Sunday		Average Day	
Time	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
12:00	21	204	25	296	24	301	27	291	33	316	62	*	*	*	32	282
12:15	19	249	15	333	10	330	16	305	24	327	47	*	*	*	22	309
12:30	12	297	15	264	14	282	16	318	16	311	30	*	*	*	17	294
12:45	16	252	10	264	11	313	9	307	19	340	27	*	*	*	15	295
1:00	11	263	12	277	11	315	2	291	18	338	32	*	*	*	14	297
1:15	9	263	2	250	9	279	8	269	14	289	23	*	*	*	11	270
1:30	12	250	5	253	6	282	9	246	6	295	22	*	*	*	10	265
1:45	5	258	7	265	3	244	7	268	9	280	14	*	*	*	8	263
2:00	15	212	8	239	8	233	12	255	10	256	19	*	*	*	12	239
2:15	4	241	5	243	3	244	4	276	8	271	21	*	*	*	8	255
2:30	8	290	4	268	7	272	6	242	5	270	9	*	*	*	7	268
2:45	3	292	7	256	12	287	5	274	3	292	16	*	*	*	8	280
3:00	3	229	1	245	4	262	4	227	3	267	15	*	*	*	5	246
3:15	6	273	7	259	4	272	6	285	5	265	18	*	*	*	8	271
3:30	5	243	4	266	5	259	3	275	2	244	8	*	*	*	5	257
3:45	7	231	5	289	3	258	4	281	4	248	12	*	*	*	6	261
4:00	10	278	9	261	4	283	10	264	10	268	12	*	*	*	9	271
4:15	6	243	15	279	10	273	19	244	15	309	12	*	*	*	13	270
4:30	16	272	18	301	26	273	28	302	15	321	19	*	*	*	20	294
4:45	38	269	29	286	36	305	32	330	38	319	34	*	*	*	35	302
5:00	30	381	26	388	33	354	36	396	36	379	29	*	*	*	32	380
5:15	41	326	39	361	34	321	46	368	48	344	30	*	*	*	40	344
5:30	35	327	40	351	45	306	39	328	51	355	27	*	*	*	40	333
5:45	59	327	67	295	61	240	71	292	66	307	54	*	*	*	63	292
6:00	79	251	79	289	77	323	78	290	60	341	54	*	*	*	71	299
6:15	108	211	134	228	117	339	125	252	140	260	73	*	*	*	116	258
6:30	173	199	199	217	193	211	194	234	203	207	126	*	*	*	181	214
6:45	197	219	241	215	226	183	223	195	210	256	175	*	*	*	212	214
7:00	212	180	216	187	245	169	206	217	238	216	139	*	*	*	209	194
7:15	228	168	247	149	209	168	238	148	242	183	133	*	*	*	216	163
7:30	286	145	338	169	340	137	291	169	294	171	153	*	*	*	284	158
7:45	326	149	330	128	360	108	346	152	315	165	192	*	*	*	312	140
8:00	275	103	353	125	336	98	312	129	308	129	151	*	*	*	289	117
8:15	295	120	306	125	319	104	311	107	288	126	162	*	*	*	280	116
8:30	242	108	273	111	288	90	300	114	292	138	223	*	*	*	270	112
8:45	238	104	289	84	289	95	285	138	284	114	241	*	*	*	271	107
9:00	181	105	238	102	265	105	248	127	260	136	229	*	*	*	237	115
9:15	205	86	254	89	227	97	234	105	245	123	262	*	*	*	238	100
9:30	174	74	238	107	240	90	232	86	248	103	260	*	*	*	232	92
9:45	179	66	243	92	221	61	227	75	242	95	314	*	*	*	238	78
10:00	172	52	218	93	226	68	213	69	216	87	296	*	*	*	224	74
10:15	173	64	215	68	215	56	220	56	235	79	274	*	*	*	222	65
10:30	175	69	224	48	227	57	245	44	246	83	273	*	*	*	232	60
10:45	196	44	223	47	230	48	210	43	218	77	89	*	*	*	194	52
11:00	175	36	243	26	226	30	219	43	229	70	*	*	*	*	218	41
11:15	188	30	207	24	223	39	239	26	231	55	*	*	*	*	218	35
11:30	196	25	256	24	249	35	267	38	258	72	*	*	*	*	245	39
11:45	231	27	296	30	311	27	288	39	298	50	*	*	*	*	285	35
Total	5295	9105	6235	9566	6242	9526	6170	9830	6258	10547	4411	0	0	0	5930	9715
Day Total	14400		15801		15768		16000		16805		4411		0		15644	
% Splits	36.8%	63.2%	39.5%	60.5%	39.6%	60.4%	38.6%	61.4%	37.2%	62.8%	100.0%	0.0%	*	*	37.9%	62.1%
Peak	7:30	5:00	7:30	5:00	7:30	4:45	7:45	4:45	7:30	4:45	9:45				7:30	4:45
Volume	1182	1361	1327	1395	1355	1286	1269	1422	1205	1397	1157				1165	1359
Peak Factor	0.906	0.893	0.940	0.899	0.941	0.908	0.917	0.898	0.956	0.922	0.921				0.933	0.894

ADT ADT: 15,763 AADT: 15,763

Site Code: ATR306-NB
Station ID:
Location 1: ETH
Location 2: NORTH of NATIONAL GALLERY
Location 3:
Location 4:
Direction: Northbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: atr306-north w2019 - raw
Date Printed: 12/6/2022
Start Date: 4/6/2019
End Date: 4/13/2019

4/6/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
2:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
3:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
4:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
5:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
6:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
7:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
8:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
9:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
10:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
11:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
12:00 PM	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
1:00	7	381	17	1	8	4	0	0	0	0	0	0	0	23	441	13
2:00	5	994	37	1	7	10	1	0	3	1	0	1	0	49		24
3:00	12	975	35	0	6	11	0	2	4	1	0	0	0	43		24
4:00	7	919	43	3	4	7	1	3	3	0	0	0	0	50		21
5:00	5	1009	32	0	5	9	0	2	2	0	0	0	0	44		18
6:00	13	980	31	3	7	10	1	3	3	3	0	0	0	42		30
7:00	9	927	29	3	1	3	0	2	1	0	0	0	1	40		11
8:00	6	804	26	1	0	2	0	1	3	0	0	0	0	24		7
9:00	5	599	24	1	1	1	0	1	1	0	0	0	0	20		5
10:00	2	443	19	0	2	2	0	0	0	0	0	0	0	13		4
11:00	2	330	13	0	0	1	0	0	0	0	0	0	0	5		1
	0	237	10	0	0	2	0	0	0	0	0	0	0	3		2
Total	73	8598	316	13	41	62	3	14	20	5	0	1	1	356		160
Percent																
AM Peak																
	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
PM Peak	5:00	4:00	3:00	3:00	12:00 PM	2:00	1:00	3:00	2:00	5:00		1:00	6:00	3:00	1:00	5:00
	13	1009	43	3	8	11	1	3	4	3	*	1	1	50	1109	30

Site Code: ATR306-NB
Station ID:
Location 1: ETH
Location 2: NORTH of NATIONAL GALLERY
Location 3:
Location 4:
Direction: Northbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: atr306-north w2019 - raw
Date Printed: 12/6/2022
Start Date: 4/6/2019
End Date: 4/13/2019

4/7/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	0	190	13	0	1	0	0	0	0	0	0	0	0	1		1
2:00	0	86	7	0	0	0	0	0	0	0	0	0	0	0		0
3:00	0	49	3	0	0	0	0	0	0	0	0	0	0	0		0
4:00	0	26	0	0	0	0	0	0	0	0	0	0	0	0		0
5:00	3	73	6	0	1	0	0	0	0	0	0	0	0	0		1
6:00	0	109	7	0	1	0	0	0	0	0	0	0	0	3		1
7:00	3	164	13	0	5	0	0	0	0	0	0	0	0	2		5
8:00	2	266	12	0	4	2	0	1	1	0	0	0	0	10		8
9:00	7	340	21	0	3	0	0	2	0	0	0	0	0	12		5
10:00	5	514	23	1	2	4	0	3	4	0	0	0	1	22		15
11:00	2	594	37	0	2	2	0	3	1	1	1	1	0	21		11
12:00 PM	3	577	32	0	4	4	0	1	1	1	0	0	0	17		11
1:00	7	695	36	1	0	6	0	0	0	0	0	0	0	30		7
2:00	3	652	38	1	1	6	0	0	1	0	0	0	0	16		9
3:00	3	550	36	0	2	2	0	0	0	0	0	0	0	23		4
4:00	2	586	15	2	2	1	0	1	1	1	1	0	0	12		9
5:00	6	543	23	0	3	3	0	1	0	0	0	0	0	13		7
6:00	0	560	22	0	1	3	0	1	0	0	1	0	0	16		6
7:00	2	516	26	2	0	3	0	0	0	0	1	0	0	13		6
8:00	6	459	24	3	1	4	0	0	0	0	0	0	0	22		8
9:00	2	357	19	0	1	0	0	1	0	0	0	0	0	11		2
10:00	1	305	18	0	4	0	0	1	0	0	0	0	0	1		5
11:00	1	206	8	0	0	1	0	0	0	0	0	0	0	1		1
	2	130	6	0	1	0	0	0	0	0	0	0	0	0		1
Total	60	8547	445	10	39	41	0	15	9	3	4	1	1	246		123
Percent																
AM Peak	8:00	10:00	10:00	9:00	6:00	9:00		9:00	9:00	10:00	10:00	10:00	9:00	9:00	10:00	9:00
	7	594	37	1	5	4	*	3	4	1	1	1	1	22	665	15
PM Peak	12:00 PM	12:00 PM	1:00	7:00	9:00	12:00 PM		3:00	1:00	3:00	3:00			12:00 PM	12:00 PM	1:00
	7	695	38	3	4	6	*	1	1	1	1	*	*	30	775	9

Site Code: ATR306-NB
Station ID:
Location 1: ETH
Location 2: NORTH of NATIONAL GALLERY
Location 3:
Location 4:
Direction: Northbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: atr306-north w2019 - raw
Date Printed: 12/6/2022
Start Date: 4/6/2019
End Date: 4/13/2019

4/8/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	0	64	4	0	0	0	0	0	0	0	0	0	0	0		0
2:00	0	28	3	0	2	2	0	0	0	0	0	0	0	2		4
3:00	0	26	2	0	0	0	0	1	0	0	0	0	0	1		1
4:00	0	17	2	0	0	0	0	1	0	0	0	0	0	1		1
5:00	0	61	3	0	1	0	0	2	0	0	0	0	0	3		3
6:00	0	150	9	0	3	1	0	1	0	0	0	0	0	1		5
7:00	11	368	31	2	4	3	0	0	1	0	0	0	0	137		10
8:00	9	860	65	5	12	10	1	4	2	2	0	1	0	81		37
9:00	6	475	32	16	7	6	0	0	1	0	0	0	0	507		30
10:00	0	2	0	0	0	0	0	0	0	0	0	0	0	737		0
11:00	0	0	0	0	0	0	0	0	0	0	0	0	0	716		0
12:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	790		0
1:00	6	534	46	3	2	4	0	3	3	1	0	0	0	400		16
2:00	8	886	69	2	8	15	3	0	2	0	1	0	0	40		31
3:00	9	911	47	4	4	14	1	2	3	0	0	0	0	40		28
4:00	9	857	48	0	5	12	2	0	3	0	1	0	0	39		23
5:00	6	945	45	2	5	11	2	1	0	1	0	0	0	44		22
6:00	12	1229	30	5	5	11	2	1	2	0	0	1	1	62		28
7:00	10	810	29	0	3	3	0	1	0	0	0	0	0	24		7
8:00	4	597	15	0	2	3	0	0	0	0	0	0	0	21		5
9:00	2	407	11	0	1	5	0	0	0	0	0	0	0	9		6
10:00	2	312	10	0	2	0	0	0	0	0	0	0	0	5		2
11:00	0	218	5	0	0	2	0	0	0	0	0	0	0	4		2
	2	113	2	0	0	1	0	0	0	0	0	0	0	0		1
Total	96	9870	508	39	66	103	11	17	17	4	2	2	1	3664		262
Percent																
AM Peak	6:00	7:00	7:00	8:00	7:00	7:00	7:00	7:00	7:00	7:00		7:00		11:00	7:00	7:00
	11	860	65	16	12	10	1	4	2	2	*	1	*	790	1052	37
PM Peak	5:00	5:00	1:00	5:00	1:00	1:00	1:00	12:00 PM	12:00 PM	12:00 PM	1:00	5:00	5:00	12:00 PM	5:00	1:00
	12	1229	69	5	8	15	3	3	3	1	1	1	1	400	1361	31

Site Code: ATR306-NB
Station ID:
Location 1: ETH
Location 2: NORTH of NATIONAL GALLERY
Location 3:
Location 4:
Direction: Northbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: atr306-north w2019 - raw
Date Printed: 12/6/2022
Start Date: 4/6/2019
End Date: 4/13/2019

4/9/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	0	65	0	0	0	0	0	0	0	0	0	0	0	0		0
2:00	0	26	0	0	0	0	0	0	0	0	0	0	0	0		0
3:00	0	24	0	0	0	0	0	0	0	0	0	0	0	0		0
4:00	0	15	1	0	0	0	0	1	0	0	0	0	0	0		1
5:00	2	62	1	0	0	0	0	2	0	0	0	0	0	4		2
6:00	0	153	7	0	4	1	1	2	0	0	0	0	0	4		8
7:00	10	545	38	2	1	15	1	3	1	3	0	0	0	34		26
8:00	6	1024	42	1	6	13	2	2	2	2	0	0	0	31		28
9:00	12	1048	48	3	8	22	1	5	2	1	1	0	1	69		44
10:00	7	833	70	2	3	12	0	2	3	3	0	0	0	38		25
11:00	5	748	51	1	7	12	0	4	0	0	0	0	0	52		24
12:00 PM	10	861	56	2	8	15	2	1	3	1	0	0	1	42		33
1:00	6	1026	49	3	2	22	0	1	1	2	0	0	0	45		31
2:00	12	901	46	2	0	17	1	5	4	1	0	0	0	56		30
3:00	13	870	43	2	1	12	0	2	2	3	0	0	1	57		23
4:00	9	928	52	1	5	13	0	2	5	1	1	0	1	41		29
5:00	14	990	50	0	5	15	0	0	4	0	0	0	0	49		24
6:00	20	1261	30	1	3	8	0	1	2	1	0	1	2	65		19
7:00	10	890	17	0	1	5	1	1	1	0	0	0	1	22		10
8:00	3	599	12	0	1	3	0	0	0	0	0	0	0	15		4
9:00	1	420	15	0	1	2	0	0	0	0	0	0	0	6		3
10:00	5	369	8	0	0	1	0	0	0	0	0	0	0	7		1
11:00	5	241	5	0	1	1	0	1	0	0	0	0	0	2		3
	2	98	3	0	0	0	0	0	0	0	0	0	0	1		0
Total	152	13997	644	20	57	189	9	35	30	18	2	1	7	640		368
Percent																
AM Peak	8:00	8:00	9:00	8:00	8:00	8:00	7:00	8:00	9:00	6:00	8:00		8:00	8:00	8:00	8:00
	12	1048	70	3	8	22	2	5	3	3	1	*	1	69	1221	44
PM Peak	5:00	5:00	3:00	12:00 PM	3:00	12:00 PM	1:00	1:00	3:00	2:00	3:00	5:00	5:00	5:00	5:00	12:00 PM
	20	1261	52	3	5	22	1	5	5	3	1	1	2	65	1395	31

Site Code: ATR306-NB
Station ID:
Location 1: ETH
Location 2: NORTH of NATIONAL GALLERY
Location 3:
Location 4:
Direction: Northbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: atr306-north w2019 - raw
Date Printed: 12/6/2022
Start Date: 4/6/2019
End Date: 4/13/2019

4/10/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	0	58	1	0	0	0	0	0	0	0	0	0	0	0		0
2:00	0	29	0	0	0	0	0	0	0	0	0	0	0	0		0
3:00	0	29	1	0	0	0	0	0	0	0	0	0	0	0		0
4:00	0	15	0	0	0	0	0	1	0	0	0	0	0	0		1
5:00	1	69	2	0	0	1	0	2	0	0	0	0	0	1		3
6:00	2	157	5	0	1	2	1	1	1	0	0	0	0	3		6
7:00	13	525	30	5	4	8	0	0	2	1	0	0	0	25		20
8:00	10	1013	47	4	8	18	1	1	0	2	0	0	0	50		34
9:00	10	1094	43	4	3	19	0	2	2	1	1	0	0	53		32
10:00	5	816	41	6	11	20	1	1	4	1	0	0	0	47		44
11:00	7	784	38	0	6	14	0	1	4	1	1	1	2	39		30
12:00 PM	7	873	44	2	11	26	3	0	1	0	0	0	0	42		43
1:00	8	1083	44	4	4	21	0	1	2	0	1	1	1	56		35
2:00	14	972	50	3	5	17	0	0	2	1	0	0	0	56		28
3:00	15	870	65	1	10	18	0	5	0	1	0	0	0	51		35
4:00	8	952	33	2	4	14	0	2	3	1	0	1	0	31		27
5:00	10	991	45	1	3	13	2	4	3	2	0	1	0	59		29
6:00	14	1091	32	0	4	8	1	0	2	2	1	0	0	66		18
7:00	9	957	25	4	2	11	1	1	1	1	0	2	0	42		23
8:00	3	556	10	0	1	3	0	0	0	1	0	0	0	8		5
9:00	5	358	10	0	0	0	0	0	0	0	0	0	0	14		0
10:00	2	334	3	1	1	1	0	0	0	0	0	0	0	11		3
11:00	2	217	6	0	0	1	0	0	0	0	0	0	0	3		1
	1	123	4	0	1	1	0	0	0	0	0	0	0	1		2
Total	146	13966	579	37	79	216	10	22	27	15	4	6	3	658		419
Percent																
AM Peak	6:00	8:00	7:00	9:00	9:00	11:00	11:00	4:00	9:00	7:00	8:00	10:00	10:00	8:00	8:00	9:00
	13	1094	47	6	11	26	3	2	4	2	1	1	2	53	1232	44
PM Peak	2:00	5:00	2:00	12:00 PM	2:00	12:00 PM	4:00	2:00	3:00	4:00	12:00 PM	6:00	12:00 PM	5:00	12:00 PM	12:00 PM
	15	1091	65	4	10	21	2	5	3	2	1	2	1	66	1226	35

Site Code: ATR306-NB
Station ID:
Location 1: ETH
Location 2: NORTH of NATIONAL GALLERY
Location 3:
Location 4:
Direction: Northbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: atr306-north w2019 - raw
Date Printed: 12/6/2022
Start Date: 4/6/2019
End Date: 4/13/2019

4/11/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	1	65	2	0	0	0	0	0	0	0	0	0	0	0		0
2:00	0	26	0	0	0	0	0	0	0	0	0	0	0	0		0
3:00	0	26	1	0	0	0	0	0	0	0	0	0	0	0		0
4:00	0	17	0	0	0	0	0	0	0	0	0	0	0	0		0
5:00	2	77	5	0	0	2	0	0	0	0	0	0	0	3		2
6:00	4	173	3	0	2	3	0	2	0	0	0	0	0	5		7
7:00	13	543	17	0	7	7	0	4	1	1	0	1	0	26		21
8:00	13	937	39	2	5	16	0	5	3	5	0	1	0	55		37
9:00	16	1048	35	4	10	20	0	2	3	1	0	0	0	69		40
10:00	6	812	41	2	5	22	2	2	3	0	2	1	1	42		40
11:00	8	746	62	5	6	18	1	1	2	1	0	0	0	38		34
12:00 PM	3	875	58	3	5	16	2	2	3	1	0	0	0	45		32
1:00	15	1052	45	6	8	14	2	3	2	1	0	1	1	71		38
2:00	7	958	47	3	2	14	1	1	2	1	1	0	0	37		25
3:00	11	911	37	2	10	11	1	2	4	0	0	0	0	58		30
4:00	13	939	44	2	3	11	1	4	1	1	0	0	0	49		23
5:00	15	1012	33	2	4	11	1	1	1	2	1	0	0	57		23
6:00	23	1231	27	5	1	14	1	1	0	1	0	1	3	76		27
7:00	12	906	13	1	4	7	0	0	0	0	0	0	0	28		12
8:00	5	638	16	0	0	4	0	0	0	1	1	0	0	21		6
9:00	6	459	11	0	0	2	0	0	0	0	0	0	0	10		2
10:00	4	366	9	0	0	2	0	1	0	0	0	0	0	11		3
11:00	3	198	3	0	2	2	0	0	0	0	0	0	0	4		4
	3	138	4	0	0	0	0	0	0	0	0	0	0	1		0
Total	183	14153	552	37	74	196	12	31	25	16	5	5	5	706		406
Percent																
AM Peak	8:00	8:00	10:00	10:00	8:00	9:00	9:00	7:00	7:00	7:00	9:00	6:00	9:00	8:00	8:00	8:00
	16	1048	62	5	10	22	2	5	3	5	2	1	1	69	1208	40
PM Peak	5:00	5:00	1:00	12:00 PM	2:00	12:00 PM	12:00 PM	3:00	2:00	4:00	1:00	12:00 PM	5:00	5:00	5:00	12:00 PM
	23	1231	47	6	10	14	2	4	4	2	1	1	3	76	1384	38

Site Code: ATR306-NB
Station ID:
Location 1: ETH
Location 2: NORTH of NATIONAL GALLERY
Location 3:
Location 4:
Direction: Northbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: atr306-north w2019 - raw
Date Printed: 12/6/2022
Start Date: 4/6/2019
End Date: 4/13/2019

4/12/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	0	90	1	0	0	0	0	0	0	0	0	0	0	1		0
2:00	0	46	0	0	0	0	0	0	0	0	0	0	0	1		0
3:00	0	26	0	0	0	0	0	0	0	0	0	0	0	0		0
4:00	0	14	0	0	0	0	0	0	0	0	0	0	0	0		0
5:00	0	69	3	0	0	2	0	2	0	0	0	0	0	2		4
6:00	3	183	6	0	3	1	0	2	1	1	0	0	0	1		8
7:00	6	549	20	0	6	8	0	0	1	0	0	0	0	23		15
8:00	18	965	25	5	5	17	1	1	3	4	1	0	0	44		37
9:00	17	1013	39	3	11	23	0	4	2	0	0	0	0	60		43
10:00	10	859	45	3	8	19	2	0	4	3	0	0	0	42		39
11:00	8	788	55	2	5	19	1	2	1	1	0	0	0	33		31
12:00 PM	8	887	39	3	6	17	2	2	2	1	0	0	1	48		34
1:00	13	1151	43	1	7	13	0	1	1	1	0	0	0	63		24
2:00	16	1049	43	2	7	18	1	2	3	0	0	0	1	60		34
3:00	18	966	29	3	7	12	1	1	3	2	0	0	0	47		29
4:00	6	915	41	1	2	15	2	0	0	0	0	0	0	42		20
5:00	13	1092	36	2	4	15	0	5	2	1	0	1	0	46		30
6:00	13	1235	29	4	5	16	0	0	2	2	2	0	0	77		31
7:00	7	964	28	2	0	15	0	1	3	1	0	0	0	43		22
8:00	3	669	22	1	2	7	1	1	2	1	0	0	1	25		16
9:00	5	471	13	1	1	3	0	0	0	0	0	0	0	13		5
10:00	4	434	4	0	1	3	0	0	0	0	0	0	0	11		4
11:00	3	310	6	1	0	0	0	0	0	0	0	0	0	6		1
	4	238	3	0	0	1	0	0	0	0	0	0	0	1		1
Total	175	14983	530	34	80	224	11	24	30	18	3	1	3	689		428
Percent																
AM Peak	7:00	8:00	10:00	7:00	8:00	8:00	9:00	8:00	9:00	7:00	7:00		11:00	8:00	8:00	8:00
	18	1013	55	5	11	23	2	4	4	4	1	*	1	60	1172	43
PM Peak	2:00	5:00	12:00 PM	5:00	12:00 PM	1:00	3:00	4:00	1:00	2:00	5:00	4:00	1:00	5:00	5:00	1:00
	18	1235	43	4	7	18	2	5	3	2	2	1	1	77	1385	34

Site Code: ATR306-NB
Station ID:
Location 1: ETH
Location 2: NORTH of NATIONAL GALLERY
Location 3:
Location 4:
Direction: Northbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: atr306-north w2019 - raw
Date Printed: 12/6/2022
Start Date: 4/6/2019
End Date: 4/13/2019

4/13/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	1	160	3	0	0	0	0	0	0	0	0	0	0	2		0
2:00	0	86	4	0	0	1	0	0	0	0	0	0	0	0		1
3:00	1	62	2	0	0	0	0	0	0	0	0	0	0	0		0
4:00	0	49	1	0	0	0	0	0	0	0	0	0	0	3		0
5:00	1	69	2	0	0	2	1	1	0	0	0	0	0	1		4
6:00	1	120	3	0	3	7	0	1	0	0	0	0	0	5		11
7:00	5	386	14	0	2	9	0	0	0	0	0	0	0	12		11
8:00	8	558	24	0	5	5	0	3	2	0	2	0	0	10		17
9:00	6	702	33	0	4	10	0	2	1	0	0	2	0	17		19
10:00	3	965	32	7	4	9	1	3	1	2	0	0	0	38		27
11:00	8	825	36	2	6	11	0	1	3	0	0	0	1	39		24
12:00 PM	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
1:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
2:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
3:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
4:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
5:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
6:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
7:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
8:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
9:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
10:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
11:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
Total	34	3982	154	9	24	54	2	11	7	2	2	2	1	127		114
Percent																
AM Peak	7:00	9:00	10:00	9:00	10:00	10:00	4:00	7:00	10:00	9:00	7:00	8:00	10:00	10:00	9:00	9:00
	8	965	36	7	6	11	1	3	3	2	2	2	1	39	1065	27
PM Peak																
	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Grand Total	919	88096	3728	199	460	1085	58	169	165	81	22	19	22	7086		2280

Site Code: ATR306-SB
Station ID:
Location 1: ETH
Location 2: AT ENTRANCE TO
Location 3:
Location 4:

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR306-SOUTH W2019 -
Date Printed: 12/5/2022
Start Date: 4/6/2019
End Date: 4/13/2019

	4/1/2019		Tuesday		Wednesd		Thursday		Friday		Saturday		Sunday		Average Day	
Time	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
12:00	*	*	*	*	*	*	*	*	*	*	*	0	130	178	130	89
12:15	*	*	*	*	*	*	*	*	*	*	*	0	84	145	84	73
12:30	*	*	*	*	*	*	*	*	*	*	*	0	64	172	64	86
12:45	*	*	*	*	*	*	*	*	*	*	*	132	33	155	33	144
1:00	*	*	*	*	*	*	*	*	*	*	*	266	25	172	25	219
1:15	*	*	*	*	*	*	*	*	*	*	*	257	38	146	38	202
1:30	*	*	*	*	*	*	*	*	*	*	*	243	28	135	28	189
1:45	*	*	*	*	*	*	*	*	*	*	*	280	15	152	15	216
2:00	*	*	*	*	*	*	*	*	*	*	*	228	17	163	17	196
2:15	*	*	*	*	*	*	*	*	*	*	*	236	13	151	13	194
2:30	*	*	*	*	*	*	*	*	*	*	*	252	9	140	9	196
2:45	*	*	*	*	*	*	*	*	*	*	*	242	8	170	8	206
3:00	*	*	*	*	*	*	*	*	*	*	*	248	12	129	12	189
3:15	*	*	*	*	*	*	*	*	*	*	*	263	11	131	11	197
3:30	*	*	*	*	*	*	*	*	*	*	*	237	5	144	5	191
3:45	*	*	*	*	*	*	*	*	*	*	*	244	6	127	6	186
4:00	*	*	*	*	*	*	*	*	*	*	*	206	5	134	5	170
4:15	*	*	*	*	*	*	*	*	*	*	*	214	11	139	11	177
4:30	*	*	*	*	*	*	*	*	*	*	*	213	14	170	14	192
4:45	*	*	*	*	*	*	*	*	*	*	*	222	23	133	23	178
5:00	*	*	*	*	*	*	*	*	*	*	*	206	29	135	29	171
5:15	*	*	*	*	*	*	*	*	*	*	*	229	26	154	26	192
5:30	*	*	*	*	*	*	*	*	*	*	*	184	25	132	25	158
5:45	*	*	*	*	*	*	*	*	*	*	*	185	28	151	28	168
6:00	*	*	*	*	*	*	*	*	*	*	*	186	39	160	39	173
6:15	*	*	*	*	*	*	*	*	*	*	*	195	39	171	39	183
6:30	*	*	*	*	*	*	*	*	*	*	*	172	18	148	18	160
6:45	*	*	*	*	*	*	*	*	*	*	*	196	34	147	34	172
7:00	*	*	*	*	*	*	*	*	*	*	*	225	46	187	46	206
7:15	*	*	*	*	*	*	*	*	*	*	*	184	40	189	40	187
7:30	*	*	*	*	*	*	*	*	*	*	*	177	55	135	55	156
7:45	*	*	*	*	*	*	*	*	*	*	*	179	74	127	74	153
8:00	*	*	*	*	*	*	*	*	*	*	*	135	62	118	62	127
8:15	*	*	*	*	*	*	*	*	*	*	*	168	88	130	88	149
8:30	*	*	*	*	*	*	*	*	*	*	*	135	83	99	83	117
8:45	*	*	*	*	*	*	*	*	*	*	*	176	128	110	128	143
9:00	*	*	*	*	*	*	*	*	*	*	*	176	92	128	92	152
9:15	*	*	*	*	*	*	*	*	*	*	*	184	121	107	121	146
9:30	*	*	*	*	*	*	*	*	*	*	*	171	140	96	140	134
9:45	*	*	*	*	*	*	*	*	*	*	*	166	167	70	167	118
10:00	*	*	*	*	*	*	*	*	*	*	*	155	183	70	183	113
10:15	*	*	*	*	*	*	*	*	*	*	*	176	171	60	171	118
10:30	*	*	*	*	*	*	*	*	*	*	*	186	161	43	161	115
10:45	*	*	*	*	*	*	*	*	*	*	*	173	183	39	183	106
11:00	*	*	*	*	*	*	*	*	*	*	*	141	159	40	159	91
11:15	*	*	*	*	*	*	*	*	*	*	*	147	176	36	176	92
11:30	*	*	*	*	*	*	*	*	*	*	*	133	168	42	168	88
11:45	*	*	*	*	*	*	*	*	*	*	*	202	158	25	158	114
Total	0	0	0	0	0	0	0	0	0	0	0	8925	3244	6035	3244	7480
Day Total	0		0		0		0		0		8925		9279		10724	
% Splits	*	*	*	*	*	*	*	*	*	*	0.0%	100.0%	35.0%	65.0%	30.2%	69.8%
Peak												1:00	10:00	6:30	10:00	1:00
Volume												1046	698	671	698	826
Peak Factor												0.934	0.954	0.888	0.954	0.943

Site Code: ATR306-SB
Station ID:
Location 1: ETH
Location 2: AT ENTRANCE TO CAYMAN
Location 3:
Location 4:

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR306-SOUTH
Date Printed: 12/5/2022
Start Date: 4/6/2019
End Date: 4/13/2019

	4/8/2019		Tuesday		Wednesday		Thursday		Friday		Saturday		Sunday		Average Day	
Time	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
12:00	36	283	30	282	24	273	31	233	28	282	53	*	*	*	34	271
12:15	20	210	14	236	22	296	23	227	18	244	46	*	*	*	24	243
12:30	14	217	18	277	17	259	21	261	15	260	46	*	*	*	22	255
12:45	50	233	11	283	12	279	14	287	16	291	31	*	*	*	22	275
1:00	14	273	11	261	13	296	14	285	12	256	40	*	*	*	17	274
1:15	13	258	11	271	6	285	12	270	8	286	27	*	*	*	13	274
1:30	6	256	6	252	2	282	8	251	13	288	33	*	*	*	11	266
1:45	10	272	6	288	11	326	12	296	6	311	34	*	*	*	13	299
2:00	7	261	4	267	5	302	5	286	13	268	39	*	*	*	12	277
2:15	12	218	7	262	3	237	8	261	5	266	20	*	*	*	9	249
2:30	4	254	4	238	2	265	3	245	8	259	18	*	*	*	7	252
2:45	10	251	2	262	2	244	1	291	5	272	16	*	*	*	6	264
3:00	2	273	3	279	4	264	4	266	6	290	12	*	*	*	5	274
3:15	1	256	5	255	6	222	5	256	3	289	14	*	*	*	6	256
3:30	5	273	4	273	8	236	7	257	4	240	14	*	*	*	7	256
3:45	6	228	7	221	9	264	5	289	6	241	17	*	*	*	8	249
4:00	5	247	7	248	9	242	4	264	3	262	15	*	*	*	7	253
4:15	5	280	6	233	2	241	7	285	9	263	11	*	*	*	7	260
4:30	9	282	15	287	15	310	11	297	10	266	16	*	*	*	13	288
4:45	23	246	21	232	13	269	31	260	20	276	26	*	*	*	22	257
5:00	26	308	22	297	32	300	28	295	43	267	32	*	*	*	31	293
5:15	30	249	31	244	40	237	24	267	47	229	25	*	*	*	33	245
5:30	51	223	41	230	61	207	55	229	43	223	34	*	*	*	48	222
5:45	58	187	68	224	53	204	72	207	74	198	56	*	*	*	64	204
6:00	78	238	74	209	56	161	73	188	77	203	48	*	*	*	68	200
6:15	104	197	115	184	102	161	96	163	102	191	59	*	*	*	96	179
6:30	139	167	161	201	143	185	139	212	151	185	97	*	*	*	138	190
6:45	185	179	207	206	174	176	197	199	185	198	115	*	*	*	177	192
7:00	212	204	220	182	234	159	206	238	209	196	99	*	*	*	197	196
7:15	330	174	312	206	307	131	279	186	304	169	111	*	*	*	274	173
7:30	386	141	378	162	401	142	351	186	396	134	140	*	*	*	342	153
7:45	417	122	424	127	412	107	323	127	394	145	156	*	*	*	354	126
8:00	349	116	386	147	372	99	282	111	337	135	155	*	*	*	314	122
8:15	356	110	334	115	343	94	278	136	308	114	195	*	*	*	302	114
8:30	265	96	267	123	281	93	214	125	262	124	178	*	*	*	245	112
8:45	251	78	256	100	238	83	245	112	278	114	235	*	*	*	251	97
9:00	198	113	200	95	185	85	178	124	193	128	239	*	*	*	199	109
9:15	184	93	195	91	194	111	197	104	202	130	234	*	*	*	201	106
9:30	185	75	204	79	195	86	174	115	224	115	239	*	*	*	204	94
9:45	215	64	215	80	211	74	177	70	236	97	274	*	*	*	221	77
10:00	174	75	182	83	217	62	199	114	220	137	252	*	*	*	207	94
10:15	194	51	192	79	231	53	211	77	239	118	300	*	*	*	228	76
10:30	223	35	212	45	203	51	183	57	215	85	268	*	*	*	217	55
10:45	205	50	235	49	218	49	190	70	204	87	259	*	*	*	219	61
11:00	207	39	233	41	234	47	183	44	236	88	28	*	*	*	187	52
11:15	224	38	229	45	255	40	200	56	261	90	0	*	*	*	195	54
11:30	244	40	233	34	296	35	249	39	275	71	0	*	*	*	216	44
11:45	210	30	255	33	279	33	234	39	304	78	0	*	*	*	214	43
Total	5952	8563	6073	8918	6152	8657	5463	9257	6227	9459	4356	0	0	0	5704	8971
Day Total	14515		14991		14809		14720		15686		4356		0		14675	
% Splits	41.0%	59.0%	40.5%	59.5%	41.5%	58.5%	37.1%	62.9%	39.7%	60.3%	100.0%	0.0%	*	*	38.9%	61.1%
Peak	7:30	4:15	7:30	12:30	7:30	1:15	7:15	4:15	7:30	1:15	9:45				7:30	1:15
Volume	1508	1116	1522	1092	1528	1195	1235	1137	1435	1153	1094				1312	1116
Peak Factor	0.904	0.906	0.897	0.965	0.927	0.916	0.880	0.957	0.906	0.927	0.912				0.927	0.933

ADT ADT: 14,948 AADT: 14,948

Site Code: ATR306-SB
Station ID:
Location 1: ETH
Location 2: AT ENTRANCE TO CAYMAN INT'L SCHOOL
Location 3:
Location 4:
Direction: Southbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR306-SOUTH W2019 - RAW
Date Printed: 12/6/2022
Start Date: 4/6/2019
End Date: 4/13/2019

4/6/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
2:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
3:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
4:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
5:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
6:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
7:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
8:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
9:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
10:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
11:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
12:00 PM	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*
1:00	1	76	35	0	5	1	0	3	1	0	0	0	0	10	132	10
2:00	0	628	305	2	42	2	0	21	3	2	2	0	0	39	1046	74
3:00	8	599	238	1	47	6	0	13	0	1	0	0	0	45	958	68
4:00	5	613	267	3	42	2	0	11	1	2	1	0	0	45	992	62
5:00	6	527	226	4	44	2	0	15	1	2	0	0	1	27	855	69
6:00	2	508	229	6	22	3	0	4	0	2	0	0	0	28	804	37
7:00	2	501	184	0	26	4	0	4	0	0	1	0	0	27	749	35
8:00	0	536	177	2	15	1	0	8	0	0	0	0	0	26	765	26
9:00	1	419	154	0	24	0	0	7	0	0	0	0	0	9	614	31
10:00	2	490	170	0	14	2	0	7	0	1	1	0	0	10	697	25
11:00	4	476	163	1	19	1	0	7	0	0	0	0	0	19	690	28
	4	451	134	1	11	3	0	4	0	0	0	0	0	15	623	19
Total	35	5824	2282	20	311	27	0	104	6	10	5	0	1	300	8925	484
Percent	0.4%	65.3%	25.6%	0.2%	3.5%	0.3%	0.0%	1.2%	0.1%	0.1%	0.1%	0.0%	0.0%	3.4%		5.4%
AM Peak																
	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
PM Peak	2:00	1:00	1:00	5:00	2:00	2:00		1:00	1:00	1:00	1:00		4:00	2:00	1:00	1:00
	8	628	305	6	47	6	*	21	3	2	2	*	1	45	1046	74

Site Code: ATR306-SB
Station ID:
Location 1: ETH
Location 2: AT ENTRANCE TO CAYMAN INT'L SCHOOL
Location 3:
Location 4:
Direction: Southbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR306-SOUTH W2019 - RAW
Date Printed: 12/6/2022
Start Date: 4/6/2019
End Date: 4/13/2019

4/7/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	4	212	73	0	12	0	0	4	0	0	0	0	0	6	311	16
2:00	0	63	39	0	1	0	0	1	0	0	0	0	0	2	106	2
3:00	0	27	18	0	1	0	0	0	0	0	0	0	0	1	47	1
4:00	0	22	11	0	1	0	0	0	0	0	0	0	0	0	34	1
5:00	0	18	32	0	2	0	0	0	0	0	0	0	0	1	53	2
6:00	0	42	57	0	8	0	0	0	0	0	0	0	0	1	108	8
7:00	0	73	35	0	7	0	0	0	0	0	0	0	0	15	130	7
8:00	0	181	22	0	6	1	0	0	0	0	0	0	0	5	215	7
9:00	0	296	43	1	11	0	0	3	0	0	0	0	0	7	361	15
10:00	1	420	71	0	8	1	0	5	2	0	0	0	0	12	520	16
11:00	4	543	99	1	20	3	0	4	0	0	0	1	0	23	698	29
12:00 PM	8	523	93	1	19	3	0	3	0	0	0	0	0	11	661	26
1:00	0	501	111	2	19	3	0	1	1	1	0	0	0	11	650	27
2:00	1	487	76	0	17	0	0	7	0	0	0	0	0	17	605	24
3:00	3	497	84	0	16	1	0	5	0	1	0	0	0	17	624	23
4:00	1	461	53	0	5	0	0	0	2	0	0	0	0	9	531	7
5:00	3	480	50	1	16	0	0	3	0	0	0	0	0	23	576	20
6:00	6	483	52	0	7	1	0	2	0	1	0	0	0	20	572	11
7:00	2	545	56	1	6	0	0	5	0	1	0	0	0	10	626	13
8:00	6	543	63	3	8	0	0	0	0	0	0	0	0	15	638	11
9:00	2	385	41	0	6	2	0	0	0	0	0	0	0	21	457	8
10:00	2	335	44	0	9	1	0	1	0	0	0	0	0	9	401	11
11:00	1	186	17	0	2	0	0	0	0	0	0	0	0	6	212	2
	0	122	13	0	8	0	0	0	0	0	0	0	0	0	143	8
Total	44	7445	1253	10	215	16	0	44	5	4	0	1	0	242	9279	295
Percent	0.5%	80.2%	13.5%	0.1%	2.3%	0.2%	0.0%	0.5%	0.1%	0.0%	0.0%	0.0%	0.0%	2.6%		3.2%
AM Peak	11:00	10:00	10:00	8:00	10:00	10:00		9:00	9:00			10:00		10:00	10:00	10:00
	8	543	99	1	20	3	*	5	2	*	*	1	*	23	698	29
PM Peak	5:00	6:00	12:00 PM	7:00	12:00 PM	12:00 PM		1:00	3:00	12:00 PM				4:00	12:00 PM	12:00 PM
	6	545	111	3	19	3	*	7	2	1	*	*	*	23	650	27

Site Code: ATR306-SB
Station ID:
Location 1: ETH
Location 2: AT ENTRANCE TO CAYMAN INT'L SCHOOL
Location 3:
Location 4:
Direction: Southbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR306-SOUTH W2019 - RAW
Date Printed: 12/6/2022
Start Date: 4/6/2019
End Date: 4/13/2019

4/8/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	1	109	8	0	1	0	0	0	0	0	0	0	0	1	120	1
2:00	0	36	5	0	2	0	0	0	0	0	0	0	0	0	43	2
3:00	0	27	5	0	0	0	0	1	0	0	0	0	0	0	33	1
4:00	0	11	0	0	1	0	0	2	0	0	0	0	0	0	14	3
5:00	0	34	6	1	0	1	0	0	0	0	0	0	0	0	42	2
6:00	1	126	23	0	7	1	0	3	0	0	0	0	0	4	165	11
7:00	1	417	68	0	5	2	0	2	0	0	0	0	0	11	506	9
8:00	15	1091	97	3	18	1	0	9	3	7	3	0	1	97	1345	45
9:00	8	991	109	5	23	9	1	9	3	5	0	1	1	56	1221	57
10:00	6	581	119	5	25	6	0	7	0	2	1	0	0	30	782	46
11:00	3	614	122	1	26	5	0	3	1	1	0	0	0	20	796	37
12:00 PM	6	667	140	6	22	3	0	6	1	5	1	0	0	28	885	44
1:00	7	708	132	2	33	9	2	7	3	1	1	0	0	38	943	58
2:00	3	821	133	2	25	8	0	13	1	3	3	1	1	45	1059	57
3:00	7	761	122	2	28	14	1	6	2	1	0	0	0	40	984	54
4:00	2	810	122	5	25	13	0	4	4	2	0	0	0	43	1030	53
5:00	5	849	107	6	25	11	1	4	1	2	1	0	3	40	1055	54
6:00	5	813	75	3	10	9	0	7	1	1	1	0	0	42	967	32
7:00	4	674	62	0	11	3	1	3	0	0	0	0	0	23	781	18
8:00	4	542	62	0	11	1	0	2	0	0	0	0	0	19	641	14
9:00	4	356	25	0	5	1	0	0	0	0	0	0	0	9	400	6
10:00	2	282	42	0	7	1	0	1	0	0	2	0	0	8	345	11
11:00	1	185	24	0	0	0	0	0	0	0	0	0	0	1	211	0
	1	136	7	0	1	0	0	1	0	0	0	0	0	1	147	2
Total	86	11641	1615	41	311	98	6	90	20	30	13	2	6	556	14515	617
Percent	0.6%	80.2%	11.1%	0.3%	2.1%	0.7%	0.0%	0.6%	0.1%	0.2%	0.1%	0.0%	0.0%	3.8%		4.3%
AM Peak	7:00	7:00	11:00	11:00	10:00	8:00	8:00	7:00	7:00	7:00	7:00	8:00	7:00	7:00	7:00	8:00
	15	1091	140	6	26	9	1	9	3	7	3	1	1	97	1345	57
PM Peak	12:00 PM	4:00	1:00	4:00	12:00 PM	2:00	12:00 PM	1:00	3:00	1:00	1:00	1:00	4:00	1:00	1:00	12:00 PM
	7	849	133	6	33	14	2	13	4	3	3	1	3	45	1059	58

Site Code: ATR306-SB
Station ID:
Location 1: ETH
Location 2: AT ENTRANCE TO CAYMAN INT'L SCHOOL
Location 3:
Location 4:
Direction: Southbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR306-SOUTH W2019 - RAW
Date Printed: 12/6/2022
Start Date: 4/6/2019
End Date: 4/13/2019

4/9/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	0	63	9	1	0	0	0	0	0	0	0	0	0	0	73	1
2:00	1	29	4	0	0	0	0	0	0	0	0	0	0	0	34	0
3:00	0	15	2	0	0	0	0	0	0	0	0	0	0	0	17	0
4:00	0	17	0	0	1	0	0	1	0	0	0	0	0	0	19	2
5:00	0	40	5	0	1	2	0	1	0	0	0	0	0	0	49	4
6:00	0	125	24	0	12	0	0	1	0	0	0	0	0	0	162	13
7:00	3	425	89	1	20	2	0	5	0	1	0	0	0	11	557	29
8:00	12	1060	110	6	31	7	0	12	4	3	4	2	1	82	1334	70
9:00	5	1006	105	9	24	10	0	11	2	4	1	0	0	66	1243	61
10:00	2	618	107	0	34	11	0	7	1	2	2	0	0	30	814	57
11:00	3	607	112	2	31	9	1	14	0	2	0	1	0	39	821	60
12:00 PM	7	694	143	3	27	16	1	10	3	2	0	0	0	44	950	62
1:00	9	852	111	4	33	7	0	7	1	0	0	1	1	52	1078	54
2:00	7	817	133	4	32	17	1	12	4	1	1	0	0	43	1072	72
3:00	6	819	117	4	25	9	0	5	1	3	1	0	0	39	1029	48
4:00	4	793	128	3	37	9	0	7	5	1	1	1	0	39	1028	64
5:00	1	783	113	5	27	14	1	7	2	2	0	0	0	45	1000	58
6:00	10	820	95	3	13	2	0	9	3	1	0	0	0	39	995	31
7:00	5	683	64	3	8	2	1	3	1	0	0	0	0	30	800	18
8:00	1	592	49	1	9	2	0	1	0	1	1	0	0	20	677	15
9:00	2	410	52	1	5	1	0	2	0	0	0	0	0	12	485	9
10:00	3	304	31	0	2	0	0	0	0	0	0	0	0	5	345	2
11:00	1	215	26	0	10	0	0	1	0	0	0	0	0	3	256	11
	1	138	12	0	1	0	0	1	0	0	0	0	0	0	153	2
Total	83	11925	1641	50	383	120	5	117	27	23	11	5	2	599	14991	743
Percent	0.6%	79.5%	10.9%	0.3%	2.6%	0.8%	0.0%	0.8%	0.2%	0.2%	0.1%	0.0%	0.0%	4.0%		5.0%
AM Peak	7:00	7:00	11:00	8:00	9:00	11:00	10:00	10:00	7:00	8:00	7:00	7:00	7:00	7:00	7:00	7:00
	12	1060	143	9	34	16	1	14	4	4	4	2	1	82	1334	70
PM Peak	5:00	12:00 PM	1:00	4:00	3:00	1:00	1:00	1:00	3:00	2:00	1:00	12:00 PM	12:00 PM	12:00 PM	12:00 PM	1:00
	10	852	133	5	37	17	1	12	5	3	1	1	1	52	1078	72

Site Code: ATR306-SB
Station ID:
Location 1: ETH
Location 2: AT ENTRANCE TO CAYMAN INT'L SCHOOL
Location 3:
Location 4:
Direction: Southbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR306-SOUTH W2019 - RAW
Date Printed: 12/6/2022
Start Date: 4/6/2019
End Date: 4/13/2019

4/10/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	0	67	8	0	0	0	0	0	0	0	0	0	0	0	75	0
2:00	0	28	3	0	1	0	0	0	0	0	0	0	0	0	32	1
3:00	0	10	2	0	0	0	0	0	0	0	0	0	0	0	12	0
4:00	0	23	1	0	3	0	0	0	0	0	0	0	0	0	27	3
5:00	0	30	6	0	1	1	0	1	0	0	0	0	0	0	39	3
6:00	0	122	47	0	14	0	0	1	0	0	0	0	0	2	186	15
7:00	3	379	65	1	10	0	0	3	0	0	0	0	0	14	475	14
8:00	4	1104	118	2	26	6	1	6	2	2	3	1	1	78	1354	50
9:00	7	1002	110	4	32	8	0	10	3	4	2	0	0	52	1234	63
10:00	3	618	98	1	19	10	0	3	1	0	1	0	0	31	785	35
11:00	6	652	121	3	25	23	0	7	1	2	0	0	0	29	869	61
12:00 PM	3	813	136	6	30	11	1	9	4	2	1	0	0	48	1064	64
1:00	8	853	132	4	29	10	1	10	3	1	1	0	0	55	1107	59
2:00	11	913	133	5	41	10	3	8	2	2	0	0	0	61	1189	71
3:00	7	788	134	6	35	9	1	14	3	0	0	0	0	51	1048	68
4:00	4	754	127	1	31	11	0	10	0	2	1	0	2	43	986	58
5:00	7	824	102	4	30	4	1	16	2	0	6	0	0	66	1062	63
6:00	23	268	41	20	19	2	0	2	0	1	0	0	0	572	948	44
7:00	7	1	0	5	0	0	0	0	0	0	0	0	0	670	683	5
8:00	4	0	2	4	6	0	0	0	0	0	0	0	0	523	539	10
9:00	0	1	0	0	0	0	0	0	0	0	0	0	0	368	369	0
10:00	0	0	0	0	0	0	0	0	0	0	0	0	0	356	356	0
11:00	0	0	0	0	0	0	0	0	0	0	0	0	0	215	215	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	155	155	0
Total	97	9250	1386	66	352	105	8	100	21	16	15	1	3	3389	14809	687
Percent	0.7%	62.5%	9.4%	0.4%	2.4%	0.7%	0.1%	0.7%	0.1%	0.1%	0.1%	0.0%	0.0%	22.9%		4.6%
AM Peak	8:00	7:00	11:00	11:00	8:00	10:00	7:00	8:00	11:00	8:00	7:00	7:00	7:00	7:00	7:00	11:00
	7	1104	136	6	32	23	1	10	4	4	3	1	1	78	1354	64
PM Peak	5:00	1:00	2:00	5:00	1:00	3:00	1:00	4:00	12:00 PM	1:00	4:00		3:00	6:00	1:00	1:00
	23	913	134	20	41	11	3	16	3	2	6	*	2	670	1189	71

Site Code: ATR306-SB
Station ID:
Location 1: ETH
Location 2: AT ENTRANCE TO CAYMAN INT'L SCHOOL
Location 3:
Location 4:
Direction: Southbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR306-SOUTH W2019 - RAW
Date Printed: 12/6/2022
Start Date: 4/6/2019
End Date: 4/13/2019

4/11/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	0	0	0	0	0	0	0	0	0	0	0	0	0	89	89	0
2:00	0	0	0	0	0	0	0	0	0	0	0	0	0	46	46	0
3:00	0	0	0	0	0	0	0	0	0	0	0	0	0	17	17	0
4:00	0	0	0	0	0	0	0	0	0	0	0	0	0	21	21	0
5:00	0	0	0	0	0	0	0	0	0	0	0	0	0	53	53	0
6:00	0	0	0	1	0	0	0	0	0	0	0	0	0	178	179	1
7:00	0	0	0	0	0	0	0	0	0	0	0	0	0	505	505	0
8:00	0	0	0	0	0	0	0	0	0	0	0	0	0	1159	1159	0
9:00	0	0	0	0	0	0	0	0	0	0	0	0	0	1019	1019	0
10:00	0	0	0	0	0	0	0	0	0	0	0	0	0	726	726	0
11:00	0	0	0	0	0	0	0	0	0	0	0	0	0	783	783	0
12:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	866	866	0
1:00	4	412	32	0	5	5	0	0	0	0	0	0	0	550	1008	10
2:00	5	920	81	3	9	15	0	9	3	1	0	1	0	55	1102	41
3:00	8	886	82	3	25	16	0	2	6	3	3	0	2	47	1083	60
4:00	7	874	86	2	21	11	1	5	7	1	0	0	1	52	1068	49
5:00	8	903	92	2	24	10	1	3	3	1	1	1	2	55	1106	48
6:00	8	853	76	4	9	5	1	2	0	0	1	0	1	38	998	23
7:00	4	674	47	1	9	1	0	2	0	1	0	1	0	22	762	15
8:00	5	657	46	1	5	2	0	3	1	0	0	0	0	17	737	12
9:00	3	412	43	0	8	1	0	1	0	0	0	0	0	16	484	10
10:00	1	357	41	0	5	3	0	0	0	1	0	0	0	5	413	9
11:00	5	276	25	0	8	0	0	1	0	0	0	0	0	3	318	9
	1	161	10	1	2	0	0	1	0	0	0	0	0	2	178	4
Total	59	7385	661	18	130	69	3	29	20	8	5	3	6	6324	14720	291
Percent	0.4%	50.2%	4.5%	0.1%	0.9%	0.5%	0.0%	0.2%	0.1%	0.1%	0.0%	0.0%	0.0%	43.0%		2.0%
AM Peak				5:00										7:00	7:00	5:00
	*	*	*	1	*	*	*	*	*	*	*	*	*	1159	1159	1
PM Peak	2:00	1:00	4:00	5:00	2:00	2:00	3:00	1:00	3:00	2:00	2:00	1:00	2:00	12:00 PM	4:00	2:00
	8	920	92	4	25	16	1	9	7	3	3	1	2	550	1106	60

Site Code: ATR306-SB
Station ID:
Location 1: ETH
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Direction: Southbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR306-SOUTH W2019 - RAW
Date Printed: 12/6/2022
Start Date: 4/6/2019
End Date: 4/13/2019

4/12/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	0	69	6	0	2	0	0	0	0	0	0	0	0	0	77	2
2:00	0	38	0	0	0	0	0	1	0	0	0	0	0	0	39	1
3:00	1	27	3	0	0	0	0	0	0	0	0	0	0	0	31	0
4:00	0	16	3	0	0	0	0	0	0	0	0	0	0	0	19	0
5:00	0	37	2	0	2	0	0	1	0	0	0	0	0	0	42	3
6:00	0	168	29	0	8	0	0	1	0	1	0	0	0	0	207	10
7:00	3	404	77	0	7	2	0	3	2	1	0	0	0	16	515	15
8:00	11	1046	105	4	22	11	0	11	2	4	3	1	2	81	1303	60
9:00	7	964	86	5	29	9	0	11	2	3	0	0	3	66	1185	62
10:00	6	668	104	4	17	13	3	4	3	1	0	1	0	31	855	46
11:00	5	702	100	4	10	16	1	3	0	3	0	1	0	33	878	38
12:00 PM	7	887	88	9	14	21	1	3	2	1	2	0	1	40	1076	54
1:00	8	878	90	4	12	13	0	11	3	1	0	1	0	56	1077	45
2:00	8	935	93	6	13	12	0	3	0	1	1	2	0	67	1141	38
3:00	13	894	71	4	15	9	0	3	4	0	0	1	0	51	1065	36
4:00	8	864	94	6	12	11	0	5	2	1	1	0	0	56	1060	38
5:00	13	884	68	2	22	3	0	9	2	0	0	0	2	62	1067	40
6:00	5	760	84	4	9	8	1	2	2	2	3	0	0	37	917	31
7:00	3	674	66	1	10	1	0	0	0	0	1	0	1	20	777	14
8:00	5	539	61	0	11	2	0	1	0	1	0	0	0	24	644	15
9:00	2	423	45	0	8	1	0	2	0	0	1	0	0	5	487	12
10:00	3	404	40	2	8	3	0	0	0	0	0	0	1	9	470	14
11:00	3	357	46	0	7	1	0	2	0	1	0	0	0	10	427	11
	1	284	26	0	6	2	0	0	1	0	1	0	0	6	327	10
Total	112	12922	1387	55	244	138	6	76	25	21	13	7	10	670	15686	595
Percent	0.7%	82.4%	8.8%	0.4%	1.6%	0.9%	0.0%	0.5%	0.2%	0.1%	0.1%	0.0%	0.1%	4.3%		3.8%
AM Peak	7:00	7:00	7:00	11:00	8:00	11:00	9:00	7:00	9:00	7:00	7:00	7:00	8:00	7:00	7:00	8:00
	11	1046	105	9	29	21	3	11	3	4	3	1	3	81	1303	62
PM Peak	2:00	1:00	3:00	1:00	4:00	12:00 PM	5:00	12:00 PM	2:00	5:00	5:00	1:00	4:00	1:00	1:00	12:00 PM
	13	935	94	6	22	13	1	11	4	2	3	2	2	67	1141	45

Site Code: ATR306-SB
Station ID:
Location 1: ETH
Location 2: AT ENTRANCE TO CAYMAN INT'L SCHOOL
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Direction: Southbound

National Roads Authority (Cayman Islands)
Use Preferences to Define Titles

Latitude: 0.000000
Longitude: 0.000000
File Name: ATR306-SOUTH W2019 - RAW
Date Printed: 12/6/2022
Start Date: 4/6/2019
End Date: 4/13/2019

4/13/2019 Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	No Class	Total	Truck Total
1:00	0	141	28	0	3	0	1	1	0	0	0	0	0	2	176	5
2:00	1	96	32	0	4	0	0	0	0	0	0	0	0	1	134	4
3:00	0	68	21	0	2	0	0	1	0	0	0	0	0	1	93	3
4:00	1	41	15	0	0	0	0	0	0	0	0	0	0	0	57	0
5:00	0	52	15	0	0	0	0	1	0	0	0	0	0	0	68	1
6:00	0	108	27	2	7	2	0	0	0	0	0	0	0	1	147	11
7:00	1	227	62	0	11	8	0	0	0	1	0	0	0	9	319	20
8:00	3	392	70	1	15	6	0	3	0	0	0	0	0	16	506	25
9:00	7	601	99	1	11	5	0	4	0	1	1	1	0	32	763	24
10:00	5	771	109	2	31	10	1	6	3	1	0	0	0	47	986	54
11:00	6	844	128	1	23	6	2	7	1	1	0	1	0	59	1079	42
12:00 PM	0	20	3	1	0	0	0	0	0	0	0	0	0	4	28	1
1:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	*
2:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	*
3:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	*
4:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	*
5:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	*
6:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	*
7:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	*
8:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	*
9:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	*
10:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	*
11:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	*
	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	*
Total	24	3361	609	8	107	37	4	23	4	4	1	2	0	172	4356	190
Percent	0.6%	77.2%	14.0%	0.2%	2.5%	0.8%	0.1%	0.5%	0.1%	0.1%	0.0%	0.0%	0.0%	3.9%		4.4%
AM Peak	8:00	10:00	10:00	5:00	9:00	9:00	10:00	10:00	9:00	6:00	8:00	8:00		10:00	10:00	9:00
	7	844	128	2	31	10	2	7	3	1	1	1	*	59	1079	54
PM Peak																
	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Grand Total	540	69753	10834	268	2053	610	32	583	128	116	63	21	28	12252	97281	3902

	Eastbound	Westbound	Combined
Average Weekday Morning (AM) Peak 08:30 – 09:30	518	496	1015
Average Weekday Evening (PM) Peak 17:45 – 18:45 [2]	373	272	645
Average Weekday ADT	5816	4654	10471

Table 1 – North Sound Road (Agave) Traffic Volume [2]

	Eastbound [2]	Westbound	Combined
Average Weekday Morning (AM) Peak 09:00 – 10:00	50	511	561
Average Weekday Evening (PM) Peak 18:30 – 19:30	82	439	521
Average Weekday ADT	1222	5760	6972

Table 2 – North Sound Road (East of Tony's Toys Lot) Traffic Volume [2]

	Eastbound	Westbound [2]	Combined
Average Weekday Morning (AM) Peak 06:45 – 07:45	469	219	689
Average Weekday PM Peak 12:30 – 13:30	516	101	616
Average Weekday ADT	6782	2142	8923

Table 3 – North Sound Road (Paramount) Traffic Volume [2]

[2] Some traffic flow data was not recorded by the automatic traffic counters due to slow-moving nature of traffic during peak periods and the counters missing these vehicles. The automatic count data was supplemented by data from the NRA and manual turning movement counts.

	Northbound [2]	Southbound	Combined
Average Weekday Morning (AM) Peak 07:15 – 08:15	308	284	592
Average Weekday Evening (PM) Peak 18:00 – 19:00	214	226	440
Average Weekday ADT	2809	3779	6588

Table 4 – Dorcy Drive (Ashley furniture) Traffic Volume [2]

	Eastbound	Westbound	Combined
Average Weekday Morning (AM) Peak 06:45 – 07:45	292	214	506
Average Weekday Evening (PM) Peak 12:30 – 13:30	211	200	411
Average Weekday ADT	3006	2646	5651

Table 5 – North Sound Road (East of Dorcy Drive intersection) Traffic Volume [2]

	Northbound	Southbound	Combined
Average Weekday Morning (AM) Peak 06:45 – 07:45	205	164	370
Average Weekday Evening (PM) Peak 12:00 – 13:00	134	200	334
Average Weekday ADT	1908	2648	4556

Table 6 – Seymour Road (north of intersection with North Sound Road) Traffic Volume

Appendix C

Sound Level Data

Table C.1

Noise Source Summary
Dart
IWSMS, George Town, Cayman Islands

Cadna A ID	Source Description	Sound Power Level[1] (dBA)	Source Characteristics[2]	Source Location[3]	Noise Control Measures[4]	Source Type
Steady State Sources						
ADMIN_HVAC1	Admin - Office HVAC	86.4	S	O	U	Point
ADMIN_HVAC2	Admin - Office HVAC	86.4	S	O	U	Point
AG1	Angle Grinder	111.7	S	O	U	Point
AG2	Angle Grinder	111.7	S	O	U	Point
AG3	Angle Grinder	111.7	S	O	U	Point
AG4	Angle Grinder	111.7	S	O	U	Point
AP1	Asphalt Paver	114.8	S	O	U	Point
BAP_AIL1	BAP Sidewall Air Intake Louvre	90.2	S	O	U	Vertical Area
BAP_AIL2	BAP Sidewall Air Intake Louvre	90.2	S	O	U	Vertical Area
BAP_AIL3	BAP Sidewall Air Intake Louvre	90.2	S	O	U	Vertical Area
BAP_AIL4	BAP Sidewall Air Intake Louvre	90.2	S	O	U	Vertical Area
BAP_BayDoor1	BAP Open Bay Door	107.5	S	O	U	Vertical Area
BAP_BayDoor2	BAP Open Bay Door	107.5	S	O	U	Vertical Area
BD1	Dozer	106.3	S	O	U	Point
BH1	Backhoe	98.9	S	O	U	Point
BulldozerMovement	Construction Dozer	75.2	S	O	U	Area
C&D_Crusher	Rubble Master (Mobile Crusher)	112.4	S	O	U	Point
CD1	Core Drill (Drilling Concrete)	115.5	S	O	U	Point
CD2	Core Drill (Drilling Concrete)	115.5	S	O	U	Point
CD3	Core Drill (Drilling Concrete)	115.5	S	O	U	Point
CD4	Core Drill (Drilling Concrete)	115.5	S	O	U	Point
CD5	Core Drill (Drilling Concrete)	115.5	S	O	U	Point
CDF_BayDoor1	CDF Open BayDoor	107.5	S	O	U	Vertical Area
CDF_BayDoor2	CDF Open Bay Door	107.5	S	O	U	Vertical Area
CD_BAF_TR1	C&D and BAF - Inbound/Outbound Truck Route	109.9	S	O	U	Line
CR1	150 Ton Crane	109.2	S	O	U	Point
CR2	60 Ton Crane	107.7	S	O	U	Point
CR3	30 Ton Crane	100.8	S	O	U	Point
CS1	Circular Saw (Cutting Concrete)	124.3	S	O	U	Point
CS2	Circular Saw (Cutting Concrete)	124.3	S	O	U	Point
CS3	Circular Saw (Cutting Concrete)	124.3	S	O	U	Point
CS4	Circular Saw (Cutting Concrete)	124.3	S	O	U	Point
CS5	Circular Saw (Cutting Concrete)	124.3	S	O	U	Point
CT1	Concrete Mixer Truck	111.0	S	O	U	Point
CT2	Concrete Mixer Truck	111.0	S	O	U	Point
CT3	Concrete Mixer Truck	111.0	S	O	U	Point
CT4	Concrete Mixer Truck	111.0	S	O	U	Point
CT5	Concrete Mixer Truck	111.0	S	O	U	Point
CT6	Concrete Mixer Truck	111.0	S	O	U	Point
CT7	Concrete Mixer Truck	111.0	S	O	U	Point
CT8	Concrete Mixer Truck	111.0	S	O	U	Point
DR1	Drill Rig	104.9	S	O	U	Point
DR2	Drill Rig	104.9	S	O	U	Point
DR3	Drill Rig	104.9	S	O	U	Point
DR4	Drill Rig	104.9	S	O	U	Point
DR5	Drill Rig	104.9	S	O	U	Point
DT1	Dump Truck	94.0	S	O	U	Point
DT2	Dump Truck	94.0	S	O	U	Point
DT3	Dump Truck	94.0	S	O	U	Point
ELV_BayDoor3	ELV Open Bay Door	98.5	S	O	U	Vertical Area
ELV_BayDoor4	ELV Open Bay Door	98.5	S	O	U	Vertical Area
ELV_HVAC1	ELV - Office HVAC	86.4	S	O	U	Point
ELV_HVAC2	ELV - Office HVAC	86.4	S	O	U	Point
ELV_TR1	ELV - Inbound/Outbound Truck Route	109.9	S	O	U	Line
ERF_AIL1	ERF Sidewall Air Intake Louvre	91.7	S	O	U	Vertical Area
ERF_AIL10	ERF Sidewall Air Intake Louvre	84.8	S	O	U	Vertical Area
ERF_AIL11	ERF Sidewall Air Intake Louvre	84.5	S	O	U	Vertical Area
ERF_AIL12	ERF Sidewall Air Intake Louvre	91.5	S	O	U	Vertical Area
ERF_AIL13	ERF Sidewall Air Intake Louvre	90.2	S	O	U	Vertical Area
ERF_AIL14	ERF Sidewall Air Intake Louvre	86.2	S	O	U	Vertical Area
ERF_AIL2	ERF Sidewall Air Intake Louvre	90.2	S	O	U	Vertical Area
ERF_AIL3	ERF Sidewall Air Intake Louvre	86.5	S	O	U	Vertical Area
ERF_AIL4	ERF Sidewall Air Intake Louvre	84.9	S	O	U	Vertical Area
ERF_AIL5	ERF Sidewall Air Intake Louvre	91.8	S	O	U	Vertical Area
ERF_AIL7	ERF Sidewall Air Intake Louvre	90.2	S	O	U	Vertical Area
ERF_AIL8	ERF Sidewall Air Intake Louvre	90.2	S	O	U	Vertical Area
ERF_AIL9	ERF Sidewall Air Intake Louvre	87.9	S	O	U	Vertical Area
ERF_TR1	ERF- Inbound/Outbound Truck Route	109.9	S	O	U	Line
Ex1	Excavator	107.9	S	O	U	Point
FP_Bldg_Ex	Fire Pump Bldg. - Sidewall Exhaust	85.0	S	O	U	Point
FP_Bldg_ExStack	Fire Pump Bldg. - Fire Pump Exhaust Stack	96.7	S	O	U	Point
FP_Bldg_Intake	Fire Pump Bldg. - Diesel Fire Water Sidewall Air Intake	91.4	S	O	U	Point
FTL1	Fuel Tanker Lorry	107.1	S	O	U	Point
FTL2	Fuel Tanker Lorry	107.1	S	O	U	Point
GC1	Gas Cutter	96.4	S	O	U	Point
GC2	Gas Cutter	96.4	S	O	U	Point
GC3	Gas Cutter	96.4	S	O	U	Point
GC4	Gas Cutter	96.4	S	O	U	Point
GC5	Gas Cutter	96.4	S	O	U	Point
GWF_Loader1	Green Waste Facility Front End Load Route 1	109.9	S	O	U	Line
GWF_Loader2	Green Waste Facility Front End Load Route 2	109.9	S	O	U	Line
GWF_Screener	Green Waste Facility - Screener	111.6	S	O	U	Point
GWF_Shredder2	Green Waste Facility - Komptech Shredder	111.7	S	O	U	Point
GWF_TR1	Green Waste Facility - Inbound/Outbound Truck Route	109.9	S	O	U	Line
GWF_Tubgrinder	Green Waste Facility - Mobark 950 Tub Grinder	114.0	S	O	U	Point
Gen1	Generator	104.7	S	O	U	Point

Table C.1

Noise Source Summary
Dart
IWSMS, George Town, Cayman Islands

Cadna A ID	Source Description	Sound Power Level[1] (dBA)	Source Characteristics[2]	Source Location[3]	Noise Control Measures[4]	Source Type
Gen2	Generator	104.7	S	O	U	Point
Gen3	Generator	104.7	S	O	U	Point
Gen4	Generator	104.7	S	O	U	Point
Gen5	Generator	104.7	S	O	U	Point
GraderMovement	Construction Grader	86.4	S	O	U	Area
HW_TR1	Household Recycling Container Movements	109.9	S	O	U	Line
HWRC_HVAC1	HWRC - Office HVAC	86.4	S	O	U	Point
HWRC_HVAC2	HWRC - Office HVAC	86.4	S	O	U	Point
L1	Loader	110.0	S	O	U	Point
L2	Loader	110.0	S	O	U	Point
L3	Loader	110.0	S	O	U	Point
L4	Loader	110.0	S	O	U	Point
LFG_Flare	Landfill Gas Flare	94.7	S	O	U	Point
LP1	Scissor Lift	98.2	S	O	U	Point
MEx1	Mini Excavator	98.6	S	O	U	Point
MEx2	Mini Excavator	98.6	S	O	U	Point
MEx3	Mini Excavator	98.6	S	O	U	Point
MEx4	Mini Excavator	98.6	S	O	U	Point
MRF_AIL1	MRF Sidewall Air Intake Louvre	90.2	S	O	U	Vertical Area
MRF_AIL10	MRF Sidewall Air Intake Louvre	90.2	S	O	U	Vertical Area
MRF_AIL11	MRF Sidewall Air Intake Louvre	90.2	S	O	U	Vertical Area
MRF_AIL12	MRF Sidewall Air Intake Louvre	90.2	S	O	U	Vertical Area
MRF_AIL13	MRF Sidewall Air Intake Louvre	90.2	S	O	U	Vertical Area
MRF_AIL2	MRF Sidewall Air Intake Louvre	90.2	S	O	U	Vertical Area
MRF_AIL3	MRF Sidewall Air Intake Louvre	90.2	S	O	U	Vertical Area
MRF_AIL4	MRF Sidewall Air Intake Louvre	90.2	S	O	U	Vertical Area
MRF_AIL5	MRF Sidewall Air Intake Louvre	90.2	S	O	U	Vertical Area
MRF_AIL6	MRF Sidewall Air Intake Louvre	90.2	S	O	U	Vertical Area
MRF_AIL7	MRF Sidewall Air Intake Louvre	90.2	S	O	U	Vertical Area
MRF_AIL8	MRF Sidewall Air Intake Louvre	90.2	S	O	U	Vertical Area
MRF_AIL9	MRF Sidewall Air Intake Louvre	90.2	S	O	U	Vertical Area
MRF_BayDoor1	MRF Open Bay Door	107.5	S	O	U	Vertical Area
MRF_BayDoor2	MRF Open Bay Door	107.5	S	O	U	Vertical Area
MRF_Forklift1	MRF - Forklift Moving Bails Route1	109.9	S	O	U	Line
MRF_GlassRolloffBin	MRF - Glass falling into Rolloff Bin	116.7	S	O	U	Point
MRP1	Mini Road Planer	98.4	S	O	U	Point
MRP2	Mini Road Planer	98.4	S	O	U	Point
MWF_HVAC1	MWF - Office HVAC	86.4	S	O	U	Point
MWF_HVAC2	MWF - Office HVAC	86.4	S	O	U	Point
MW_TR1	Medical Waste Bldg. - Inbound/Outbound Truck Route	109.9	S	O	U	Line
Main_HVAC1	Maintence Bldg. - Office HVAC	86.4	S	O	U	Point
Main_HVAC2	Maintence Bldg. - Office HVAC	86.4	S	O	U	Point
Main_TR1	Maintence Bldg. - Inbound/Outbound Truck Route	109.9	S	O	U	Line
Maintenance_BayDoor1	Maintenance Bldg Open BayDoor	111.8	S	O	U	Vertical Area
Maintenance_BayDoor2	Maintenance Bldg Open Bay Door	111.8	S	O	U	Vertical Area
PT1	Pneumatic Tool	115.5	S	O	U	Point
PT2	Pneumatic Tool	115.5	S	O	U	Point
PT3	Pneumatic Tool	115.5	S	O	U	Point
PT4	Pneumatic Tool	115.5	S	O	U	Point
PT5	Pneumatic Tool	115.5	S	O	U	Point
PV1	Poker Vibrator	109.5	S	O	U	Point
PV2	Poker Vibrator	109.5	S	O	U	Point
PV3	Poker Vibrator	109.5	S	O	U	Point
PV4	Poker Vibrator	109.5	S	O	U	Point
PV5	Poker Vibrator	109.5	S	O	U	Point
PaverRoute1	Paver	109.9	S	O	U	Line
PaverRoute2	Paver	109.9	S	O	U	Line
PaverRoute3	Paver	109.9	S	O	U	Line
Phase2Landfill_Ex	Landfill Excavator	109.5	S	O	U	Point
Piling1	Piling - Precast Concrete	119.7	S	O	U	Point
Piling2	Piling - Precast Concrete	119.7	S	O	U	Point
Piling3	Piling - Precast Concrete	119.7	S	O	U	Point
Piling4	Piling - Precast Concrete	119.7	S	O	U	Point
RP1	Road Planer	112.7	S	O	U	Point
RP2	Road Planer	112.7	S	O	U	Point
RP3	Road Planer	112.7	S	O	U	Point
RR1	Road Roller	110.7	S	O	U	Point
RR2	Road Roller	110.7	S	O	U	Point
SCM1	Small Cement Mixer	92.6	S	O	U	Point
SCM2	Small Cement Mixer	92.6	S	O	U	Point
SCM3	Small Cement Mixer	92.6	S	O	U	Point
S_BAP_RoofGEx1	BAP Building - Rooftop General Exhaust	84.9	S	O	U	Point
S_BAP_RoofGEx2	BAP Building - Rooftop General Exhaust	84.9	S	O	U	Point
S_BAP_SW_GEx1	BAP Building - Sidewall Exhaust	84.9	S	O	U	Point
S_BAP_SW_GEx2	BAP Building - Sidewall Exhaust	84.9	S	O	U	Point
S_BAP_SW_GEx3	BAP Building - Sidewall Exhaust	84.9	S	O	U	Point
S_BAP_SW_GEx4	BAP Building - Sidewall Exhaust	84.9	S	O	U	Point
S_CDF_RoofGEx1	CDF Building - Rooftop General Exhaust	84.9	S	O	U	Point
S_CDF_RoofGEx2	CDF Building - Rooftop General Exhaust	84.9	S	O	U	Point
S_CD_BAF_Loader	C&D_BAF Front End Loader Material Handling Area	88.5	S	O	U	Area
S_ELV_Crane	Excavator w Grapple Moving Vehicles	100.0	S	O	U	Point
S_ELV_Hydraulic_shear_bal	Hydraulic shear/baler	107.3	S	O	U	Point
S_ELV_Loader	ELV_Front End Loader Material Handling With Broom	71.0	S	O	U	Area
S_ELV_Torching	Torch Cutting	100.3	S	O	U	Point
S_ELV_Truck_Idling	Truck Idling	99.5	S	O	U	Point
S_ERF_ACC	Air Cooled Condenser unit (ACC)	93.4	S	O	U	Area
S_ERF_BayDoor1	ERF Building_Tipping Hall BayDoor#1	86.0	S	O	U	Vertical Area

Table C.1

Noise Source Summary
Dart
IWSMS, George Town, Cayman Islands

Cadna A ID	Source Description	Sound Power Level[1] (dBA)	Source Characteristics[2]	Source Location[3]	Noise Control Measures[4]	Source Type
S_ERF_BayDoor2	ERF Building_Tipping Hall BayDoor#2	90.0	S	O	U	Vertical Area
S_ERF_CompEx1	ERF Building - Compressor Exhaust	96.6	S	O	U	Point
S_ERF_CompEx2	ERF Building - Compressor Exhaust	96.6	S	O	U	Point
S_ERF_CompIN1	ERF Building - Compressor Intake	99.6	S	O	U	Point
S_ERF_MainStack	ERF Building - Stack Exhaust	103.8	S	O	U	Point
S_ERF_MainStackIDfan	ERF Building - ID Fan for Stack Exhaust	103.8	S	O	U	Point
S_ERF_RoofGEx1	ERF Building - Rooftop General Exhaust	84.9	S	O	U	Point
S_ERF_RoofGEx2	ERF Building - Rooftop General Exhaust	84.9	S	O	U	Point
S_ERF_SiloBlowTruck	ERF Building - Silo Blower Truck	105.7	S	O	U	Point
S_ERF_Turbine1	Generator Enclosure Air Inlet	102.3	S	O	U	Point
S_ERF_Turbine2	Generator Enclosure Exhaust	101.8	S	O	U	Point
S_ERF_Turbine3	Combustion Air Inlet Stack	102.4	S	O	U	Point
S_ERF_Turbine4	Heat Recovery Steam Generator Stack	85.6	S	O	U	Point
S_ERF_Turbine5	Turbine Enclosure Exhaust	103.1	S	O	U	Point
S_ERF_Turbine6	Turbine - After Cooler	95.9	S	O	U	Point
S_ERF_Turbine7	Turbine - Oil Cooler	95.9	S	O	U	Point
S_MRF_RoofGEx1	MRF Building - Rooftop General Exhaust	84.9	S	O	U	Point
S_MRF_RoofGEx2	MRF Building - Rooftop General Exhaust	84.9	S	O	U	Point
S_Phase2Landfill_Bulldozer	Landfill Bulldozer - Future Phase 2 Cell Conditions	90.0	S	O	U	Area
S_Phase2Landfill_Comp	Landfill Compactor - Future Phase 2 Landfill Conditions	102.6	S	O	U	Point
S_TR1	Phase 2 Final Landfill Cell - Inbound/Outbound Truck Route	109.9	S	O	U	Line
S_Weigh Scale_ Idling Truck	Weigh Scale - Idling Truck	96.2	S	O	U	Point
S_Weigh Scale_ Idling Truck	Weigh Scale - Idling Truck	96.2	S	O	U	Point
TH	Telescopic Handler	109.5	S	O	U	Point
TP1	Truck-mounted Pump	110.8	S	O	U	Point
TP2	Truck-mounted Pump	110.8	S	O	U	Point
TP3	Truck-mounted Pump	110.8	S	O	U	Point
TP4	Truck-mounted Pump	110.8	S	O	U	Point
TP5	Truck-mounted Pump	110.8	S	O	U	Point
TP6	Truck-mounted Pump	110.8	S	O	U	Point
TP7	Truck-mounted Pump	110.8	S	O	U	Point
TP8	Truck-mounted Pump	110.8	S	O	U	Point
TR1	Construction Truck Route	109.9	S	O	U	Line
VC1	Vibratory Compactor	108.7	S	O	U	Point
VR1	Vibratory Roller	104.5	S	O	U	Point
VR2	Vibratory Roller	104.5	S	O	U	Point
W1	Welder	103.9	S	O	U	Point
W2	Welder	103.9	S	O	U	Point
W3	Welder	103.9	S	O	U	Point
W4	Welder	103.9	S	O	U	Point
W5	Welder	103.9	S	O	U	Point
WP	Water Pump	96.1	S	O	U	Point
WWS	Wheel Wash Station	102.8	S	O	U	Point

Notes:

[1] Sound Power Level (PWL) in dBA, excludes +5 dBA total penalty if applicable.
[2] Sound characteristics:
- S – Steady
- Q – Quasi-steady impulsive
- I – Impulsive
- B – Buzzing
- T – Tonal
- C – Cyclic

[3] Source location:
- O – Outside of building
- I – Inside of building

[4] Noise control measures:
- S – Silencer, acoustic louvre, muffler
- A – Acoustic lining, plenum
- B – Barrier, berm, screening
- L – Lagging
- E – Acoustic enclosure
- O – Other
- U – Uncontrolled
- AC – Administrative control

Table C.2A

Point of Reception Noise Impact – Construction
Dart
IWSMS, George Town, Cayman Islands

Cadna A ID	Source Description	Lakeside Residential Development NSR1 Distance (m)	Partial Sound Levels[1] (dBA) Day 7am–7pm	Evening 7pm–11pm	Night 11pm–7am	Parkside Close Residential Dwelling NSR2 Distance (m)	Partial Sound Levels[1] (dBA) Day 7am–7pm	Evening 7pm–11pm	Night 11pm–7am	Seymour Road Residential Dwelling NSR3 Distance (m)	Partial Sound Levels[1] (dBA) Day 7am–7pm	Evening 7pm–11pm	Night 11pm–7am	The Cayman International School (CIS) NSR4 Distance (m)	Partial Sound Levels[1] (dBA) Day 7am–7pm	Evening 7pm–11pm	Night 11pm–7am	WoodsideDrive/Glenwood Residential NSR5 Distance (m)	Partial Sound Levels[1] (dBA) Day 7am–7pm	Evening 7pm–11pm	Night 11pm–7am	Camana Bay Hospital NSR6 Distance (m)	Partial Sound Levels[1] (dBA) Day 7am–7pm	Evening 7pm–11pm	Night 11pm–7am
Phase 1 Noise Impact																									
BH1	Backhoe	548	28.3	—	—	1051	19.5	—	—	675	21.7	—	—	901	16.4	—	—	466	25.8	—	—	713	23.9	—	—
BulldozerMoveme	Construction Dozer	604	36.6	—	—	1137	26.8	—	—	584	34.2	—	—	1027	23.7	—	—	355	40.1	—	—	825	31.3	—	—
CR1	150 Ton Crane	459	41.9	—	—	961	31.9	—	—	756	32.0	—	—	838	28.7	—	—	503	36.8	—	—	635	36.6	—	—
CR2	60 Ton Crane	734	30.9	—	—	1295	24.5	—	—	411	37.8	—	—	1176	25.2	—	—	264	46.7	—	—	983	27.4	—	—
CR3	30 Ton Crane	542	31.0	—	—	1101	23.0	—	—	605	26.9	—	—	1016	19.4	—	—	327	37.8	—	—	805	26.8	—	—
DR1	Drill Rig	570	24.9	—	—	1148	16.0	—	—	564	26.3	—	—	1088	15.8	—	—	250	40.4	—	—	869	19.7	—	—
DR2	Drill Rig	616	24.1	—	—	1191	15.6	—	—	518	26.3	—	—	1117	16.5	—	—	234	41.0	—	—	905	19.3	—	—
DR3	Drill Rig	652	23.5	—	—	1225	15.4	—	—	484	26.2	—	—	1140	16.2	—	—	227	41.3	—	—	933	18.9	—	—
DR4	Drill Rig	687	23.0	—	—	1257	15.1	—	—	450	26.0	—	—	1162	15.9	—	—	228	41.3	—	—	959	18.5	—	—
DR5	Drill Rig	721	22.4	—	—	1289	14.8	—	—	417	25.5	—	—	1183	15.7	—	—	235	40.9	—	—	985	18.2	—	—
DT1	Dump Truck	542	23.9	—	—	1064	15.1	—	—	651	18.1	—	—	934	11.8	—	—	425	27.5	—	—	739	19.3	—	—
DT2	Dump Truck	406	27.0	—	—	922	16.8	—	—	787	15.8	—	—	831	13.0	—	—	503	20.5	—	—	614	21.2	—	—
DT3	Dump Truck	463	25.3	—	—	996	15.9	—	—	712	17.0	—	—	900	12.2	—	—	437	22.4	—	—	688	20.0	—	—
Ex1	Excavator	570	37.9	—	—	1073	29.1	—	—	656	31.9	—	—	917	26.6	—	—	461	35.6	—	—	732	33.7	—	—
Gen1	Generator	431	38.3	—	—	877	27.5	—	—	856	26.4	—	—	730	26.2	—	—	610	30.3	—	—	532	33.2	—	—
GraderMovement	Construction Grader	604	47.9	—	—	1137	38.1	—	—	584	45.7	—	—	1027	35.0	—	—	355	51.6	—	—	825	42.7	—	—
TR1	Construction Truck Route	597	29.0	—	—	1152	22.1	—	—	251	38.2	—	—	1048	20.6	—	—	293	40.0	—	—	845	26.4	—	—
VC1	Vibratory Compactor	371	38.5	—	—	906	27.3	—	—	800	26.0	—	—	843	23.3	—	—	491	30.9	—	—	616	31.9	—	—
VR1	Vibratory Roller	398	35.0	—	—	900	25.4	—	—	813	23.7	—	—	800	22.3	—	—	534	27.8	—	—	585	29.8	—	—
WWS	Wheel Wash Station	580	30.8	—	—	1134	22.2	—	—	572	27.9	—	—	1033	18.6	—	—	323	39.1	—	—	829	26.2	—	—
Total Facility Sound Level (1-hour Leq):			**50.5**	**—**	**—**		**40.8**	**—**	**—**		**47.8**	**—**	**—**		**38.0**	**—**	**—**		**54.8**	**—**	**—**		**45.3**	**—**	**—**
Phase 2 Noise Impact																									
CD1	Core Drill (Drilling Concrete)	477	43.0	—	—	987	31.9	—	—	728	33.4	—	—	866	28.8	—	—	478	39.2	—	—	663	37.2	—	—
CD2	Core Drill (Drilling Concrete)	573	34.9	—	—	1141	25.3	—	—	566	36.5	—	—	1062	26.1	—	—	283	50.5	—	—	850	29.4	—	—
CD3	Core Drill (Drilling Concrete)	466	43.6	—	—	923	32.4	—	—	814	31.9	—	—	765	30.3	—	—	582	36.5	—	—	574	38.9	—	—
CD4	Core Drill (Drilling Concrete)	561	35.1	—	—	1126	30.1	—	—	581	36.4	—	—	1044	26.4	—	—	300	49.8	—	—	833	34.5	—	—
CD5	Core Drill (Drilling Concrete)	636	33.6	—	—	1201	24.7	—	—	505	37.2	—	—	1106	25.6	—	—	263	51.3	—	—	902	33.4	—	—
CR1	150 Ton Crane	459	41.9	—	—	961	31.9	—	—	756	32.0	—	—	838	28.7	—	—	503	36.8	—	—	635	36.6	—	—
CR2	60 Ton Crane	734	30.9	—	—	1295	24.5	—	—	411	37.8	—	—	1176	25.2	—	—	264	46.7	—	—	983	27.4	—	—
CR3	30 Ton Crane	542	31.0	—	—	1101	23.0	—	—	605	26.9	—	—	1016	19.4	—	—	327	37.8	—	—	805	26.8	—	—
CS1	Circular Saw (Cutting Concrete)	448	48.8	—	—	898	37.8	—	—	837	36.5	—	—	744	35.6	—	—	598	41.2	—	—	550	44.3	—	—
CS2	Circular Saw (Cutting Concrete)	521	47.0	—	—	1008	36.3	—	—	723	38.6	—	—	853	33.9	—	—	508	43.3	—	—	665	42.1	—	—
CS3	Circular Saw (Cutting Concrete)	533	46.1	—	—	1064	35.9	—	—	647	40.2	—	—	946	32.6	—	—	407	46.0	—	—	745	40.7	—	—
CS4	Circular Saw (Cutting Concrete)	586	39.5	—	—	1147	34.8	—	—	559	41.7	—	—	1054	31.1	—	—	300	54.3	—	—	847	39.1	—	—
CS5	Circular Saw (Cutting Concrete)	753	36.5	—	—	1314	28.2	—	—	392	45.6	—	—	1193	28.9	—	—	263	55.7	—	—	1002	32.0	—	—
CT1	Concrete Mixer Truck	435	43.6	—	—	900	32.4	—	—	827	31.4	—	—	761	29.9	—	—	578	36.3	—	—	561	38.5	—	—
CT2	Concrete Mixer Truck	503	41.8	—	—	1005	31.3	—	—	716	33.4	—	—	868	28.3	—	—	484	38.5	—	—	673	36.6	—	—
CT3	Concrete Mixer Truck	519	40.4	—	—	1069	30.4	—	—	637	35.0	—	—	976	26.7	—	—	366	41.7	—	—	766	35.0	—	—
CT4	Concrete Mixer Truck	581	34.2	—	—	1144	29.4	—	—	562	36.3	—	—	1057	25.6	—	—	292	48.8	—	—	848	33.7	—	—
CT5	Concrete Mixer Truck	826	29.9	—	—	1372	21.9	—	—	347	47.1	—	—	1217	23.4	—	—	336	47.4	—	—	1041	26.0	—	—
CT6	Concrete Mixer Truck	471	42.2	—	—	1002	31.3	—	—	707	33.6	—	—	902	27.8	—	—	436	39.7	—	—	692	36.2	—	—
CT7	Concrete Mixer Truck	570	39.2	—	—	1127	29.7	—	—	579	36.3	—	—	1032	25.9	—	—	318	47.9	—	—	825	34.1	—	—
CT8	Concrete Mixer Truck	621	38.9	—	—	1106	29.2	—	—	644	38.2	—	—	919	27.0	—	—	493	37.8	—	—	750	34.9	—	—
DR1	Drill Rig	570	24.9	—	—	1148	16.0	—	—	564	26.3	—	—	1088	15.8	—	—	250	40.4	—	—	869	19.7	—	—
DR2	Drill Rig	617	24.1	—	—	1192	15.6	—	—	518	26.3	—	—	1118	16.5	—	—	232	41.1	—	—	906	19.3	—	—
DR3	Drill Rig	652	23.5	—	—	1225	15.4	—	—	484	26.2	—	—	1140	16.2	—	—	227	41.3	—	—	933	18.9	—	—
DR4	Drill Rig	687	23.0	—	—	1257	15.1	—	—	450	26.0	—	—	1162	15.9	—	—	228	41.3	—	—	959	18.5	—	—
DR5	Drill Rig	721	22.4	—	—	1289	14.8	—	—	417	25.5	—	—	1183	15.7	—	—	235	40.9	—	—	985	18.2	—	—
DT1	Dump Truck	542	23.9	—	—	1064	15.1	—	—	651	18.1	—	—	934	11.8	—	—	425	27.5	—	—	739	19.3	—	—
DT2	Dump Truck	406	27.0	—	—	922	16.8	—	—	787	15.8	—	—	831	13.0	—	—	503	20.5	—	—	614	21.2	—	—
DT3	Dump Truck	463	25.3	—	—	996	15.9	—	—	712	17.0	—	—	900	12.2	—	—	437	22.4	—	—	688	20.0	—	—
Ex1	Excavator	628	36.1	—	—	1172	28.3	—	—	537	34.5	—	—	1049	25.2	—	—	335	43.5	—	—	855	32.2	—	—
GC1	Gas Cutter	427	29.0	—	—	887	18.8	—	—	842	17.6	—	—	748	17.1	—	—	591	21.4	—	—	547	24.3	—	—
GC2	Gas Cutter	530	26.8	—	—	1027	17.5	—	—	701	19.6	—	—	876	15.6	—	—	487	23.4	—	—	687	22.4	—	—
GC3	Gas Cutter	568	25.5	—	—	1103	17.1	—	—	608	21.1	—	—	982	14.5	—	—	381	30.7	—	—	784	21.2	—	—
GC4	Gas Cutter	520	25.4	—	—	1076	17.4	—	—	630	20.9	—	—	992	14.4	—	—	348	26.7	—	—	779	21.4	—	—
GC5	Gas Cutter	605	24.7	—	—	1145	16.7	—	—	565	21.9	—	—	1021	14.1	—	—	354	31.4	—	—	826	20.7	—	—
Gen1	Generator	431	38.3	—	—	877	27.5	—	—	856	26.4	—	—	730	26.2	—	—	610	30.3	—	—	532	33.2	—	—

Table C.2A

Point of Reception Noise Impact – Construction
Dart
IWSMS, George Town, Cayman Islands

Cadna A ID	Source Description	Lakeside Residential Development NSR1				Parkside Close Residential Dwelling NSR2				Seymour Road Residential Dwelling NSR3				The Cayman International School (CIS) NSR4				WoodsideDrive/Glenwood Residential NSR5				Camana Bay Hospital NSR6			
		Distance (m)	Partial Sound Levels[1] (dBA)			Distance (m)	Partial Sound Levels[1] (dBA)			Distance (m)	Partial Sound Levels[1] (dBA)			Distance (m)	Partial Sound Levels[1] (dBA)			Distance (m)	Partial Sound Levels[1] (dBA)			Distance (m)	Partial Sound Levels[1] (dBA)		
			Day 7am–7pm	Evening 7pm–11pm	Night 11pm–7am		Day 7am–7pm	Evening 7pm–11pm	Night 11pm–7am		Day 7am–7pm	Evening 7pm–11pm	Night 11pm–7am		Day 7am–7pm	Evening 7pm–11pm	Night 11pm–7am		Day 7am–7pm	Evening 7pm–11pm	Night 11pm–7am		Day 7am–7pm	Evening 7pm–11pm	Night 11pm–7am
Gen2	Generator	532	36.3	—	—	1024	27.0	—	—	705	28.7	—	—	870	24.6	—	—	494	32.5	—	—	683	32.0	—	—
MEx1	Mini Excavator	419	31.7	—	—	871	21.0	—	—	858	19.7	—	—	732	19.0	—	—	605	23.6	—	—	531	26.4	—	—
MEx2	Mini Excavator	556	28.8	—	—	1065	20.4	—	—	659	22.7	—	—	918	17.3	—	—	451	26.7	—	—	729	24.5	—	—
MEx3	Mini Excavator	548	28.3	—	—	1087	20.2	—	—	621	23.3	—	—	975	16.7	—	—	378	33.2	—	—	774	23.9	—	—
MEx4	Mini Excavator	603	22.2	—	—	1165	19.4	—	—	541	24.7	—	—	1071	15.7	—	—	287	35.9	—	—	865	22.8	—	—
PV1	Poker Vibrator	509	40.1	—	—	1017	30.4	—	—	702	32.0	—	—	883	27.9	—	—	469	36.7	—	—	687	35.2	—	—
PV2	Poker Vibrator	465	40.9	—	—	982	30.9	—	—	730	31.6	—	—	871	28.0	—	—	469	36.6	—	—	664	35.5	—	—
PV3	Poker Vibrator	613	37.9	—	—	1132	29.3	—	—	591	38.8	—	—	982	26.7	—	—	411	42.9	—	—	797	33.7	—	—
PV4	Poker Vibrator	519	38.0	—	—	1086	29.6	—	—	622	33.5	—	—	1017	26.3	—	—	319	45.5	—	—	799	33.9	—	—
PV5	Poker Vibrator	557	33.3	—	—	1130	25.1	—	—	579	34.1	—	—	1063	25.7	—	—	276	47.0	—	—	846	28.6	—	—
Piling1	Piling - Precast Concrete	548	47.3	—	—	1051	38.9	—	—	675	40.5	—	—	901	35.6	—	—	466	49.0	—	—	713	43.0	—	—
Piling2	Piling - Precast Concrete	507	46.2	—	—	1065	38.8	—	—	641	41.1	—	—	988	34.6	—	—	349	51.8	—	—	773	42.4	—	—
Piling3	Piling - Precast Concrete	561	46.5	—	—	1094	38.6	—	—	618	42.0	—	—	971	34.8	—	—	390	50.8	—	—	774	42.2	—	—
Piling4	Piling - Precast Concrete	631	45.1	—	—	1171	37.9	—	—	541	43.9	—	—	1041	34.2	—	—	348	51.8	—	—	849	41.3	—	—
SCM1	Small Cement Mixer	497	23.9	—	—	997	14.4	—	—	725	15.4	—	—	859	11.6	—	—	491	19.9	—	—	664	19.0	—	—
SCM2	Small Cement Mixer	513	22.8	—	—	1055	13.8	—	—	652	16.7	—	—	955	10.4	—	—	388	22.3	—	—	748	17.9	—	—
SCM3	Small Cement Mixer	597	21.4	—	—	1127	13.0	—	—	588	17.8	—	—	992	9.9	—	—	386	27.2	—	—	801	17.1	—	—
TP1	Truck-mounted Pump	435	40.0	—	—	900	29.6	—	—	827	28.2	—	—	761	27.0	—	—	578	32.6	—	—	561	35.1	—	—
TP2	Truck-mounted Pump	503	38.3	—	—	1005	28.7	—	—	716	30.0	—	—	868	25.6	—	—	484	34.6	—	—	673	33.4	—	—
TP3	Truck-mounted Pump	519	36.9	—	—	1069	28.0	—	—	637	31.4	—	—	976	24.2	—	—	366	37.6	—	—	766	32.1	—	—
TP4	Truck-mounted Pump	581	30.8	—	—	1144	27.1	—	—	562	32.7	—	—	1057	23.3	—	—	292	44.6	—	—	848	30.9	—	—
TP5	Truck-mounted Pump	826	27.2	—	—	1372	20.1	—	—	347	42.9	—	—	1217	21.4	—	—	336	43.2	—	—	1041	23.7	—	—
TP6	Truck-mounted Pump	471	38.6	—	—	1002	28.8	—	—	707	30.2	—	—	902	25.1	—	—	436	35.7	—	—	692	33.1	—	—
TP7	Truck-mounted Pump	570	35.8	—	—	1127	27.4	—	—	579	32.6	—	—	1032	23.5	—	—	318	43.8	—	—	825	31.2	—	—
TP8	Truck-mounted Pump	621	35.4	—	—	1106	26.7	—	—	644	34.2	—	—	919	24.4	—	—	493	33.8	—	—	750	31.7	—	—
TR1	Construction Truck Route	597	29.0	—	—	1152	22.1	—	—	251	38.2	—	—	1048	20.6	—	—	293	40.0	—	—	845	26.4	—	—
W1	Welder	433	35.8	—	—	873	24.9	—	—	864	23.8	—	—	720	23.3	—	—	620	27.9	—	—	524	30.9	—	—
W2	Welder	568	33.0	—	—	1070	24.0	—	—	659	27.1	—	—	913	21.2	—	—	464	31.1	—	—	729	28.7	—	—
W3	Welder	570	32.6	—	—	1097	23.8	—	—	618	27.9	—	—	965	20.5	—	—	403	37.5	—	—	772	28.0	—	—
W4	Welder	510	32.5	—	—	1064	24.2	—	—	641	27.5	—	—	980	20.3	—	—	359	33.6	—	—	767	28.2	—	—
W5	Welder	494	33.9	—	—	1035	24.5	—	—	672	27.0	—	—	940	20.8	—	—	400	32.6	—	—	730	28.7	—	—
WP	Water Pump	669	19.0	—	—	1227	16.4	—	—	479	24.1	—	—	1116	11.4	—	—	278	34.4	—	—	919	15.1	—	—
WWS	Wheel Wash Station	580	30.8	—	—	1134	22.2	—	—	572	27.9	—	—	1033	18.6	—	—	323	39.1	—	—	829	26.2	—	—
Total Facility Sound Level (1-hour Leq):			**57.9**	**—**	**—**		**48.8**	**—**	**—**		**54.8**	**—**	**—**		**45.8**	**—**	**—**		**63.4**	**—**	**—**		**53.5**	**—**	**—**
Phase 3 Noise Impact																									
AG1	Angle Grinder	416	43.2	—	—	875	31.0	—	—	852	29.7	—	—	741	28.8	—	—	596	34.9	—	—	537	37.8	—	—
AG2	Angle Grinder	557	38.8	—	—	1098	28.3	—	—	610	34.6	—	—	986	25.0	—	—	370	45.6	—	—	785	33.3	—	—
AG3	Angle Grinder	658	36.8	—	—	1187	27.1	—	—	533	41.2	—	—	1038	24.2	—	—	375	45.5	—	—	855	32.2	—	—
AG4	Angle Grinder	807	33.6	—	—	1361	19.9	—	—	350	46.3	—	—	1220	21.6	—	—	302	49.8	—	—	1038	24.4	—	—
AP1	Asphalt Paver	833	35.5	—	—	1390	28.5	—	—	320	47.9	—	—	1251	29.6	—	—	297	52.6	—	—	1069	31.7	—	—
BD1	Dozer	544	36.6	—	—	1054	27.9	—	—	667	29.9	—	—	912	24.9	—	—	452	34.0	—	—	721	32.2	—	—
BH1	Backhoe	548	28.3	—	—	1051	19.5	—	—	675	21.7	—	—	901	16.4	—	—	466	25.8	—	—	713	23.9	—	—
CD1	Core Drill (Drilling Concrete)	477	43.0	—	—	987	31.9	—	—	728	33.4	—	—	866	28.8	—	—	478	39.2	—	—	663	37.2	—	—
CR1	150 Ton Crane	459	41.9	—	—	961	31.9	—	—	756	32.0	—	—	838	28.7	—	—	503	36.8	—	—	635	36.6	—	—
CR2	60 Ton Crane	734	30.9	—	—	1295	24.5	—	—	411	37.8	—	—	1176	25.2	—	—	264	46.7	—	—	983	27.4	—	—
CR3	30 Ton Crane	542	31.0	—	—	1101	23.0	—	—	605	26.9	—	—	1016	19.4	—	—	327	37.8	—	—	805	26.8	—	—
CS1	Circular Saw (Cutting Concrete)	448	52.8	—	—	898	41.8	—	—	837	40.5	—	—	744	39.5	—	—	598	45.1	—	—	550	48.2	—	—
CS2	Circular Saw (Cutting Concrete)	521	50.9	—	—	1008	40.3	—	—	723	42.6	—	—	853	37.9	—	—	508	47.3	—	—	665	46.1	—	—
DT1	Dump Truck	542	23.9	—	—	1064	15.1	—	—	651	18.1	—	—	934	11.8	—	—	425	27.5	—	—	739	19.3	—	—
DT2	Dump Truck	406	27.0	—	—	922	16.8	—	—	787	15.8	—	—	831	13.0	—	—	503	20.5	—	—	614	21.2	—	—
DT3	Dump Truck	463	25.3	—	—	996	15.9	—	—	712	17.0	—	—	900	12.2	—	—	437	22.4	—	—	688	20.0	—	—
DT4	Dump Truck	518	23.0	—	—	1073	15.1	—	—	633	18.4	—	—	987	11.2	—	—	354	24.6	—	—	775	18.9	—	—
Ex1	Excavator	570	37.9	—	—	1073	29.1	—	—	656	31.9	—	—	917	26.6	—	—	461	35.6	—	—	732	33.7	—	—
FTL1	Fuel Tanker Lorry	768	29.5	—	—	1323	22.7	—	—	386	38.1	—	—	1189	23.7	—	—	291	45.3	—	—	1003	25.9	—	—
FTL2	Fuel Tanker Lorry	580	36.9	—	—	1132	29.2	—	—	574	33.7	—	—	1029	25.3	—	—	329	44.1	—	—	825	32.7	—	—
Gen1	Generator	431	38.3	—	—	877	27.5	—	—	856	26.4	—	—	730	26.2	—	—	610	30.3	—	—	532	33.2	—	—
Gen2	Generator	532	36.3	—	—	1024	27.0	—	—	705	28.7	—	—	870	24.6	—	—	494	32.5	—	—	683	32.0	—	—
Gen3	Generator	512	35.7	—	—	1059	27.0	—	—	648	29.6	—	—	965	23.5	—	—	377	35.1	—	—	755	31.1	—	—
Gen4	Generator	613	33.8	—	—	1169	25.9	—	—	538	31.6	—	—	1063	22.5	—	—	304	42.1	—	—	862	29.7	—	—

Table C.2A

Point of Reception Noise Impact – Construction
Dart
IWSMS, George Town, Cayman Islands

Cadna A ID	Source Description	Lakeside Residential Development NSR1				Parkside Close Residential Dwelling NSR2				Seymour Road Residential Dwelling NSR3				The Cayman International School (CIS) NSR4				WoodsideDrive/Glenwood Residential NSR5				Camana Bay Hospital NSR6			
		Distance (m)	Partial Sound Levels[1] (dBA)			Distance (m)	Partial Sound Levels[1] (dBA)			Distance (m)	Partial Sound Levels[1] (dBA)			Distance (m)	Partial Sound Levels[1] (dBA)			Distance (m)	Partial Sound Levels[1] (dBA)			Distance (m)	Partial Sound Levels[1] (dBA)		
			Day 7am–7pm	Evening 7pm–11pm	Night 11pm–7am		Day 7am–7pm	Evening 7pm–11pm	Night 11pm–7am		Day 7am–7pm	Evening 7pm–11pm	Night 11pm–7am		Day 7am–7pm	Evening 7pm–11pm	Night 11pm–7am		Day 7am–7pm	Evening 7pm–11pm	Night 11pm–7am		Day 7am–7pm	Evening 7pm–11pm	Night 11pm–7am
Gen5	Generator	764	26.9	—	—	1322	20.1	—	—	386	34.7	—	—	1193	20.9	—	—	279	42.9	—	—	1005	23.4	—	—
L1	Loader	437	42.5	—	—	885	32.7	—	—	849	31.0	—	—	735	30.6	—	—	605	34.7	—	—	539	38.0	—	—
L2	Loader	509	40.9	—	—	1015	32.1	—	—	705	33.1	—	—	880	29.0	—	—	473	37.3	—	—	684	36.3	—	—
L3	Loader	556	39.1	—	—	1105	31.3	—	—	601	34.8	—	—	1004	27.6	—	—	348	45.2	—	—	799	34.9	—	—
L4	Loader	774	31.3	—	—	1333	24.7	—	—	374	39.2	—	—	1205	25.5	—	—	275	47.4	—	—	1017	27.7	—	—
LP1	Scissor Lift	535	29.4	—	—	1050	20.8	—	—	668	23.0	—	—	915	17.9	—	—	444	32.0	—	—	721	24.9	—	—
MEx1	Mini Excavator	419	31.7	—	—	871	21.0	—	—	858	19.7	—	—	732	19.0	—	—	605	23.6	—	—	531	26.4	—	—
MEx2	Mini Excavator	556	28.8	—	—	1065	20.4	—	—	659	22.7	—	—	918	17.3	—	—	451	26.7	—	—	729	24.5	—	—
MRP1	Mini Road Planer	545	28.2	—	—	1109	20.0	—	—	598	23.8	—	—	1030	16.5	—	—	311	35.1	—	—	817	23.8	—	—
MRP2	Mini Road Planer	684	26.2	—	—	1230	19.0	—	—	480	27.2	—	—	1099	15.8	—	—	318	34.9	—	—	909	22.7	—	—
PT1	Pneumatic Tool	483	43.2	—	—	947	32.1	—	—	790	32.3	—	—	787	30.0	—	—	564	37.0	—	—	598	38.4	—	—
PT2	Pneumatic Tool	491	42.5	—	—	1016	31.6	—	—	695	34.1	—	—	904	28.2	—	—	439	40.2	—	—	699	36.5	—	—
PT3	Pneumatic Tool	530	41.7	—	—	1038	31.3	—	—	683	34.4	—	—	898	28.3	—	—	461	39.6	—	—	705	36.4	—	—
PT4	Pneumatic Tool	603	39.1	—	—	1151	29.9	—	—	556	37.2	—	—	1038	26.5	—	—	331	48.6	—	—	839	34.2	—	—
PT5	Pneumatic Tool	627	33.8	—	—	1192	24.8	—	—	514	37.1	—	—	1099	25.7	—	—	266	51.2	—	—	894	33.5	—	—
PaverRoute1	Paver	558	44.0	—	—	1125	36.2	—	—	395	47.4	—	—	1033	34.2	34.2	34.2	228	56.1	56.1	56.1	827	39.6	39.6	39.6
PaverRoute2	Paver	607	47.0	—	—	1121	38.7	—	—	570	47.2	—	—	958	35.6	35.6	35.6	367	51.8	51.8	51.8	779	42.9	42.9	42.9
PaverRoute3	Paver	468	48.7	—	—	997	39.8	—	—	621	42.1	—	—	878	36.1	36.1	36.1	349	47.7	47.7	47.7	676	43.9	43.9	43.9
RP1	Road Planer	454	44.6	—	—	997	34.9	—	—	709	36.3	—	—	915	31.3	—	—	419	41.8	—	—	699	39.2	—	—
RP2	Road Planer	367	47.5	—	—	864	36.5	—	—	847	34.2	—	—	774	33.1	—	—	559	38.3	—	—	554	41.5	—	—
RP3	Road Planer	711	34.9	—	—	1278	27.7	—	—	428	38.6	—	—	1174	28.5	—	—	237	52.5	—	—	975	30.9	—	—
RR1	Road Roller	672	34.2	—	—	1227	26.5	—	—	480	34.8	—	—	1110	23.2	—	—	290	44.7	—	—	914	30.2	—	—
RR2	Road Roller	431	39.6	—	—	956	29.4	—	—	752	29.6	—	—	864	25.9	—	—	471	34.8	—	—	649	33.9	—	—
SCM1	Small Cement Mixer	497	23.9	—	—	997	14.4	—	—	725	15.4	—	—	859	11.6	—	—	491	19.9	—	—	664	19.0	—	—
SCM2	Small Cement Mixer	513	22.8	—	—	1055	13.8	—	—	652	16.7	—	—	955	10.4	—	—	388	22.3	—	—	748	17.9	—	—
SCM3	Small Cement Mixer	597	21.4	—	—	1127	13.0	—	—	588	17.8	—	—	992	9.9	—	—	386	27.2	—	—	801	17.1	—	—
TH	Telescopic Handler	733	32.1	—	—	1277	24.6	—	—	438	44.1	—	—	1133	26.0	—	—	325	47.0	—	—	951	28.4	—	—
TR1	ConstructionTruckRoute	597	29.0	—	—	1152	22.1	—	—	251	38.2	—	—	1048	20.6	—	—	293	40.0	—	—	845	26.4	—	—
VR1	Vibratory Roller	548	30.5	—	—	1124	23.1	—	—	587	27.2	—	—	1064	19.6	—	—	272	39.6	—	—	844	26.5	—	—
VR2	Vibratory Roller	381	35.4	—	—	889	25.7	—	—	821	23.7	—	—	801	22.3	—	—	532	27.8	—	—	581	30.0	—	—
W1	Welder	433	35.8	—	—	873	24.9	—	—	864	23.8	—	—	720	23.3	—	—	620	27.9	—	—	524	30.9	—	—
W2	Welder	568	33.0	—	—	1070	24.0	—	—	659	27.1	—	—	913	21.2	—	—	464	31.1	—	—	729	28.7	—	—
W3	Welder	570	32.6	—	—	1097	23.8	—	—	618	27.9	—	—	965	20.5	—	—	403	37.5	—	—	772	28.0	—	—
W4	Welder	510	32.5	—	—	1064	24.2	—	—	641	27.5	—	—	980	20.3	—	—	359	33.6	—	—	767	28.2	—	—
W5	Welder	494	33.9	—	—	1035	24.5	—	—	672	27.0	—	—	940	20.8	—	—	400	32.6	—	—	730	28.7	—	—
WP	Water Pump	501	27.8	—	—	1003	18.6	—	—	718	19.6	—	—	866	15.7	—	—	486	23.9	—	—	670	23.1	—	—
WWS	Wheel Wash Station	580	30.8	—	—	1134	22.2	—	—	572	27.9	—	—	1033	18.6	—	—	323	39.1	—	—	829	26.2	—	—
Total Facility Sound Level (1-hour Leq):			**59.1**	**—**	**—**		**49.1**	**—**	**—**		**55.9**	**—**	**—**		**46.5**	**—**	**—**		**62.7**	**—**	**—**		**54.2**	**—**	**—**

Note:

[1] Sound level at the receptor was calculated using Cadna A acoustical modelling software.

Table C.2B

Point of Reception Noise Impact – Operations
Dart
IWSMS, George Town, Cayman Islands

Cadna A ID	Source Description	Lakeside Residential Development NSR1				Parkside Close Residential Dwelling NSR2				Seymour Road Residential Dwelling NSR3				The Cayman International School (CIS) NSR4				WoodsideDrive/Glenwood Residential NSR5				Camana Bay Hospital NSR6			
		Distance (m)	Partial Sound Levels[1] (dBA) Day 7am–7pm	Evening 7pm–11pm	Night 11pm–7am	Distance (m)	Partial Sound Levels[1] (dBA) Day 7am–7pm	Evening 7pm–11pm	Night 11pm–7am	Distance (m)	Partial Sound Levels[1] (dBA) Day 7am–7pm	Evening 7pm–11pm	Night 11pm–7am	Distance (m)	Partial Sound Levels[1] (dBA) Day 7am–7pm	Evening 7pm–11pm	Night 11pm–7am	Distance (m)	Partial Sound Levels[1] (dBA) Day 7am–7pm	Evening 7pm–11pm	Night 11pm–7am	Distance (m)	Partial Sound Levels[1] (dBA) Day 7am–7pm	Evening 7pm–11pm	Night 11pm–7am
Operations Noise Impact																									
ADMIN_HVAC1	Admin - Office HVAC	598	18.1	18.1	18.1	1162	5.8	5.8	5.8	544	17.0	17.0	17.0	1072	6.4	6.4	6.4	284	27.3	27.3	27.3	864	9.3	9.3	9.3
ADMIN_HVAC2	Admin - Office HVAC	602	18.1	18.1	18.1	1163	5.9	5.9	5.9	543	18.8	18.8	18.8	1067	—	—	—	292	26.3	26.3	26.3	862	9.3	9.3	9.3
BAP_AIL1	BAP Sidewall Air Intake Louvre	544	22.3	22.3	22.3	1062	—	—	—	656	—	—	—	927	3.1	3.1	3.1	434	5.3	5.3	5.3	733	9.4	9.4	9.4
BAP_AIL2	BAP Sidewall Air Intake Louvre	547	5.7	5.7	5.7	1063	—	—	—	656	—	—	—	926	3.0	3.0	3.0	437	4.9	4.9	4.9	733	9.0	9.0	9.0
BAP_AIL3	BAP Sidewall Air Intake Louvre	558	22.5	22.5	22.5	1068	—	—	—	655	3.7	3.7	3.7	921	3.1	3.1	3.1	449	3.6	3.6	3.6	733	7.3	7.3	7.3
BAP_AIL4	BAP Sidewall Air Intake Louvre	562	20.4	20.4	20.4	1069	—	—	—	655	4.2	4.2	4.2	920	9.6	9.6	9.6	453	3.3	3.3	3.3	733	6.9	6.9	6.9
BAP_BayDoor1	BAP Open Bay Door	557	17.7	17.7	17.7	1059	4.1	4.1	4.1	668	17.4	17.4	17.4	905	19.6	19.6	19.6	468	16.9	16.9	16.9	719	27.8	27.8	27.8
BAP_BayDoor2	BAP Open Bay Door	531	38.8	—	—	1048	24.0	—	—	668	12.1	—	—	918	9.1	—	—	440	23.8	—	—	720	17.1	—	—
C&D_Crusher	Rubble Master (Mobile Crusher)	514	45.3	—	—	1049	31.8	—	—	660	20.1	—	—	941	31.3	—	—	405	42.9	—	—	736	35.5	—	—
CDF_BayDoor1	CDF Open Bay Door	540	23.1	—	—	1037	5.4	—	—	692	16.8	—	—	883	16.6	—	—	484	16.5	—	—	696	24.8	—	—
CDF_BayDoor2	CDF Open Bay Door	512	39.1	—	—	1024	23.8	—	—	694	11.9	—	—	894	10.1	—	—	458	36.3	—	—	696	17.1	—	—
CD_BAF_TR1	C&D and BAF - Inbound/Outbound Truck Route	517	36.3	—	—	1048	22.4	—	—	382	36.1	—	—	890	21.5	—	—	293	39.0	—	—	707	25.5	—	—
ELV_BayDoor3	ELV Open Bay Door	630	—	—	—	1194	—	—	—	512	22.3	—	—	1098	—	—	—	270	36.3	—	—	894	—	—	—
ELV_BayDoor4	ELV Open Bay Door	631	—	—	—	1197	—	—	—	509	22.3	—	—	1104	—	—	—	262	36.7	—	—	899	—	—	—
ELV_HVAC1	ELV - Office HVAC	624	17.8	17.8	17.8	1187	5.7	5.7	5.7	519	18.0	18.0	18.0	1092	—	—	—	274	27.0	27.0	27.0	887	9.0	9.0	9.0
ELV_HVAC2	ELV - Office HVAC	625	17.7	17.7	17.7	1192	5.5	5.5	5.5	515	17.1	17.1	17.1	1100	—	—	—	263	27.4	27.4	27.4	894	9.0	9.0	9.0
ELV_TR1	ELV - Inbound/Outbound Truck Route	630	24.2	—	—	1186	13.3	—	—	386	31.6	—	—	1077	13.0	—	—	246	37.5	—	—	877	14.4	—	—
ERF_AIL1	ERF Sidewall Air Intake Louvre	549	23.1	23.1	23.1	1096	10.2	10.2	10.2	612	15.0	15.0	15.0	991	—	—	—	361	27.9	27.9	27.9	787	8.9	8.9	8.9
ERF_AIL10	ERF Sidewall Air Intake Louvre	575	6.8	6.8	6.8	1103	—	—	—	611	22.3	22.3	22.3	975	—	—	—	396	26.9	26.9	26.9	780	2.3	2.3	2.3
ERF_AIL11	ERF Sidewall Air Intake Louvre	567	17.0	17.0	17.0	1099	7.9	7.9	7.9	613	22.2	22.2	22.2	978	7.5	7.5	7.5	387	26.8	26.8	26.8	781	—	—	—
ERF_AIL12	ERF Sidewall Air Intake Louvre	557	8.4	8.4	8.4	1096	—	—	—	614	21.6	21.6	21.6	983	—	—	—	373	27.6	27.6	27.6	782	0.8	0.8	0.8
ERF_AIL13	ERF Sidewall Air Intake Louvre	563	23.0	23.0	23.0	1093	14.5	14.5	14.5	622	16.3	16.3	16.3	966	4.2	4.2	4.2	404	26.0	26.0	26.0	770	13.3	13.3	13.3
ERF_AIL14	ERF Sidewall Air Intake Louvre	548	23.1	23.1	23.1	1085	14.6	14.6	14.6	621	15.5	15.5	15.5	973	4.4	4.4	4.4	387	27.0	27.0	27.0	774	12.7	12.7	12.7
ERF_AIL2	ERF Sidewall Air Intake Louvre	544	23.2	23.2	23.2	1088	14.7	14.7	14.7	620	15.9	15.9	15.9	983	4.2	4.2	4.2	368	27.7	27.7	27.7	779	12.6	12.6	12.6
ERF_AIL3	ERF Sidewall Air Intake Louvre	544	23.3	23.3	23.3	1081	10.1	10.1	10.1	629	3.3	3.3	3.3	968	11.3	11.3	11.3	386	11.8	11.8	11.8	766	13.8	13.8	13.8
ERF_AIL4	ERF Sidewall Air Intake Louvre	553	23.2	23.2	23.2	1084	14.7	14.7	14.7	628	2.5	2.5	2.5	963	13.4	13.4	13.4	394	10.5	10.5	10.5	765	13.8	13.8	13.8
ERF_AIL5	ERF Sidewall Air Intake Louvre	551	24.1	24.1	24.1	1083	11.1	11.1	11.1	628	—	—	—	964	11.3	11.3	11.3	392	6.3	6.3	6.3	765	14.8	14.8	14.8
ERF_AIL7	ERF Sidewall Air Intake Louvre	559	25.7	25.7	25.7	1085	14.6	14.6	14.6	632	4.6	4.6	4.6	953	13.8	13.8	13.8	415	7.2	7.2	7.2	759	21.2	21.2	21.2
ERF_AIL8	ERF Sidewall Air Intake Louvre	556	23.7	23.7	23.7	1083	10.9	10.9	10.9	631	—	—	—	955	11.2	11.2	11.2	408	4.0	4.0	4.0	759	14.7	14.7	14.7
ERF_AIL9	ERF Sidewall Air Intake Louvre	569	7.4	7.4	7.4	1095	—	—	—	629	22.0	22.0	22.0	962	11.2	11.2	11.2	414	9.3	9.3	9.3	769	18.5	18.5	18.5
ERF_TR1	ERF- Inbound/Outbound Truck Route	579	31.7	—	—	1095	19.5	—	—	375	36.9	—	—	938	20.1	—	—	291	39.2	—	—	758	21.9	—	—
FP_Bldg_Ex	Fire Pump Bldg. - Sidewall Exhaust	506	14.4	—	—	1050	—	—	—	657	13.8	—	—	954	7.2	—	—	387	5.9	—	—	745	11.1	—	—
FP_Bldg_ExStack	Fire Pump Bldg. - Fire Pump Exhaust Stack	500	34.6	—	—	1049	24.5	—	—	657	23.1	—	—	960	19.8	—	—	379	33.1	—	—	748	24.0	—	—
FP_Bldg_Intake	Fire Pump Bldg. - Diesel Fire Water Sidewall Air Intake	502	17.7	—	—	1050	2.3	—	—	657	4.4	—	—	960	3.7	—	—	379	24.6	—	—	748	9.9	—	—
GWF_Loader1	Green Waste Facility Front End Load Route1	624	21.1	—	—	1166	—	—	—	527	25.1	—	—	1035	—	—	—	315	33.3	—	—	843	—	—	—
GWF_Loader2	Green Waste Facility Front End Load Route2	643	25.1	—	—	1168	24.0	—	—	486	44.1	—	—	1010	30.4	—	—	356	43.5	—	—	830	31.3	—	—
GWF_Screener	Green Waste Facility - Screener	619	32.9	—	—	1159	18.9	—	—	553	40.6	—	—	1031	15.6	—	—	352	46.6	—	—	838	20.0	—	—
GWF_Shredder2	Green Waste Facility - Komptech Shredder	629	36.5	—	—	1171	16.7	—	—	540	40.4	—	—	1044	13.7	—	—	342	45.8	—	—	851	17.0	—	—
GWF_TR1	Green Waste Facility - Inbound/Outbound Truck Route	629	22.8	—	—	1184	9.4	—	—	382	28.6	—	—	1054	10.4	—	—	291	33.1	—	—	870	10.9	—	—
GWF_Tubgrinder	Green Waste Facility - Mobark 950 Tub Grinder	631	21.4	—	—	1160	14.3	—	—	558	43.3	—	—	1017	24.4	—	—	380	46.6	—	—	830	26.6	—	—
HW_TR1	Household Recycling Container Movements	808	15.7	—	—	1361	9.2	—	—	307	33.8	—	—	1221	12.3	—	—	304	32.3	—	—	1041	13.0	—	—
HWRC_HVAC1	HWRC - Office HVAC	824	10.6	10.6	10.6	1384	2.7	2.7	2.7	323	25.6	25.6	25.6	1251	—	—	—	283	28.2	28.2	28.2	1067	0.7	0.7	0.7
HWRC_HVAC2	HWRC - Office HVAC	842	10.4	10.4	10.4	1401	3.4	3.4	3.4	308	26.0	26.0	26.0	1263	4.8	4.8	4.8	295	28.4	28.4	28.4	1081	4.0	4.0	4.0
LFG_Flare	Landfill Gas Flare	632	21.7	21.7	21.7	1108	12.6	12.6	12.6	653	20.6	20.6	20.6	910	15.9	15.9	15.9	513	23.4	23.4	23.4	746	12.8	12.8	12.8
MRF_AIL1	MRF Sidewall Air Intake Louvre	785	12.9	12.9	12.9	1347	—	—	—	359	23.9	23.9	23.9	1223	—	—	—	265	31.2	31.2	31.2	1034	—	—	—
MRF_AIL10	MRF Sidewall Air Intake Louvre	778	17.8	17.8	17.8	1330	3.7	3.7	3.7	380	12.6	12.6	12.6	1192	9.7	9.7	9.7	300	9.2	9.2	9.2	1008	11.2	11.2	11.2
MRF_AIL11	MRF Sidewall Air Intake Louvre	785	—	—	—	1338	—	—	—	373	28.3	28.3	28.3	1199	—	—	—	300	10.3	10.3	10.3	1016	—	—	—
MRF_AIL12	MRF Sidewall Air Intake Louvre	790	12.7	12.7	12.7	1351	—	—	—	356	24.0	24.0	24.0	1223	—	—	—	272	17.2	17.2	17.2	1035	—	—	—
MRF_AIL13	MRF Sidewall Air Intake Louvre	789	12.7	12.7	12.7	1349	—	—	—	358	23.9	23.9	23.9	1220	—	—	—	276	14.9	14.9	14.9	1033	—	—	—
MRF_AIL2	MRF Sidewall Air Intake Louvre	777	12.8	12.8	12.8	1339	—	—	—	367	23.7	23.7	23.7	1217	—	—	—	261	31.3	31.3	31.3	1027	—	—	—
MRF_AIL3	MRF Sidewall Air Intake Louvre	770	15.5	15.5	15.5	1331	8.7	8.7	8.7	375	4.6	4.6	4.6	1208	8.7	8.7	8.7	264	31.2	31.2	31.2	1018	4.8	4.8	4.8
MRF_AIL4	MRF Sidewall Air Intake Louvre	769	15.5	15.5	15.5	1329	8.7	8.7	8.7	378	4.3	4.3	4.3	1204	8.7	8.7	8.7	269	31.1	31.1	31.1	1015	4.7	4.7	4.7
MRF_AIL5	MRF Sidewall Air Intake Louvre	768	15.5	15.5	15.5	1326	8.7	8.7	8.7	381	4.4	4.4	4.4	1199	8.7	8.7	8.7	275	30.9	30.9	30.9	1011	4.6	4.6	4.6
MRF_AIL6	MRF Sidewall Air Intake Louvre	767	15.6	15.6	15.6	1324	8.8	8.8	8.8	384	4.5	4.5	4.5	1194	9.6	9.6	9.6	281	30.7	30.7	30.7	1007	4.9	4.9	4.9
MRF_AIL7	MRF Sidewall Air Intake Louvre	766	16.2	16.2	16.2	1321	8.4	8.4	8.4	387	4.8	4.8	4.8	1189	9.7	9.7	9.7	287	30.5	30.5	30.5	1003	2.3	2.3	2.3
MRF_AIL8	MRF Sidewall Air Intake Louvre	765	16.9	16.9	16.9	1319	7.7	7.7	7.7	390	5.5	5.5	5.5	1185	9.7	9.7	9.7	292	30.4	30.4	30.4	999	2.7	2.7	2.7
MRF_AIL9	MRF Sidewall Air Intake Louvre	769	17.5	17.5	17.5	1322	7.7	7.7	7.7	388	9.8	9.8	9.8	1186	9.7	9.7	9.7	296	12.1	12.1	12.1	1001	2.2	2.2	2.2
MRF_BayDoor1	MRF Open BayDoor	787	9.8	9.8	9.8	1344	0.8	0.8	0.8	365	37.4	37.4	37.4	1210	2.0	2.0	2.0	288	25.7	25.7	25.7	1024	4.6	4.6	4.6
MRF_BayDoor2	MRF Open BayDoor	788	9.7	9.7	9.7	1346	0.8	0.8	0.8	362	36.8	36.8	36.8	1215	2.0	2.0	2.0	281	26.8	26.8	26.8	1029	4.5	4.5	4.5
MRF_Forklift1	MRF - Forklift Moving Bails Route1	778	10.2	—	—	1324	0.6	—	—	349	24.7	—	—	1186	3.3	—	—	308	21.3	—	—	1004	4.5	—	—
MRF_GlassRolloff	MRF - Glass falling into Rolloff Bin	783	37.7	—	—	1334	24.2	—	—	377	33.9	—	—	1194	28.2	—	—	305	33.7	—	—	1011	28.1	—	—
MWF_HVAC1	MWF - Office HVAC	455	22.2	22.2	22.2	916	7.8	7.8	7.8	817	11.6	11.6	11.6	765	3.4	3.4	3.4	579	19.7	19.7	19.7	571	10.4	10.4	10.4
MWF_HVAC2	MWF - Office HVAC	461	22.0	22.0	22.0	922	7.7	7.7	7.7	811	11.8	11.8	11.8	770	3.2	3.2	3.2	576	19.7	19.7	19.7	577	10.2	10.2	10.2
MW_TR1	Medical Waste Bldg. - Inbound/Outbound Truck Route	471	31.2	—	—	934	16.7	—	—	384	28.3	—	—	784	14.4	—	—	293	31.7	—	—	594	19.2	—	—
Main_HVAC1	Maintence Bldg. - Office HVAC	583	18.5	18.5	18.5	1152	5.6	5.6	5.6	555	14.9	14.9	14.9	1073	6.5	6.5	6.5	273	27.1	27.1	27.1	862	9.5	9.5	9.5
Main_HVAC2	Maintence Bldg. - Office HVAC	584	20.3	20.3	20.3	1155	5.5	5.5	5.5	553	14.9	14.9	14.9	1080	6.5	6.5	6.5	266	27.3	27.3	27.3	867	9.5	9.5	9.5
Main_TR1	Maintence Bldg. - Inbound/Outbound Truck Route	549	26.6	—	—	1124	14.0	—	—	385	28.7	—	—	1032	13.1	—	—	237	35.6	—	—	827	16.1	—	—
Maintenance_Bay	Maintenance Bldg Open BayDoor	595	18.1	—	—	1167	—	—	—	542	9.3	—	—	1088	—	—	—	260	41.8	—	—	877	3.1	—	—

Table C.2B

Point of Reception Noise Impact – Operations
Dart
IWSMS, George Town, Cayman Islands

Cadna A ID	Source Description	Lakeside Residential Development NSR1				Parkside Close Residential Dwelling NSR2				Seymour Road Residential Dwelling NSR3				The Cayman International School (CIS) NSR4				WoodsideDrive/Glenwood Residential NSR5				Camana Bay Hospital NSR6			
		Distance (m)	Partial Sound Levels[1] (dBA) Day 7am–7pm	Evening 7pm–11pm	Night 11pm–7am	Distance (m)	Partial Sound Levels[1] (dBA) Day 7am–7pm	Evening 7pm–11pm	Night 11pm–7am	Distance (m)	Partial Sound Levels[1] (dBA) Day 7am–7pm	Evening 7pm–11pm	Night 11pm–7am	Distance (m)	Partial Sound Levels[1] (dBA) Day 7am–7pm	Evening 7pm–11pm	Night 11pm–7am	Distance (m)	Partial Sound Levels[1] (dBA) Day 7am–7pm	Evening 7pm–11pm	Night 11pm–7am	Distance (m)	Partial Sound Levels[1] (dBA) Day 7am–7pm	Evening 7pm–11pm	Night 11pm–7am
Maintenance_Bay	Maintenance Bldg Open Bay Door	604	18.8	—	—	1175	—	—	—	533	10.9	—	—	1096	—	—	—	255	42.0	—	—	885	1.7	—	—
Phase2Landfill_Ex	Landfill Excavator	221	52.4	—	—	739	32.0	—	—	967	33.0	—	—	738	30.4	—	—	628	41.7	—	—	484	31.2	—	—
S_BAP_RoofGEx	BAP Building - Rooftop General Exhaust	538	20.6	20.6	20.6	1050	6.3	6.3	6.3	670	—	—	—	912	9.1	9.1	9.1	449	7.5	7.5	7.5	719	12.0	12.0	12.0
S_BAP_RoofGEx	BAP Building - Rooftop General Exhaust	549	20.1	20.1	20.1	1056	6.3	6.3	6.3	668	10.0	10.0	10.0	909	9.0	9.0	9.0	458	3.9	3.9	3.9	720	12.3	12.3	12.3
S_BAP_SW_GEx	BAP Building - Sidewall Exhaust	525	22.1	22.1	22.1	1037	6.7	6.7	6.7	681	—	—	—	903	8.6	8.6	8.6	454	5.6	5.6	5.6	708	13.1	13.1	13.1
S_BAP_SW_GEx	BAP Building - Sidewall Exhaust	527	19.6	19.6	19.6	1038	6.7	6.7	6.7	681	—	—	—	902	6.0	6.0	6.0	455	4.5	4.5	4.5	708	10.6	10.6	10.6
S_BAP_SW_GEx	BAP Building - Sidewall Exhaust	540	19.5	19.5	19.5	1043	6.6	6.6	6.6	681	—	—	—	896	5.7	5.7	5.7	468	1.2	1.2	1.2	707	10.1	10.1	10.1
S_BAP_SW_GEx	BAP Building - Sidewall Exhaust	542	19.5	19.5	19.5	1044	6.6	6.6	6.6	681	—	—	—	895	5.6	5.6	5.6	470	0.9	0.9	0.9	707	9.9	9.9	9.9
S_CDF_RoofGEx	CDF Building - Rooftop General Exhaust	520	22.1	22.1	22.1	1029	6.8	6.8	6.8	691	—	—	—	892	8.4	8.4	8.4	464	14.1	14.1	14.1	698	13.1	13.1	13.1
S_CDF_RoofGEx	CDF Building - Rooftop General Exhaust	529	22.0	22.0	22.0	1032	6.7	6.7	6.7	692	3.8	3.8	3.8	887	8.1	8.1	8.1	473	6.3	6.3	6.3	696	12.7	12.7	12.7
S_CD_BAF_Load	C&D_BAF Front End Loader Material Handling Area	521	38.5	—	—	1030	23.2	—	—	674	10.9	—	—	926	19.3	—	—	432	34.5	—	—	726	27.1	—	—
S_ELV_Crane	Excavator w Grapple Moving Vehicles	677	22.2	—	—	1242	14.7	—	—	464	27.9	—	—	1138	7.3	—	—	254	39.4	—	—	938	9.0	—	—
S_ELV_Hydraulic_	Hydraulic shear/baler	701	29.7	—	—	1258	21.6	—	—	448	33.5	—	—	1139	11.3	—	—	279	40.4	—	—	946	15.0	—	—
S_ELV_Loader	ELV_Front End Loader Material Handling With Broom	697	27.4	—	—	1265	17.9	—	—	462	32.5	—	—	1139	14.4	—	—	276	43.1	—	—	949	14.9	—	—
S_ELV_Torching	Torch Cutting	684	16.3	—	—	1251	7.5	—	—	455	24.4	—	—	1152	—	—	—	240	28.8	—	—	951	8.6	—	—
S_ELV_Truck_Idli	Truck Idling	656	20.6	—	—	1216	12.5	—	—	489	32.5	—	—	1111	3.1	—	—	273	41.1	—	—	911	11.8	—	—
S_ERF_ACC	Air Cooled Condenser unit (ACC)	599	7.5	7.5	7.5	1119	—	—	—	603	33.5	33.5	33.5	972	5.6	5.6	5.6	416	32.7	32.7	32.7	786	5.0	5.0	5.0
S_ERF_BayDoor1	ERF Building_Tipping Hall BayDoor#1	590	—	—	—	1098	—	—	—	629	16.8	—	—	943	8.3	—	—	442	3.1	—	—	759	1.4	—	—
S_ERF_BayDoor2	ERF Building_Tipping Hall BayDoor#2	597	—	—	—	1108	—	—	—	619	17.3	—	—	953	8.6	—	—	434	3.3	—	—	769	1.5	—	—
S_ERF_CompEx1	ERF Building - Compressor Exhaust	583	6.7	6.7	6.7	1118	—	—	—	594	27.9	27.9	27.9	992	—	—	—	377	30.8	30.8	30.8	797	1.7	1.7	1.7
S_ERF_CompEx2	ERF Building - Compressor Exhaust	594	6.1	6.1	6.1	1115	—	—	—	605	28.7	28.7	28.7	971	2.7	2.7	2.7	410	15.4	15.4	15.4	783	2.3	2.3	2.3
S_ERF_CompIN1	ERF Building - Compressor Intake	578	9.5	9.5	9.5	1114	0.4	0.4	0.4	595	31.2	31.2	31.2	971	4.2	4.2	4.2	370	30.2	30.2	30.2	783	5.1	5.1	5.1
S_ERF_MainStacl	ERF Building - Stack Exhaust	573	37.0	37.0	37.0	1116	28.7	28.7	28.7	595	36.7	36.7	36.7	1003	25.6	25.6	25.6	360	36.9	36.9	36.9	803	32.7	32.7	32.7
S_ERF_MainStacl	ERF Building - ID Fan for Stack Exhaust	570	27.6	27.6	27.6	1114	7.6	7.6	7.6	594	34.0	34.0	34.0	1004	7.0	7.0	7.0	355	37.6	37.6	37.6	802	14.1	14.1	14.1
S_ERF_RoofGEx	ERF Building - Rooftop General Exhaust	565	3.9	3.9	3.9	1105	—	—	—	605	19.8	19.8	19.8	990	—	—	—	370	24.9	24.9	24.9	790	—	—	—
S_ERF_RoofGEx	ERF Building - Rooftop General Exhaust	559	10.8	10.8	10.8	1103	—	—	—	606	19.8	19.8	19.8	993	—	—	—	363	25.1	25.1	25.1	791	—	—	—
S_ERF_SiloBlowT	ERF Building - Silo Blower Truck	526	39.6	—	—	1065	25.4	—	—	644	14.1	—	—	958	24.8	—	—	390	38.1	—	—	753	29.4	—	—
S_ERF_Turbine1	Generator Enclosure Air Inlet	570	12.8	12.8	12.8	1108	0.4	0.4	0.4	603	31.0	31.0	31.0	989	1.0	1.0	1.0	374	36.6	36.6	36.6	790	4.3	4.3	4.3
S_ERF_Turbine2	Generator Enclosure Exhaust	572	11.3	11.3	11.3	1108	0.0	0.0	0.0	603	30.3	30.3	30.3	987	0.6	0.6	0.6	377	35.6	35.6	35.6	790	3.9	3.9	3.9
S_ERF_Turbine3	Combustion Air Inlet Stack	574	—	—	—	1109	—	—	—	603	11.5	11.5	11.5	986	—	—	—	380	17.7	17.7	17.7	789	—	—	—
S_ERF_Turbine4	Heat Recovery Steam Generator Stack	578	6.1	6.1	6.1	1111	—	—	—	602	21.8	21.8	21.8	984	4.1	4.1	4.1	384	24.7	24.7	24.7	789	10.0	10.0	10.0
S_ERF_Turbine5	Turbine Enclosure Exhaust	581	10.6	10.6	10.6	1112	1.4	1.4	1.4	602	31.9	31.9	31.9	983	5.2	5.2	5.2	387	36.6	36.6	36.6	789	9.4	9.4	9.4
S_ERF_Turbine6	Turbine - After Cooler	579	5.0	5.0	5.0	1108	—	—	—	606	29.6	29.6	29.6	977	—	—	—	394	35.8	35.8	35.8	784	1.2	1.2	1.2
S_ERF_Turbine7	Turbine - Oil Cooler	583	5.6	5.6	5.6	1113	—	—	—	602	29.6	29.6	29.6	981	—	—	—	391	34.5	34.5	34.5	788	1.9	1.9	1.9
S_MRF_RoofGEx	MRF Building - Rooftop General Exhaust	780	14.9	14.9	14.9	1339	3.9	3.9	3.9	368	22.6	22.6	22.6	1211	4.8	4.8	4.8	274	25.5	25.5	25.5	1023	4.2	4.2	4.2
S_MRF_RoofGEx	MRF Building - Rooftop General Exhaust	777	15.0	15.0	15.0	1333	4.0	4.0	4.0	376	22.4	22.4	22.4	1200	4.9	4.9	4.9	287	25.0	25.0	25.0	1014	2.4	2.4	2.4
S_Phase2Landfill_	Landfill Bulldozer - Future Phase 2 Cell Conditions	266	46.9	—	—	775	27.8	—	—	927	29.5	—	—	745	27.9	—	—	607	37.9	—	—	503	28.6	—	—
S_Phase2Landfill_	Landfill Compactor - Future Phase 2 Landfill Conditions	214	45.9	—	—	740	25.9	—	—	967	25.9	—	—	746	23.4	—	—	624	34.7	—	—	491	24.3	—	—
S_TR1	Phase 2 Final Landfill Cell - Inbound/Outbound Truck Route	260	45.3	—	—	773	29.2	—	—	386	39.6	—	—	747	27.8	—	—	291	43.5	—	—	502	31.5	—	—
S_Weigh Scale_ I	Weigh Scale - Idling Truck	793	19.9	—	—	1334	6.7	—	—	388	34.0	—	—	1176	14.0	—	—	345	19.2	—	—	1001	16.2	—	—
S_Weigh Scale_ I	Weigh Scale - Idling Truck	774	22.6	—	—	1320	8.1	—	—	396	33.8	—	—	1172	14.1	—	—	324	31.1	—	—	992	13.4	—	—
Total Facility Sound Level (1-hour Leq):			**56.0**	**40.3**	**40.3**		**39.4**	**30.5**	**30.5**		**51.6**	**45.1**	**45.1**		**38.9**	**29.0**	**29.0**		**56.2**	**47.4**	**47.4**		**42.0**	**35.0**	**35.0**

Note:

[1] Sound level at the receptor was calculated using Cadna A acoustical modelling software.

Table C.3

Noise Source Sound Level Summary
Dart
IWSMS, George Town, Cayman Islands

Cadna A ID	Noise Source Description		1/1 Octave Band Data 32	63	125	250	500	1000	2000	4000	8000	Unadjusted Total Sound Power Level (dBA)	Tonal Penalty Assessment	(dBA)	Height Absolute (m)	Operating Time Day/Eve/Night (min)	Vehicle Volumes Day/Eve/Night (veh/hr)	Speed (km/hr)	Reference/Comments
ADMIN_HVAC	Admin - Office HVAC	PWL (dB)	—	83.2	87.4	83.5	82.8	83.0	77.7	71.8	67.0	91.6							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	57.0	71.3	74.9	79.6	83.0	78.9	72.8	65.9	**86.4**	No	0	14.8	60/60/60	—	—	GHD Reference Spectra
ADMIN_HVAC	Admin - Office HVAC	PWL (dB)	—	83.2	87.4	83.5	82.8	83.0	77.7	71.8	67.0	91.6							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	57.0	71.3	74.9	79.6	83.0	78.9	72.8	65.9	**86.4**	No	0	14.8	60/60/60	—	—	GHD Reference Spectra
AG1	Angle Grinder	PWL (dB)	88.0	88.0	82.0	83.0	91.0	101.0	108.0	104.0	104.0	111.1							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	48.6	61.8	65.9	74.4	87.8	101.0	109.2	105.0	102.9	**111.7**	No	0	4.8	30/0/0	—	—	BS:5228 Reference Spectra
AG2	Angle Grinder	PWL (dB)	88.0	88.0	82.0	83.0	91.0	101.0	108.0	104.0	104.0	111.1							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	48.6	61.8	65.9	74.4	87.8	101.0	109.2	105.0	102.9	**111.7**	No	0	7.4	30/0/0	—	—	BS:5228 Reference Spectra
AG3	Angle Grinder	PWL (dB)	88.0	88.0	82.0	83.0	91.0	101.0	108.0	104.0	104.0	111.1							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	48.6	61.8	65.9	74.4	87.8	101.0	109.2	105.0	102.9	**111.7**	No	0	8.5	30/0/0	—	—	BS:5228 Reference Spectra
AG4	Angle Grinder	PWL (dB)	88.0	88.0	82.0	83.0	91.0	101.0	108.0	104.0	104.0	111.1							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	48.6	61.8	65.9	74.4	87.8	101.0	109.2	105.0	102.9	**111.7**	No	0	5.1	30/0/0	—	—	BS:5228 Reference Spectra
AP1	Asphalt Paver	PWL (dB)	118.0	118.0	115.0	112.0	111.0	110.0	107.0	105.0	96.0	123.1							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	78.6	91.8	98.9	103.4	107.8	110.0	108.2	106.0	94.9	**114.8**	No	0	4.9	30/0/0	—	—	BS:5228 Reference Spectra
BAP_AIL1	BAP Sidewall Air Intake Louvre	PWL (dB)	—	85.0	88.0	86.0	89.0	86.0	80.0	75.0	74.0	94.3							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	58.8	71.9	77.4	85.8	86.0	81.2	76.0	72.9	**90.2**	No	0	11.4	60/60/60	—	—	GHD Reference Spectra
BAP_AIL2	BAP Sidewall Air Intake Louvre	PWL (dB)	—	85.0	88.0	86.0	89.0	86.0	80.0	75.0	74.0	94.3							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	58.8	71.9	77.4	85.8	86.0	81.2	76.0	72.9	**90.2**	No	0	11.4	60/60/60	—	—	GHD Reference Spectra
BAP_AIL3	BAP Sidewall Air Intake Louvre	PWL (dB)	—	85.0	88.0	86.0	89.0	86.0	80.0	75.0	74.0	94.3							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	58.8	71.9	77.4	85.8	86.0	81.2	76.0	72.9	**90.2**	No	0	11.4	60/60/60	—	—	GHD Reference Spectra
BAP_AIL4	BAP Sidewall Air Intake Louvre	PWL (dB)	—	85.0	88.0	86.0	89.0	86.0	80.0	75.0	74.0	94.3							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	58.8	71.9	77.4	85.8	86.0	81.2	76.0	72.9	**90.2**	No	0	11.4	60/60/60	—	—	GHD Reference Spectra
BAP_BayDoor	BAP Open Bay Door	PWL (dB)	93.6	89.2	89.6	94.9	98.5	99.5	101.5	102.1	98.4	107.8							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	54.2	63.0	73.5	86.3	95.3	99.5	102.7	103.1	97.3	**107.5**	No	0	11.0	60/60/60	—	—	GHD Reference Spectra
BAP_BayDoor	BAP Open Bay Door	PWL (dB)	93.6	89.2	89.6	94.9	98.5	99.5	101.5	102.1	98.4	107.8							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	54.2	63.0	73.5	86.3	95.3	99.5	102.7	103.1	97.3	**107.5**	No	0	9.0	60/0/0	—	—	GHD Reference Spectra
BD1	Dozer	PWL (dB)	110.0	110.0	108.0	107.0	105.0	99.0	98.0	91.0	90.0	115.6							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	70.6	83.8	91.9	98.4	101.8	99.0	99.2	92.0	88.9	**106.3**	No	0	6.4	24/0/0	—	—	BS:5228 Reference Spectra
BH1	Backhoe	PWL (dB)	105.0	105.0	97.0	95.0	95.0	94.0	91.0	90.0	81.0	109.0							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	65.6	78.8	80.9	86.4	91.8	94.0	92.2	91.0	79.9	**98.9**	No	0	5.9	24/0/0	—	—	BS:5228 Reference Spectra
BulldozerMove	Construction Dozer	PWL (dB)	-0.1	73.9	75.9	72.9	70.9	70.9	67.9	63.9	57.9	80.7							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-39.5	47.7	59.8	64.3	67.7	70.9	69.1	64.9	56.8	**75.2**	No	0	5.7	24/0/0	—	—	BS:5228 Reference Spectra
C&D_Crusher	Rubble Master (Mobile Crusher)	PWL (dB)	31.0	124.0	117.0	110.0	112.0	106.0	102.0	97.0	90.0	125.2							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	97.8	100.9	101.4	108.8	106.0	103.2	98.0	88.9	**112.4**	No	0	7.3	30/0/0	—	—	BS:5228 Reference Spectra
CD1	Core Drill (Drilling Concrete)	PWL (dB)	106.0	106.0	105.0	106.0	103.0	105.0	106.0	111.0	111.0	116.9							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	66.6	79.8	88.9	97.4	99.8	105.0	107.2	112.0	109.9	**115.5**	No	0	4.6	30/0/0	—	—	BS:5228 Reference Spectra
CD2	Core Drill (Drilling Concrete)	PWL (dB)	106.0	106.0	105.0	106.0	103.0	105.0	106.0	111.0	111.0	116.9							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	66.6	79.8	88.9	97.4	99.8	105.0	107.2	112.0	109.9	**115.5**	No	0	7.0	30/0/0	—	—	BS:5228 Reference Spectra
CD3	Core Drill (Drilling Concrete)	PWL (dB)	106.0	106.0	105.0	106.0	103.0	105.0	106.0	111.0	111.0	116.9							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	66.6	79.8	88.9	97.4	99.8	105.0	107.2	112.0	109.9	**115.5**	No	0	4.8	30/0/0	—	—	BS:5228 Reference Spectra
CD4	Core Drill (Drilling Concrete)	PWL (dB)	106.0	106.0	105.0	106.0	103.0	105.0	106.0	111.0	111.0	116.9							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	66.6	79.8	88.9	97.4	99.8	105.0	107.2	112.0	109.9	**115.5**	No	0	7.8	30/0/0	—	—	BS:5228 Reference Spectra
CD5	Core Drill (Drilling Concrete)	PWL (dB)	106.0	106.0	105.0	106.0	103.0	105.0	106.0	111.0	111.0	116.9							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	66.6	79.8	88.9	97.4	99.8	105.0	107.2	112.0	109.9	**115.5**	No	0	6.6	30/0/0	—	—	BS:5228 Reference Spectra
CDF_BayDoor	CDF Open Bay Door	PWL (dB)	93.6	89.2	89.6	94.9	98.5	99.5	101.5	102.1	98.4	107.8							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	54.2	63.0	73.5	86.3	95.3	99.5	102.7	103.1	97.3	**107.5**	No	0	5.4	60/0/0	—	—	GHD Reference Spectra

Table C.3

Noise Source Sound Level Summary
Dart
IWSMS, George Town, Cayman Islands

Cadna A ID	Noise Source Description		32	63	125	250	500	1000	2000	4000	8000	Unadjusted Total Sound Power Level (dBA)	Tonal Penalty Assessment	(dBA)	Height Absolute (m)	Operating Time Day/Eve/Night (min)	Vehicle Volumes Day/Eve/Night (veh/hr)	Speed (km/hr)	Reference/Comments
			1/1 Octave Band Data																
CDF_BayDoor	CDF Open Bay Door	PWL (dB)	93.6	89.2	89.6	94.9	98.5	99.5	101.5	102.1	98.4	107.8							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	54.2	63.0	73.5	86.3	95.3	99.5	102.7	103.1	97.3	**107.5**	No	0	2.0	60/0/0	—	—	GHD Reference Spectra
CD_BAF_TR1	C&D and BAF - Inbound/Outbound Truck Route	PWL (dB)	31.0	117.0	112.0	105.0	107.0	104.0	103.0	100.0	91.0	119.0							Referenced from British Standard 5228-1:2009+A1:2014
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								Code of practice for noise and vibration control on construction and open sites (BS:5228)
		PWL (dBA)	—	90.8	95.9	96.4	103.8	104.0	104.2	101.0	89.9	**109.9**	No	0	6.6	—	12/0/0	20	Lorry - 26T 235kW - BS:5228 Table C.11-16
CR1	150 Ton Crane	PWL (dB)	111.0	111.0	110.0	104.0	105.0	104.0	104.0	95.0	86.0	116.6							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	71.6	84.8	93.9	95.4	101.8	104.0	105.2	96.0	84.9	**109.2**	No	0	5.5	30/0/0	—	—	BS:5228 Reference Spectra
CR2	60 Ton Crane	PWL (dB)	118.0	118.0	113.0	109.0	105.0	102.0	98.0	91.0	83.0	122.0							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	78.6	91.8	96.9	100.4	101.8	102.0	99.2	92.0	81.9	**107.7**	No	0	5.5	30/0/0	—	—	BS:5228 Reference Spectra
CR3	30 Ton Crane	PWL (dB)	111.0	111.0	107.0	102.0	94.0	95.0	94.0	87.0	81.0	115.1							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	71.6	84.8	90.9	93.4	90.8	95.0	95.2	88.0	79.9	**100.8**	No	0	8.4	30/0/0	—	—	BS:5228 Reference Spectra
CS1	Circular Saw (Cutting Concrete)	PWL (dB)	103.0	120.0	112.0	111.0	111.0	113.0	117.0	116.0	122.0	126.1							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	63.6	93.8	95.9	102.4	107.8	113.0	118.2	117.0	120.9	**124.3**	No	0	4.9	12/0/0	—	—	BS:5228 Reference Spectra
CS2	Circular Saw (Cutting Concrete)	PWL (dB)	103.0	120.0	112.0	111.0	111.0	113.0	117.0	116.0	122.0	126.1							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	63.6	93.8	95.9	102.4	107.8	113.0	118.2	117.0	120.9	**124.3**	No	0	5.1	12/0/0	—	—	BS:5228 Reference Spectra
CS3	Circular Saw (Cutting Concrete)	PWL (dB)	103.0	120.0	112.0	111.0	111.0	113.0	117.0	116.0	122.0	126.1							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	63.6	93.8	95.9	102.4	107.8	113.0	118.2	117.0	120.9	**124.3**	No	0	6.5	12/0/0	—	—	BS:5228 Reference Spectra
CS4	Circular Saw (Cutting Concrete)	PWL (dB)	103.0	120.0	112.0	111.0	111.0	113.0	117.0	116.0	122.0	126.1							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	63.6	93.8	95.9	102.4	107.8	113.0	118.2	117.0	120.9	**124.3**	No	0	7.1	12/0/0	—	—	BS:5228 Reference Spectra
CS5	Circular Saw (Cutting Concrete)	PWL (dB)	103.0	120.0	112.0	111.0	111.0	113.0	117.0	116.0	122.0	126.1							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	63.6	93.8	95.9	102.4	107.8	113.0	118.2	117.0	120.9	**124.3**	No	0	5.0	12/0/0	—	—	BS:5228 Reference Spectra
CT1	Concrete Mixer Truck	PWL (dB)	114.0	114.0	105.0	97.0	100.0	101.0	109.0	91.0	86.0	118.1							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	74.6	87.8	88.9	88.4	96.8	101.0	110.2	92.0	84.9	**111.0**	No	0	5.3	30/0/0	—	—	BS:5228 Reference Spectra
CT2	Concrete Mixer Truck	PWL (dB)	114.0	114.0	105.0	97.0	100.0	101.0	109.0	91.0	86.0	118.1							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	74.6	87.8	88.9	88.4	96.8	101.0	110.2	92.0	84.9	**111.0**	No	0	5.3	30/0/0	—	—	BS:5228 Reference Spectra
CT3	Concrete Mixer Truck	PWL (dB)	114.0	114.0	105.0	97.0	100.0	101.0	109.0	91.0	86.0	118.1							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	74.6	87.8	88.9	88.4	96.8	101.0	110.2	92.0	84.9	**111.0**	No	0	7.0	30/0/0	—	—	BS:5228 Reference Spectra
CT4	Concrete Mixer Truck	PWL (dB)	114.0	114.0	105.0	97.0	100.0	101.0	109.0	91.0	86.0	118.1							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	74.6	87.8	88.9	88.4	96.8	101.0	110.2	92.0	84.9	**111.0**	No	0	7.3	30/0/0	—	—	BS:5228 Reference Spectra
CT5	Concrete Mixer Truck	PWL (dB)	114.0	114.0	105.0	97.0	100.0	101.0	109.0	91.0	86.0	118.1							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	74.6	87.8	88.9	88.4	96.8	101.0	110.2	92.0	84.9	**111.0**	No	0	5.5	30/0/0	—	—	BS:5228 Reference Spectra
CT6	Concrete Mixer Truck	PWL (dB)	114.0	114.0	105.0	97.0	100.0	101.0	109.0	91.0	86.0	118.1							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	74.6	87.8	88.9	88.4	96.8	101.0	110.2	92.0	84.9	**111.0**	No	0	5.1	30/0/0	—	—	BS:5228 Reference Spectra
CT7	Concrete Mixer Truck	PWL (dB)	114.0	114.0	105.0	97.0	100.0	101.0	109.0	91.0	86.0	118.1							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	74.6	87.8	88.9	88.4	96.8	101.0	110.2	92.0	84.9	**111.0**	No	0	8.0	30/0/0	—	—	BS:5228 Reference Spectra
CT8	Concrete Mixer Truck	PWL (dB)	114.0	114.0	105.0	97.0	100.0	101.0	109.0	91.0	86.0	118.1							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	74.6	87.8	88.9	88.4	96.8	101.0	110.2	92.0	84.9	**111.0**	No	0	7.5	30/0/0	—	—	BS:5228 Reference Spectra
DR1	Drill Rig	PWL (dB)	108.0	108.0	108.0	98.0	97.0	101.0	99.0	93.0	87.0	113.5							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	68.6	81.8	91.9	89.4	93.8	101.0	100.2	94.0	85.9	**104.9**	No	0	4.8	12/0/0	—	—	BS:5228 Reference Spectra
DR2	Drill Rig	PWL (dB)	108.0	108.0	108.0	98.0	97.0	101.0	99.0	93.0	87.0	113.5							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	68.6	81.8	91.9	89.4	93.8	101.0	100.2	94.0	85.9	**104.9**	No	0	4.0	12/0/0	—	—	BS:5228 Reference Spectra
DR3	Drill Rig	PWL (dB)	108.0	108.0	108.0	98.0	97.0	101.0	99.0	93.0	87.0	113.5							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	68.6	81.8	91.9	89.4	93.8	101.0	100.2	94.0	85.9	**104.9**	No	0	4.0	12/0/0	—	—	BS:5228 Reference Spectra
DR4	Drill Rig	PWL (dB)	108.0	108.0	108.0	98.0	97.0	101.0	99.0	93.0	87.0	113.5							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	68.6	81.8	91.9	89.4	93.8	101.0	100.2	94.0	85.9	**104.9**	No	0	4.0	12/0/0	—	—	BS:5228 Reference Spectra
DR5	Drill Rig	PWL (dB)	108.0	108.0	108.0	98.0	97.0	101.0	99.0	93.0	87.0	113.5							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	68.6	81.8	91.9	89.4	93.8	101.0	100.2	94.0	85.9	**104.9**	No	0	4.1	12/0/0	—	—	BS:5228 Reference Spectra

Table C.3

Noise Source Sound Level Summary
Dart
IWSMS, George Town, Cayman Islands

Cadna A ID	Noise Source Description		1/1 Octave Band Data 32	63	125	250	500	1000	2000	4000	8000	Unadjusted Total Sound Power Level (dBA)	Tonal Penalty Assessment	(dBA)	Height Absolute (m)	Operating Time Day/Eve/Night (min)	Vehicle Volumes Day/Eve/Night (veh/hr)	Speed (km/hr)	Reference/Comments
DT1	Dump Truck	PWL (dB)	104.0	104.0	95.0	86.0	86.0	91.0	87.0	81.0	74.0	107.5							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	64.6	77.8	78.9	77.4	82.8	91.0	88.2	82.0	72.9	**94.0**	No	0	7.3	24/0/0	—	—	BS:5228 Reference Spectra
DT2	Dump Truck	PWL (dB)	104.0	104.0	95.0	86.0	86.0	91.0	87.0	81.0	74.0	107.5							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	64.6	77.8	78.9	77.4	82.8	91.0	88.2	82.0	72.9	**94.0**	No	0	5.8	24/0/0	—	—	BS:5228 Reference Spectra
DT3	Dump Truck	PWL (dB)	104.0	104.0	95.0	86.0	86.0	91.0	87.0	81.0	74.0	107.5							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	64.6	77.8	78.9	77.4	82.8	91.0	88.2	82.0	72.9	**94.0**	No	0	5.0	24/0/0	—	—	BS:5228 Reference Spectra
DT4	Dump Truck	PWL (dB)	104.0	104.0	95.0	86.0	86.0	91.0	87.0	81.0	74.0	107.5							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	64.6	77.8	78.9	77.4	82.8	91.0	88.2	82.0	72.9	**94.0**	No	0	7.2	24/0/0	—	—	BS:5228 Reference Spectra
ELV_BayDoor	ELV Open Bay Door	PWL (dB)	87.0	85.2	85.1	81.1	78.7	78.9	90.6	94.9	93.3	98.9							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	47.6	59.0	69.0	72.5	75.5	78.9	91.8	95.9	92.2	**98.5**	No	0	7.7	60/0/0	—	—	GHD Reference Spectra
ELV_BayDoor	ELV Open Bay Door	PWL (dB)	87.0	85.2	85.1	81.1	78.7	78.9	90.6	94.9	93.3	98.9							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	47.6	59.0	69.0	72.5	75.5	78.9	91.8	95.9	92.2	**98.5**	No	0	9.4	60/0/0	—	—	GHD Reference Spectra
ELV_HVAC1	ELV - Office HVAC	PWL (dB)	—	83.2	87.4	83.5	82.8	83.0	77.7	71.8	67.0	91.6							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	57.0	71.3	74.9	79.6	83.0	78.9	72.8	65.9	**86.4**	No	0	14.1	60/60/60	—	—	GHD Reference Spectra
ELV_HVAC2	ELV - Office HVAC	PWL (dB)	—	83.2	87.4	83.5	82.8	83.0	77.7	71.8	67.0	91.6							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	57.0	71.3	74.9	79.6	83.0	78.9	72.8	65.9	**86.4**	No	0	14.1	60/60/60	—	—	GHD Reference Spectra
ELV_TR1	ELV - Inbound/Outbound Truck Route	PWL (dB)	31.0	117.0	112.0	105.0	107.0	104.0	103.0	100.0	91.0	119.0							Referenced from British Standard 5228-1:2009+A1:2014
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								Code of practice for noise and vibration control on construction and open sites (BS:5228)
		PWL (dBA)	—	90.8	95.9	96.4	103.8	104.0	104.2	101.0	89.9	**109.9**	No	0	7.7	—	4/0/0	20	Lorry - 26T 235kW - BS:5228 Table C.11-16
ERF_AIL1	ERF Sidewall Air Intake Louvre	PWL (dB)	—	86.5	89.5	87.5	90.5	87.5	81.5	76.5	75.5	95.8							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	60.3	73.4	78.9	87.3	87.5	82.7	77.5	74.4	**91.7**	No	0	23.9	60/60/60	—	—	GHD Reference Spectra
ERF_AIL10	ERF Sidewall Air Intake Louvre	PWL (dB)	—	79.6	82.6	80.6	83.6	80.6	74.6	69.6	68.6	88.9							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	53.4	66.5	72.0	80.4	80.6	75.8	70.6	67.5	**84.8**	No	0	40.6	60/60/60	—	—	GHD Reference Spectra
ERF_AIL11	ERF Sidewall Air Intake Louvre	PWL (dB)	—	79.3	82.3	80.3	83.3	80.3	74.3	69.3	68.3	88.6							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	53.1	66.2	71.7	80.1	80.3	75.5	70.3	67.2	**84.5**	No	0	36.2	60/60/60	—	—	GHD Reference Spectra
ERF_AIL12	ERF Sidewall Air Intake Louvre	PWL (dB)	—	86.3	89.3	87.3	90.3	87.3	81.3	76.3	75.3	95.6							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	60.1	73.2	78.7	87.1	87.3	82.5	77.3	74.2	**91.5**	No	0	33.6	60/60/60	—	—	GHD Reference Spectra
ERF_AIL13	ERF Sidewall Air Intake Louvre	PWL (dB)	—	85.0	88.0	86.0	89.0	86.0	80.0	75.0	74.0	94.3							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	58.8	71.9	77.4	85.8	86.0	81.2	76.0	72.9	**90.2**	No	0	40.3	60/60/60	—	—	GHD Reference Spectra
ERF_AIL14	ERF Sidewall Air Intake Louvre	PWL (dB)	—	81.0	84.0	82.0	85.0	82.0	76.0	71.0	70.0	90.3							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	54.8	67.9	73.4	81.8	82.0	77.2	72.0	68.9	**86.2**	No	0	35.4	60/60/60	—	—	GHD Reference Spectra
ERF_AIL2	ERF Sidewall Air Intake Louvre	PWL (dB)	—	85.0	88.0	86.0	89.0	86.0	80.0	75.0	74.0	94.3							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	58.8	71.9	77.4	85.8	86.0	81.2	76.0	72.9	**90.2**	No	0	32.9	60/60/60	—	—	GHD Reference Spectra
ERF_AIL3	ERF Sidewall Air Intake Louvre	PWL (dB)	—	81.4	84.4	82.4	85.4	82.4	76.4	71.4	70.4	90.7							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	55.2	68.3	73.8	82.2	82.4	77.6	72.4	69.3	**86.5**	No	0	33.4	60/60/60	—	—	GHD Reference Spectra
ERF_AIL4	ERF Sidewall Air Intake Louvre	PWL (dB)	—	79.8	82.8	80.8	83.8	80.8	74.8	69.8	68.8	89.1							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	53.6	66.7	72.2	80.6	80.8	76.0	70.8	67.7	**84.9**	No	0	37.0	60/60/60	—	—	GHD Reference Spectra
ERF_AIL5	ERF Sidewall Air Intake Louvre	PWL (dB)	—	86.6	89.6	87.6	90.6	87.6	81.6	76.6	75.6	95.9							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	60.4	73.5	79.0	87.4	87.6	82.8	77.6	74.5	**91.8**	No	0	10.8	60/60/60	—	—	GHD Reference Spectra
ERF_AIL7	ERF Sidewall Air Intake Louvre	PWL (dB)	—	85.0	88.0	86.0	89.0	86.0	80.0	75.0	74.0	94.3							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	58.8	71.9	77.4	85.8	86.0	81.2	76.0	72.9	**90.2**	No	0	40.1	60/60/60	—	—	GHD Reference Spectra
ERF_AIL8	ERF Sidewall Air Intake Louvre	PWL (dB)	—	85.0	88.0	86.0	89.0	86.0	80.0	75.0	74.0	94.3							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	58.8	71.9	77.4	85.8	86.0	81.2	76.0	72.9	**90.2**	No	0	14.0	60/60/60	—	—	GHD Reference Spectra
ERF_AIL9	ERF Sidewall Air Intake Louvre	PWL (dB)	—	82.7	85.7	83.7	86.7	83.7	77.7	72.7	71.7	92.0							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	56.5	69.6	75.1	83.5	83.7	78.9	73.7	70.6	**87.9**	No	0	40.3	60/60/60	—	—	GHD Reference Spectra
ERF_TR1	ERF- Inbound/Outbound Truck Route	PWL (dB)	31.0	117.0	112.0	105.0	107.0	104.0	103.0	100.0	91.0	119.0							Referenced from British Standard 5228-1:2009+A1:2014
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								Code of practice for noise and vibration control on construction and open sites (BS:5228)
		PWL (dBA)	—	90.8	95.9	96.4	103.8	104.0	104.2	101.0	89.9	**109.9**	No	0	8.3	—	10/0/0	20	Lorry - 26T 235kW - BS:5228 Table C.11-16

Table C.3

Noise Source Sound Level Summary
Dart
IWSMS, George Town, Cayman Islands

Cadna A ID	Noise Source Description		1/1 Octave Band Data 32	63	125	250	500	1000	2000	4000	8000	Unadjusted Total Sound Power Level (dBA)	Tonal Penalty Assessment	(dBA)	Height Absolute (m)	Operating Time Day/Eve/Night (min)	Vehicle Volumes Day/Eve/Night (veh/hr)	Speed (km/hr)	Reference/Comments
Ex1	Excavator	PWL (dB)	106.0	106.0	115.0	109.0	105.0	101.0	99.0	95.0	92.0	117.3							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	66.6	79.8	98.9	100.4	101.8	101.0	100.2	96.0	90.9	**107.9**	No	0	6.9	24/0/0	—	—	BS:5228 Reference Spectra
FP_Bldg_Ex	Fire Pump Bldg. - Sidewall Exhaust	PWL (dB)	29.0	29.0	29.0	29.0	88.2	29.0	29.0	29.0	29.0	88.2							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-10.4	2.8	12.9	20.4	85.0	29.0	30.2	30.0	27.9	**85.0**	No	0	7.2	60/0/0	—	—	GHD Reference Spectra
FP_Bldg_ExSt	Fire Pump Bldg. - Fire Pump Exhaust Stack	PWL (dB)	—	121.5	95.8	83.0	81.8	80.2	80.7	82.1	88.9	121.5							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	95.3	79.7	74.4	78.6	80.2	81.9	83.1	87.8	**96.7**	No	0	7.1	60/0/0	—	—	GHD Reference Spectra
FP_Bldg_Intak	Fire Pump Bldg. - Diesel Fire Water Sidewall Air Intake	PWL (dB)	—	97.9	99.7	96.3	86.3	77.6	76.5	80.6	79.8	103.1							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	71.7	83.6	87.7	83.1	77.6	77.7	81.6	78.7	**91.4**	No	0	7.2	60/0/0	—	—	GHD Reference Spectra
FTL1	Fuel Tanker Lorry	PWL (dB)	110.0	110.0	104.0	102.0	106.0	103.0	98.0	90.0	81.0	114.9							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	70.6	83.8	87.9	93.4	102.8	103.0	99.2	91.0	79.9	**107.1**	No	0	5.8	30/0/0	—	—	BS:5228 Reference Spectra
FTL2	Fuel Tanker Lorry	PWL (dB)	110.0	110.0	104.0	102.0	106.0	103.0	98.0	90.0	81.0	114.9							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	70.6	83.8	87.9	93.4	102.8	103.0	99.2	91.0	79.9	**107.1**	No	0	8.0	30/0/0	—	—	BS:5228 Reference Spectra
GC1	Gas Cutter	PWL (dB)	105.0	105.0	107.0	97.0	89.0	87.0	87.0	86.0	86.0	110.8							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	65.6	78.8	90.9	88.4	85.8	87.0	88.2	87.0	84.9	**96.4**	No	0	4.7	24/0/0	—	—	BS:5228 Reference Spectra
GC2	Gas Cutter	PWL (dB)	105.0	105.0	107.0	97.0	89.0	87.0	87.0	86.0	86.0	110.8							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	65.6	78.8	90.9	88.4	85.8	87.0	88.2	87.0	84.9	**96.4**	No	0	5.3	24/0/0	—	—	BS:5228 Reference Spectra
GC3	Gas Cutter	PWL (dB)	105.0	105.0	107.0	97.0	89.0	87.0	87.0	86.0	86.0	110.8							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	65.6	78.8	90.9	88.4	85.8	87.0	88.2	87.0	84.9	**96.4**	No	0	8.1	24/0/0	—	—	BS:5228 Reference Spectra
GC4	Gas Cutter	PWL (dB)	105.0	105.0	107.0	97.0	89.0	87.0	87.0	86.0	86.0	110.8							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	65.6	78.8	90.9	88.4	85.8	87.0	88.2	87.0	84.9	**96.4**	No	0	6.8	24/0/0	—	—	BS:5228 Reference Spectra
GC5	Gas Cutter	PWL (dB)	105.0	105.0	107.0	97.0	89.0	87.0	87.0	86.0	86.0	110.8							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	65.6	78.8	90.9	88.4	85.8	87.0	88.2	87.0	84.9	**96.4**	No	0	8.6	24/0/0	—	—	BS:5228 Reference Spectra
GWF_Loader1	Green Waste Facility Front End Load Route 1	PWL (dB)	31.0	117.0	112.0	105.0	107.0	104.0	103.0	100.0	91.0	119.0							Referenced from British Standard 5228-1:2009+A1:2014
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								Code of practice for noise and vibration control on construction and open sites (BS:5228)
		PWL (dBA)	—	90.8	95.9	96.4	103.8	104.0	104.2	101.0	89.9	**109.9**	No	0	8.9	—	20/0/0	15	Lorry - 26T 235kW - BS:5228 Table C.11-16
GWF_Loader2	Green Waste Facility Front End Load Route 2	PWL (dB)	31.0	117.0	112.0	105.0	107.0	104.0	103.0	100.0	91.0	119.0							Referenced from British Standard 5228-1:2009+A1:2014
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								Code of practice for noise and vibration control on construction and open sites (BS:5228)
		PWL (dBA)	—	90.8	95.9	96.4	103.8	104.0	104.2	101.0	89.9	**109.9**	No	0	8.5	—	20/0/0	15	Lorry - 26T 235kW - BS:5228 Table C.11-16
GWF_Screene	Green Waste Facility - Screener	PWL (dB)	31.0	124.0	117.0	110.0	109.0	106.0	102.0	100.0	93.0	125.1							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	97.8	100.9	101.4	105.8	106.0	103.2	101.0	91.9	**111.6**	No	0	10.0	30/0/0	—	—	GHD Reference Spectra
GWF_Shredde	Green Waste Facility - Komptech Shredder	PWL (dB)	105.5	111.7	117.1	110.0	109.8	105.7	102.3	99.8	95.6	119.8							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	66.1	85.5	101.0	101.4	106.6	105.7	103.5	100.8	94.5	**111.7**	No	0	10.0	30/0/0	—	—	GHD Reference Spectra
GWF_TR1	Green Waste Facility - Inbound/Outbound Truck Route	PWL (dB)	31.0	117.0	112.0	105.0	107.0	104.0	103.0	100.0	91.0	119.0							Referenced from British Standard 5228-1:2009+A1:2014
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								Code of practice for noise and vibration control on construction and open sites (BS:5228)
		PWL (dBA)	—	90.8	95.9	96.4	103.8	104.0	104.2	101.0	89.9	**109.9**	No	0	8.5	—	2/0/0	15	Lorry - 26T 235kW - BS:5228 Table C.11-16
GWF_Tubgrin	Green Waste Facility - Mobark 950 Tub Grinder	PWL (dB)	39.4	26.2	16.1	8.6	117.2	—	-1.2	-1.0	1.1	117.2							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	—	—	—	114.0	—	—	—	—	**114.0**	No	0	11.0	30/0/0	—	—	GHD Reference Spectra
Gen1	Generator	PWL (dB)	106.0	106.0	103.0	107.0	101.0	100.0	96.0	87.0	78.0	112.5							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	66.6	79.8	86.9	98.4	97.8	100.0	97.2	88.0	76.9	**104.7**	No	0	4.7	30/0/0	—	—	BS:5228 Reference Spectra
Gen2	Generator	PWL (dB)	106.0	106.0	103.0	107.0	101.0	100.0	96.0	87.0	78.0	112.5							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	66.6	79.8	86.9	98.4	97.8	100.0	97.2	88.0	76.9	**104.7**	No	0	5.3	30/0/0	—	—	BS:5228 Reference Spectra
Gen3	Generator	PWL (dB)	106.0	106.0	103.0	107.0	101.0	100.0	96.0	87.0	78.0	112.5							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	66.6	79.8	86.9	98.4	97.8	100.0	97.2	88.0	76.9	**104.7**	No	0	6.1	30/0/0	—	—	BS:5228 Reference Spectra
Gen4	Generator	PWL (dB)	106.0	106.0	103.0	107.0	101.0	100.0	96.0	87.0	78.0	112.5							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	66.6	79.8	86.9	98.4	97.8	100.0	97.2	88.0	76.9	**104.7**	No	0	7.5	30/0/0	—	—	BS:5228 Reference Spectra
Gen5	Generator	PWL (dB)	106.0	106.0	103.0	107.0	101.0	100.0	96.0	87.0	78.0	112.5							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	66.6	79.8	86.9	98.4	97.8	100.0	97.2	88.0	76.9	**104.7**	No	0	5.1	30/0/0	—	—	BS:5228 Reference Spectra
GraderMovem	Construction Grader	PWL (dB)	87.9	87.9	86.9	82.9	78.9	83.9	77.9	73.9	64.9	93.7							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	48.5	61.7	70.8	74.3	75.7	83.9	79.1	74.9	63.8	**86.4**	No	0	5.7	24/0/0	—	—	BS:5228 Reference Spectra
HW_TR1	Household Recycling Container Movements	PWL (dB)	31.0	117.0	112.0	105.0	107.0	104.0	103.0	100.0	91.0	119.0							Referenced from British Standard 5228-1:2009+A1:2014
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								Code of practice for noise and vibration control on construction and open sites (BS:5228)
		PWL (dBA)	—	90.8	95.9	96.4	103.8	104.0	104.2	101.0	89.9	**109.9**	No	0	3.0	—	4/0/0	20	Lorry - 26T 235kW - BS:5228 Table C.11-16

Table C.3

Noise Source Sound Level Summary
Dart
IWSMS, George Town, Cayman Islands

Cadna A ID	Noise Source Description		32	63	125	250	500	1000	2000	4000	8000	Unadjusted Total Sound Power Level (dBA)	Tonal Penalty	Assessment (dBA)	Height Absolute (m)	Operating Time Day/Eve/Night (min)	Vehicle Volumes Day/Eve/Night (veh/hr)	Speed (km/hr)	Reference/Comments
HWRC_HVAC	HWRC - Office HVAC	PWL (dB)	—	83.2	87.4	83.5	82.8	83.0	77.7	71.8	67.0	91.6							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	57.0	71.3	74.9	79.6	83.0	78.9	72.8	65.9	**86.4**	No	0	11.0	60/60/60	—	—	GHD Reference Spectra
HWRC_HVAC	HWRC - Office HVAC	PWL (dB)	—	83.2	87.4	83.5	82.8	83.0	77.7	71.8	67.0	91.6							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	57.0	71.3	74.9	79.6	83.0	78.9	72.8	65.9	**86.4**	No	0	11.0	60/60/60	—	—	GHD Reference Spectra
L1	Loader	PWL (dB)	118.0	118.0	113.0	108.0	109.0	104.0	101.0	95.0	88.0	122.2							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	78.6	91.8	96.9	99.4	105.8	104.0	102.2	96.0	86.9	**110.0**	No	0	4.8	24/0/0	—	—	BS:5228 Reference Spectra
L2	Loader	PWL (dB)	118.0	118.0	113.0	108.0	109.0	104.0	101.0	95.0	88.0	122.2							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	78.6	91.8	96.9	99.4	105.8	104.0	102.2	96.0	86.9	**110.0**	No	0	5.0	24/0/0	—	—	BS:5228 Reference Spectra
L3	Loader	PWL (dB)	118.0	118.0	113.0	108.0	109.0	104.0	101.0	95.0	88.0	122.2							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	78.6	91.8	96.9	99.4	105.8	104.0	102.2	96.0	86.9	**110.0**	No	0	7.4	24/0/0	—	—	BS:5228 Reference Spectra
L4	Loader	PWL (dB)	118.0	118.0	113.0	108.0	109.0	104.0	101.0	95.0	88.0	122.2							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	78.6	91.8	96.9	99.4	105.8	104.0	102.2	96.0	86.9	**110.0**	No	0	5.1	24/0/0	—	—	BS:5228 Reference Spectra
LFG_Flare	Landfill Gas Flare	PWL (dB)	89.0	95.0	88.0	97.0	90.0	89.0	87.0	83.0	76.0	100.8							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	49.6	68.8	71.9	88.4	86.8	89.0	88.2	84.0	74.9	**94.7**	No	0	8.4	60/60/60	—	—	GHD Reference Spectra
LP1	Scissor Lift	PWL (dB)	109.0	109.0	107.0	93.0	94.0	91.0	90.0	89.0	80.0	113.4							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	69.6	82.8	90.9	84.4	90.8	91.0	91.2	90.0	78.9	**98.2**	No	0	7.1	30/0/0	—	—	BS:5228 Reference Spectra
MEx1	Mini Excavator	PWL (dB)	107.0	107.0	104.0	93.0	97.0	93.0	90.0	85.0	80.0	111.3							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	67.6	80.8	87.9	84.4	93.8	93.0	91.2	86.0	78.9	**98.6**	No	0	5.1	24/0/0	—	—	BS:5228 Reference Spectra
MEx2	Mini Excavator	PWL (dB)	107.0	107.0	104.0	93.0	97.0	93.0	90.0	85.0	80.0	111.3							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	67.6	80.8	87.9	84.4	93.8	93.0	91.2	86.0	78.9	**98.6**	No	0	6.8	24/0/0	—	—	BS:5228 Reference Spectra
MEx3	Mini Excavator	PWL (dB)	107.0	107.0	104.0	93.0	97.0	93.0	90.0	85.0	80.0	111.3							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	67.6	80.8	87.9	84.4	93.8	93.0	91.2	86.0	78.9	**98.6**	No	0	7.8	24/0/0	—	—	BS:5228 Reference Spectra
MEx4	Mini Excavator	PWL (dB)	107.0	107.0	104.0	93.0	97.0	93.0	90.0	85.0	80.0	111.3							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	67.6	80.8	87.9	84.4	93.8	93.0	91.2	86.0	78.9	**98.6**	No	0	7.3	24/0/0	—	—	BS:5228 Reference Spectra
MRF_AIL1	MRF Sidewall Air Intake Louvre	PWL (dB)	—	85.0	88.0	86.0	89.0	86.0	80.0	75.0	74.0	94.3							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	58.8	71.9	77.4	85.8	86.0	81.2	76.0	72.9	**90.2**	No	0	9.9	60/60/60	—	—	GHD Reference Spectra
MRF_AIL10	MRF Sidewall Air Intake Louvre	PWL (dB)	—	85.0	88.0	86.0	89.0	86.0	80.0	75.0	74.0	94.3							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	58.8	71.9	77.4	85.8	86.0	81.2	76.0	72.9	**90.2**	No	0	10.3	60/60/60	—	—	GHD Reference Spectra
MRF_AIL11	MRF Sidewall Air Intake Louvre	PWL (dB)	—	85.0	88.0	86.0	89.0	86.0	80.0	75.0	74.0	94.3							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	58.8	71.9	77.4	85.8	86.0	81.2	76.0	72.9	**90.2**	No	0	10.3	60/60/60	—	—	GHD Reference Spectra
MRF_AIL12	MRF Sidewall Air Intake Louvre	PWL (dB)	—	85.0	88.0	86.0	89.0	86.0	80.0	75.0	74.0	94.3							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	58.8	71.9	77.4	85.8	86.0	81.2	76.0	72.9	**90.2**	No	0	10.0	60/60/60	—	—	GHD Reference Spectra
MRF_AIL13	MRF Sidewall Air Intake Louvre	PWL (dB)	—	85.0	88.0	86.0	89.0	86.0	80.0	75.0	74.0	94.3							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	58.8	71.9	77.4	85.8	86.0	81.2	76.0	72.9	**90.2**	No	0	10.0	60/60/60	—	—	GHD Reference Spectra
MRF_AIL2	MRF Sidewall Air Intake Louvre	PWL (dB)	—	85.0	88.0	86.0	89.0	86.0	80.0	75.0	74.0	94.3							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	58.8	71.9	77.4	85.8	86.0	81.2	76.0	72.9	**90.2**	No	0	9.9	60/60/60	—	—	GHD Reference Spectra
MRF_AIL3	MRF Sidewall Air Intake Louvre	PWL (dB)	—	85.0	88.0	86.0	89.0	86.0	80.0	75.0	74.0	94.3							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	58.8	71.9	77.4	85.8	86.0	81.2	76.0	72.9	**90.2**	No	0	9.9	60/60/60	—	—	GHD Reference Spectra
MRF_AIL4	MRF Sidewall Air Intake Louvre	PWL (dB)	—	85.0	88.0	86.0	89.0	86.0	80.0	75.0	74.0	94.3							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	58.8	71.9	77.4	85.8	86.0	81.2	76.0	72.9	**90.2**	No	0	10.0	60/60/60	—	—	GHD Reference Spectra
MRF_AIL5	MRF Sidewall Air Intake Louvre	PWL (dB)	—	85.0	88.0	86.0	89.0	86.0	80.0	75.0	74.0	94.3							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	58.8	71.9	77.4	85.8	86.0	81.2	76.0	72.9	**90.2**	No	0	10.1	60/60/60	—	—	GHD Reference Spectra
MRF_AIL6	MRF Sidewall Air Intake Louvre	PWL (dB)	—	85.0	88.0	86.0	89.0	86.0	80.0	75.0	74.0	94.3							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	58.8	71.9	77.4	85.8	86.0	81.2	76.0	72.9	**90.2**	No	0	10.1	60/60/60	—	—	GHD Reference Spectra
MRF_AIL7	MRF Sidewall Air Intake Louvre	PWL (dB)	—	85.0	88.0	86.0	89.0	86.0	80.0	75.0	74.0	94.3							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	58.8	71.9	77.4	85.8	86.0	81.2	76.0	72.9	**90.2**	No	0	10.2	60/60/60	—	—	GHD Reference Spectra

Table C.3

Noise Source Sound Level Summary
Dart
IWSMS, George Town, Cayman Islands

Cadna A ID	Noise Source Description		1/1 Octave Band Data 32	63	125	250	500	1000	2000	4000	8000	Unadjusted Total Sound Power Level (dBA)	Tonal Penalty Assessment	(dBA)	Height Absolute (m)	Operating Time Day/Eve/Night (min)	Vehicle Volumes Day/Eve/Night (veh/hr)	Speed (km/hr)	Reference/Comments
MRF_AIL8	MRF Sidewall Air Intake Louvre	PWL (dB)	—	85.0	88.0	86.0	89.0	86.0	80.0	75.0	74.0	94.3							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	58.8	71.9	77.4	85.8	86.0	81.2	76.0	72.9	**90.2**	No	0	10.3	60/60/60	—	—	GHD Reference Spectra
MRF_AIL9	MRF Sidewall Air Intake Louvre	PWL (dB)	—	85.0	88.0	86.0	89.0	86.0	80.0	75.0	74.0	94.3							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	58.8	71.9	77.4	85.8	86.0	81.2	76.0	72.9	**90.2**	No	0	10.3	60/60/60	—	—	GHD Reference Spectra
MRF_BayDoo	MRF Open Bay Door	PWL (dB)	93.6	89.2	89.6	94.9	98.5	99.5	101.5	102.1	98.4	107.8							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	54.2	63.0	73.5	86.3	95.3	99.5	102.7	103.1	97.3	**107.5**	No	0	9.2	60/60/60	—	—	GHD Reference Spectra
MRF_BayDoo	MRF Open Bay Door	PWL (dB)	93.6	89.2	89.6	94.9	98.5	99.5	101.5	102.1	98.4	107.8							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	54.2	63.0	73.5	86.3	95.3	99.5	102.7	103.1	97.3	**107.5**	No	0	10.1	60/60/60	—	—	GHD Reference Spectra
MRF_Forklift1	MRF - Forklift Moving Bails Route1	PWL (dB)	31.0	117.0	112.0	105.0	107.0	104.0	103.0	100.0	91.0	119.0							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	90.8	95.9	96.4	103.8	104.0	104.2	101.0	89.9	**109.9**	No	0	5.7	—	10/0/0	15	GHD Reference Spectra
MRF_GlassRo	MRF - Glass falling into Rolloff Bin	PWL (dB)	119.5	112.2	107.2	102.6	104.8	108.7	112.2	110.4	104.4	121.9							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	80.1	86.0	91.1	94.0	101.6	108.7	113.4	111.4	103.3	**116.7**	No	0	6.8	30/0/0	—	—	GHD Reference Spectra
MRP1	Mini Road Planer	PWL (dB)	103.0	103.0	98.0	101.0	96.0	93.0	87.0	84.0	79.0	108.2							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	63.6	76.8	81.9	92.4	92.8	93.0	88.2	85.0	77.9	**98.4**	No	0	8.6	30/0/0	—	—	BS:5228 Reference Spectra
MRP2	Mini Road Planer	PWL (dB)	103.0	103.0	98.0	101.0	96.0	93.0	87.0	84.0	79.0	108.2							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	63.6	76.8	81.9	92.4	92.8	93.0	88.2	85.0	77.9	**98.4**	No	0	8.9	30/0/0	—	—	BS:5228 Reference Spectra
MWF_HVAC1	MWF - Office HVAC	PWL (dB)	—	83.2	87.4	83.5	82.8	83.0	77.7	71.8	67.0	91.6							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	57.0	71.3	74.9	79.6	83.0	78.9	72.8	65.9	**86.4**	No	0	15.1	60/60/60	—	—	GHD Reference Spectra
MWF_HVAC2	MWF - Office HVAC	PWL (dB)	—	83.2	87.4	83.5	82.8	83.0	77.7	71.8	67.0	91.6							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	57.0	71.3	74.9	79.6	83.0	78.9	72.8	65.9	**86.4**	No	0	15.1	60/60/60	—	—	GHD Reference Spectra
MW_TR1	Medical Waste Bldg. - Inbound/Outbound Truck Route	PWL (dB)	31.0	117.0	112.0	105.0	107.0	104.0	103.0	100.0	91.0	119.0							Referenced from British Standard 5228-1:2009+A1:2014
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								Code of practice for noise and vibration control on construction and open sites (BS:5228)
		PWL (dBA)	—	90.8	95.9	96.4	103.8	104.0	104.2	101.0	89.9	**109.9**	No	0	4.3	—	2/0/0	20	Lorry - 26T 235kW - BS:5228 Table C.11-16
Main_HVAC1	Maintence Bldg. - Office HVAC	PWL (dB)	—	83.2	87.4	83.5	82.8	83.0	77.7	71.8	67.0	91.6							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	57.0	71.3	74.9	79.6	83.0	78.9	72.8	65.9	**86.4**	No	0	11.9	60/60/60	—	—	GHD Reference Spectra
Main_HVAC2	Maintence Bldg. - Office HVAC	PWL (dB)	—	83.2	87.4	83.5	82.8	83.0	77.7	71.8	67.0	91.6							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	57.0	71.3	74.9	79.6	83.0	78.9	72.8	65.9	**86.4**	No	0	11.9	60/60/60	—	—	GHD Reference Spectra
Main_TR1	Maintence Bldg. - Inbound/Outbound Truck Route	PWL (dB)	31.0	117.0	112.0	105.0	107.0	104.0	103.0	100.0	91.0	119.0							Referenced from British Standard 5228-1:2009+A1:2014
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								Code of practice for noise and vibration control on construction and open sites (BS:5228)
		PWL (dBA)	—	90.8	95.9	96.4	103.8	104.0	104.2	101.0	89.9	**109.9**	No	0	8.1	—	2/0/0	20	Lorry - 26T 235kW - BS:5228 Table C.11-16
Maintenance_	Maintenance Bldg Open Bay Door	PWL (dB)	31.1	88.1	82.1	83.1	91.1	101.1	108.1	104.1	104.1	111.1							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.3	61.9	66.0	74.5	87.9	101.1	109.3	105.1	103.0	**111.8**	No	0	4.5	5/0/0	—	—	GHD Reference Spectra
Maintenance_	Maintenance Bldg Open Bay Door	PWL (dB)	31.1	88.1	82.1	83.1	91.1	101.1	108.1	104.1	104.1	111.1							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.3	61.9	66.0	74.5	87.9	101.1	109.3	105.1	103.0	**111.8**	No	0	5.2	5/0/0	—	—	GHD Reference Spectra
PT1	Pneumatic Tool	PWL (dB)	106.0	106.0	105.0	106.0	103.0	105.0	106.0	111.0	111.0	116.9							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	66.6	79.8	88.9	97.4	99.8	105.0	107.2	112.0	109.9	**115.5**	No	0	4.9	30/0/0	—	—	BS:5228 Reference Spectra
PT2	Pneumatic Tool	PWL (dB)	106.0	106.0	105.0	106.0	103.0	105.0	106.0	111.0	111.0	116.9							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	66.6	79.8	88.9	97.4	99.8	105.0	107.2	112.0	109.9	**115.5**	No	0	5.0	30/0/0	—	—	BS:5228 Reference Spectra
PT3	Pneumatic Tool	PWL (dB)	106.0	106.0	105.0	106.0	103.0	105.0	106.0	111.0	111.0	116.9							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	66.6	79.8	88.9	97.4	99.8	105.0	107.2	112.0	109.9	**115.5**	No	0	5.5	30/0/0	—	—	BS:5228 Reference Spectra
PT4	Pneumatic Tool	PWL (dB)	106.0	106.0	105.0	106.0	103.0	105.0	106.0	111.0	111.0	116.9							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	66.6	79.8	88.9	97.4	99.8	105.0	107.2	112.0	109.9	**115.5**	No	0	8.0	30/0/0	—	—	BS:5228 Reference Spectra
PT5	Pneumatic Tool	PWL (dB)	106.0	106.0	105.0	106.0	103.0	105.0	106.0	111.0	111.0	116.9							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	66.6	79.8	88.9	97.4	99.8	105.0	107.2	112.0	109.9	**115.5**	No	0	6.5	30/0/0	—	—	BS:5228 Reference Spectra
PV1	Poker Vibrator	PWL (dB)	113.0	113.0	111.0	111.0	104.0	100.0	103.0	101.0	96.0	118.6							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	73.6	86.8	94.9	102.4	100.8	100.0	104.2	102.0	94.9	**109.5**	No	0	4.6	30/0/0	—	—	BS:5228 Reference Spectra
PV2	Poker Vibrator	PWL (dB)	113.0	113.0	111.0	111.0	104.0	100.0	103.0	101.0	96.0	118.6							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	73.6	86.8	94.9	102.4	100.8	100.0	104.2	102.0	94.9	**109.5**	No	0	4.2	30/0/0	—	—	BS:5228 Reference Spectra

Table C.3

Noise Source Sound Level Summary
Dart
IWSMS, George Town, Cayman Islands

Cadna A ID	Noise Source Description		32	63	125	250	500	1000	2000	4000	8000	Unadjusted Total Sound Power Level (dBA)	Tonal Penalty Assessment	(dBA)	Height Absolute (m)	Operating Time Day/Eve/Night (min)	Vehicle Volumes Day/Eve/Night (veh/hr)	Speed (km/hr)	Reference/Comments
			1/1 Octave Band Data																
PV3	Poker Vibrator	PWL (dB)	113.0	113.0	111.0	111.0	104.0	100.0	103.0	101.0	96.0	118.6							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	73.6	86.8	94.9	102.4	100.8	100.0	104.2	102.0	94.9	**109.5**	No	0	8.4	30/0/0	—	—	BS:5228 Reference Spectra
PV4	Poker Vibrator	PWL (dB)	113.0	113.0	111.0	111.0	104.0	100.0	103.0	101.0	96.0	118.6							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	73.6	86.8	94.9	102.4	100.8	100.0	104.2	102.0	94.9	**109.5**	No	0	8.8	30/0/0	—	—	BS:5228 Reference Spectra
PV5	Poker Vibrator	PWL (dB)	113.0	113.0	111.0	111.0	104.0	100.0	103.0	101.0	96.0	118.6							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	73.6	86.8	94.9	102.4	100.8	100.0	104.2	102.0	94.9	**109.5**	No	0	7.0	30/0/0	—	—	BS:5228 Reference Spectra
PaverRoute1	Paver	PWL (dB)	31.0	117.0	112.0	105.0	107.0	104.0	103.0	100.0	91.0	119.0							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	90.8	95.9	96.4	103.8	104.0	104.2	101.0	89.9	**109.9**	No	0	5.2	60/0/0	—	—	BS:5228 Reference Spectra
PaverRoute2	Paver	PWL (dB)	31.0	117.0	112.0	105.0	107.0	104.0	103.0	100.0	91.0	119.0							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	90.8	95.9	96.4	103.8	104.0	104.2	101.0	89.9	**109.9**	No	0	8.8	60/0/0	—	—	BS:5228 Reference Spectra
PaverRoute3	Paver	PWL (dB)	31.0	117.0	112.0	105.0	107.0	104.0	103.0	100.0	91.0	119.0							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	90.8	95.9	96.4	103.8	104.0	104.2	101.0	89.9	**109.9**	No	0	5.2	60/0/0	—	—	BS:5228 Reference Spectra
Phase2Landfil	Landfill Excavator	PWL (dB)	31.0	111.0	110.0	107.0	108.0	104.0	101.0	97.0	90.0	115.8							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	84.8	93.9	98.4	104.8	104.0	102.2	98.0	88.9	**109.5**	No	0	7.0	60/0/0	—	—	BS:5228 Reference Spectra
Piling1	Piling - Precast Concrete	PWL (dB)	113.0	113.0	113.0	113.0	120.0	114.0	109.0	106.0	101.0	123.4							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	73.6	86.8	96.9	104.4	116.8	114.0	110.2	107.0	99.9	**119.7**	No	0	8.4	12/0/0	—	—	BS:5228 Reference Spectra
Piling2	Piling - Precast Concrete	PWL (dB)	113.0	113.0	113.0	113.0	120.0	114.0	109.0	106.0	101.0	123.4							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	73.6	86.8	96.9	104.4	116.8	114.0	110.2	107.0	99.9	**119.7**	No	0	9.1	12/0/0	—	—	BS:5228 Reference Spectra
Piling3	Piling - Precast Concrete	PWL (dB)	113.0	113.0	113.0	113.0	120.0	114.0	109.0	106.0	101.0	123.4							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	73.6	86.8	96.9	104.4	116.8	114.0	110.2	107.0	99.9	**119.7**	No	0	10.6	12/0/0	—	—	BS:5228 Reference Spectra
Piling4	Piling - Precast Concrete	PWL (dB)	113.0	113.0	113.0	113.0	120.0	114.0	109.0	106.0	101.0	123.4							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	73.6	86.8	96.9	104.4	116.8	114.0	110.2	107.0	99.9	**119.7**	No	0	11.0	12/0/0	—	—	BS:5228 Reference Spectra
RP1	Road Planer	PWL (dB)	112.0	112.0	118.0	110.0	108.0	108.0	105.0	101.0	98.0	120.9							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	72.6	85.8	101.9	101.4	104.8	108.0	106.2	102.0	96.9	**112.7**	No	0	4.6	30/0/0	—	—	BS:5228 Reference Spectra
RP2	Road Planer	PWL (dB)	112.0	112.0	118.0	110.0	108.0	108.0	105.0	101.0	98.0	120.9							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	72.6	85.8	101.9	101.4	104.8	108.0	106.2	102.0	96.9	**112.7**	No	0	5.0	30/0/0	—	—	BS:5228 Reference Spectra
RP3	Road Planer	PWL (dB)	112.0	112.0	118.0	110.0	108.0	108.0	105.0	101.0	98.0	120.9							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	72.6	85.8	101.9	101.4	104.8	108.0	106.2	102.0	96.9	**112.7**	No	0	4.6	30/0/0	—	—	BS:5228 Reference Spectra
RR1	Road Roller	PWL (dB)	118.0	118.0	116.0	106.0	104.0	106.0	104.0	100.0	94.0	122.6							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	78.6	91.8	99.9	97.4	100.8	106.0	105.2	101.0	92.9	**110.7**	No	0	8.9	12/0/0	—	—	BS:5228 Reference Spectra
RR2	Road Roller	PWL (dB)	118.0	118.0	116.0	106.0	104.0	106.0	104.0	100.0	94.0	122.6							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	78.6	91.8	99.9	97.4	100.8	106.0	105.2	101.0	92.9	**110.7**	No	0	5.2	12/0/0	—	—	BS:5228 Reference Spectra
SCM1	Small Cement Mixer	PWL (dB)	92.0	92.0	96.0	89.0	89.0	88.0	84.0	82.0	80.0	99.9							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	52.6	65.8	79.9	80.4	85.8	88.0	85.2	83.0	78.9	**92.6**	No	0	4.2	30/0/0	—	—	BS:5228 Reference Spectra
SCM2	Small Cement Mixer	PWL (dB)	92.0	92.0	96.0	89.0	89.0	88.0	84.0	82.0	80.0	99.9							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	52.6	65.8	79.9	80.4	85.8	88.0	85.2	83.0	78.9	**92.6**	No	0	5.3	30/0/0	—	—	BS:5228 Reference Spectra
SCM3	Small Cement Mixer	PWL (dB)	92.0	92.0	96.0	89.0	89.0	88.0	84.0	82.0	80.0	99.9							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	52.6	65.8	79.9	80.4	85.8	88.0	85.2	83.0	78.9	**92.6**	No	0	8.7	30/0/0	—	—	BS:5228 Reference Spectra
S_BAP_Roof(	BAP Building - Rooftop General Exhaust	PWL (dB)	—	92.0	92.0	86.0	82.0	78.0	76.0	71.0	62.0	95.8							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	65.8	75.9	77.4	78.8	78.0	77.2	72.0	60.9	**84.9**	No	0	15.9	60/60/60	—	—	GHD Reference Spectra
S_BAP_Roof(	BAP Building - Rooftop General Exhaust	PWL (dB)	—	92.0	92.0	86.0	82.0	78.0	76.0	71.0	62.0	95.8							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	65.8	75.9	77.4	78.8	78.0	77.2	72.0	60.9	**84.9**	No	0	15.9	60/60/60	—	—	GHD Reference Spectra
S_BAP_SW_(	BAP Building - Sidewall Exhaust	PWL (dB)	—	92.0	92.0	86.0	82.0	78.0	76.0	71.0	62.0	95.8							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	65.8	75.9	77.4	78.8	78.0	77.2	72.0	60.9	**84.9**	No	0	11.0	60/60/60	—	—	GHD Reference Spectra
S_BAP_SW_(	BAP Building - Sidewall Exhaust	PWL (dB)	—	92.0	92.0	86.0	82.0	78.0	76.0	71.0	62.0	95.8							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	65.8	75.9	77.4	78.8	78.0	77.2	72.0	60.9	**84.9**	No	0	11.0	60/60/60	—	—	GHD Reference Spectra

Table C.3

Noise Source Sound Level Summary
Dart
IWSMS, George Town, Cayman Islands

Cadna A ID	Noise Source Description		1/1 Octave Band Data 32	63	125	250	500	1000	2000	4000	8000	Unadjusted Total Sound Power Level (dBA)	Tonal Penalty Assessment	(dBA)	Height Absolute (m)	Operating Time Day/Eve/Night (min)	Vehicle Volumes Day/Eve/Night (veh/hr)	Speed (km/hr)	Reference/Comments
S_BAP_SW_(	BAP Building - Sidewall Exhaust	PWL (dB)	—	92.0	92.0	86.0	82.0	78.0	76.0	71.0	62.0	95.8							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	65.8	75.9	77.4	78.8	78.0	77.2	72.0	60.9	**84.9**	No	0	11.1	60/60/60	—	—	GHD Reference Spectra
S_BAP_SW_(	BAP Building - Sidewall Exhaust	PWL (dB)	—	92.0	92.0	86.0	82.0	78.0	76.0	71.0	62.0	95.8							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	65.8	75.9	77.4	78.8	78.0	77.2	72.0	60.9	**84.9**	No	0	11.1	60/60/60	—	—	GHD Reference Spectra
S_CDF_Roof(	CDF Building - Rooftop General Exhaust	PWL (dB)	—	92.0	92.0	86.0	82.0	78.0	76.0	71.0	62.0	95.8							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	65.8	75.9	77.4	78.8	78.0	77.2	72.0	60.9	**84.9**	No	0	11.0	60/60/60	—	—	GHD Reference Spectra
S_CDF_Roof(	CDF Building - Rooftop General Exhaust	PWL (dB)	—	92.0	92.0	86.0	82.0	78.0	76.0	71.0	62.0	95.8							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	65.8	75.9	77.4	78.8	78.0	77.2	72.0	60.9	**84.9**	No	0	11.0	60/60/60	—	—	GHD Reference Spectra
S_CD_BAF_L(	C&D_BAF Front End Loader Material Handling Area	PWL (dB)	83.7	85.7	84.7	81.7	83.7	84.7	80.7	78.7	74.7	92.5							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	44.3	59.5	68.6	73.1	80.5	84.7	81.9	79.7	73.6	**88.5**	No	0	4.5	60/0/0	—	—	GHD Reference Spectra
S_ELV_Crane	Excavator w Grapple Moving Vehicles	PWL (dB)	104.3	108.9	104.7	101.2	95.7	96.0	89.5	83.0	78.9	111.9							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	64.9	82.7	88.6	92.6	92.5	96.0	90.7	84.0	77.8	**100.0**	No	0	6.3	30/0/0	—	—	GHD Reference Spectra
S_ELV_Hydra	Hydraulic shear/baler	PWL (dB)	101.9	109.7	99.6	92.1	102.8	103.1	99.3	98.7	96.0	112.5							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	62.5	83.5	83.5	83.5	99.6	103.1	100.5	99.7	94.9	**107.3**	No	0	8.4	30/0/0	—	—	GHD Reference Spectra
S_ELV_Loade	ELV_Front End Loader Material Handling With Broom	PWL (dB)	66.2	68.2	67.2	64.2	66.2	67.2	63.2	61.2	57.2	75.0							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	26.8	42.0	51.1	55.6	63.0	67.2	64.4	62.2	56.1	**71.0**	No	0	4.9	60/0/0	—	—	GHD Reference Spectra
S_ELV_Torchi	Torch Cutting	PWL (dB)	91.3	90.0	93.7	82.9	84.9	90.4	92.8	93.6	97.0	101.9							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	51.9	63.8	77.6	74.3	81.7	90.4	94.0	94.6	95.9	**100.3**	No	0	5.2	60/0/0	—	—	GHD Reference Spectra
S_ELV_Truck_	Truck Idling	PWL (dB)	92.6	91.7	91.6	91.9	95.6	96.3	91.8	86.4	80.4	102.1							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	53.2	65.5	75.5	83.3	92.4	96.3	93.0	87.4	79.3	**99.5**	No	0	7.7	60/0/0	—	—	GHD Reference Spectra
S_ERF_ACC	Air Cooled Condenser unit (ACC)	PWL (dB)	91.1	87.1	83.1	83.1	96.1	79.1	77.1	75.1	70.1	98.1							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	51.7	60.9	67.0	74.5	92.9	79.1	78.3	76.1	69.0	**93.4**	No	0	11.3	60/60/60	—	—	GHD Reference Spectra
S_ERF_BayD(	ERF Building_Tipping Hall BayDoor#1	PWL (dB)	83.3	83.3	84.8	82.3	82.8	81.7	79.3	72.1	63.5	91.2							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	43.9	57.1	68.7	73.7	79.6	81.7	80.5	73.1	62.4	**86.0**	No	0	10.2	60/0/0	—	—	GHD Reference Spectra
S_ERF_BayD(	ERF Building_Tipping Hall BayDoor#2	PWL (dB)	87.3	87.3	88.8	86.3	86.8	85.7	83.3	76.1	67.5	95.2							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	47.9	61.1	72.7	77.7	83.6	85.7	84.5	77.1	66.4	**90.0**	No	0	12.5	60/0/0	—	—	GHD Reference Spectra
S_ERF_Comp	ERF Building - Compressor Exhaust	PWL (dB)	—	92.0	94.0	92.0	96.0	92.0	86.0	81.0	80.0	100.7							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	65.8	77.9	83.4	92.8	92.0	87.2	82.0	78.9	**96.6**	No	0	9.1	60/60/60	—	—	GHD Reference Spectra
S_ERF_Comp	ERF Building - Compressor Exhaust	PWL (dB)	—	92.0	94.0	92.0	96.0	92.0	86.0	81.0	80.0	100.7							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	65.8	77.9	83.4	92.8	92.0	87.2	82.0	78.9	**96.6**	No	0	9.2	60/60/60	—	—	GHD Reference Spectra
S_ERF_Comp	ERF Building - Compressor Intake	PWL (dB)	—	95.0	97.0	95.0	99.0	95.0	89.0	84.0	83.0	103.8							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	68.8	80.9	86.4	95.8	95.0	90.2	85.0	81.9	**99.6**	No	0	8.7	60/60/60	—	—	GHD Reference Spectra
S_ERF_MainS	ERF Building - Stack Exhaust	PWL (dB)	—	115.0	110.0	107.0	100.0	96.0	94.0	90.0	87.0	116.9							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	88.8	93.9	98.4	96.8	96.0	95.2	91.0	85.9	**103.8**	No	0	47.5	60/60/60	—	—	GHD Reference Spectra
S_ERF_MainS	ERF Building - ID Fan for Stack Exhaust	PWL (dB)	—	115.0	110.0	107.0	100.0	96.0	94.0	90.0	87.0	116.9							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	88.8	93.9	98.4	96.8	96.0	95.2	91.0	85.9	**103.8**	No	0	9.0	60/60/60	—	—	GHD Reference Spectra
S_ERF_Roof(	ERF Building - Rooftop General Exhaust	PWL (dB)	—	92.0	92.0	86.0	82.0	78.0	76.0	71.0	62.0	95.8							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	65.8	75.9	77.4	78.8	78.0	77.2	72.0	60.9	**84.9**	No	0	26.9	60/60/60	—	—	GHD Reference Spectra
S_ERF_Roof(	ERF Building - Rooftop General Exhaust	PWL (dB)	—	92.0	92.0	86.0	82.0	78.0	76.0	71.0	62.0	95.8							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	65.8	75.9	77.4	78.8	78.0	77.2	72.0	60.9	**84.9**	No	0	26.9	60/60/60	—	—	GHD Reference Spectra
S_ERF_SiloBl	ERF Building - Silo Blower Truck	PWL (dB)	120.3	104.0	104.6	103.3	102.9	98.0	97.8	96.8	96.7	120.7							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	80.9	77.8	88.5	94.7	99.7	98.0	99.0	97.8	95.6	**105.7**	No	0	6.8	60/0/0	—	—	GHD Reference Spectra
S_ERF_Turbir	Generator Enclosure Air Inlet	PWL (dB)	105.0	99.0	98.0	96.0	94.0	90.0	89.0	94.0	101.0	108.4							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	65.6	72.8	81.9	87.4	90.8	90.0	90.2	95.0	99.9	**102.3**	No	0	26.9	60/60/60	—	—	GHD Reference Spectra
S_ERF_Turbir	Generator Enclosure Exhaust	PWL (dB)	105.0	99.0	98.0	96.0	93.0	89.0	88.0	92.0	101.0	108.3							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	65.6	72.8	81.9	87.4	89.8	89.0	89.2	93.0	99.9	**101.8**	No	0	26.9	60/60/60	—	—	GHD Reference Spectra

Table C.3

Noise Source Sound Level Summary
Dart
IWSMS, George Town, Cayman Islands

Cadna A ID	Noise Source Description		32	63	125	250	500	1000	2000	4000	8000	Unadjusted Total Sound Power Level (dBA)	Tonal Penalty Assessment	(dBA)	Height Absolute (m)	Operating Time Day/Eve/Night (min)	Vehicle Volumes Day/Eve/Night (veh/hr)	Speed (km/hr)	Reference/Comments
S_ERF_Turbir	Combustion Air Inlet Stack	PWL (dB)	—	96.5	82.5	68.5	58.5	55.5	63.5	78.5	103.5	104.3							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	70.3	66.4	59.9	55.3	55.5	64.7	79.5	102.4	**102.4**	No	0	26.9	60/60/60	—	—	GHD Reference Spectra
S_ERF_Turbir	Heat Recovery Steam Generator Stack	PWL (dB)	—	105.5	91.5	85.5	81.5	77.5	76.5	69.5	56.5	105.7							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	79.3	75.4	76.9	78.3	77.5	77.7	70.5	55.4	**85.6**	No	0	26.9	60/60/60	—	—	GHD Reference Spectra
S_ERF_Turbir	Turbine Enclosure Exhaust	PWL (dB)	111.5	103.5	98.5	96.5	93.5	91.5	90.5	95.5	101.5	113.0							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	72.1	77.3	82.4	87.9	90.3	91.5	91.7	96.5	100.4	**103.1**	No	0	26.9	60/60/60	—	—	GHD Reference Spectra
S_ERF_Turbir	Turbine - After Cooler	PWL (dB)	88.2	89.2	90.2	91.2	91.2	91.2	89.2	85.2	84.2	99.0							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	48.8	63.0	74.1	82.6	88.0	91.2	90.4	86.2	83.1	**95.9**	No	0	26.9	60/60/60	—	—	GHD Reference Spectra
S_ERF_Turbir	Turbine - Oil Cooler	PWL (dB)	88.2	89.2	90.2	91.2	91.2	91.2	89.2	85.2	84.2	99.0							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	48.8	63.0	74.1	82.6	88.0	91.2	90.4	86.2	83.1	**95.9**	No	0	26.9	60/60/60	—	—	GHD Reference Spectra
S_MRF_Roof(	MRF Building - Rooftop General Exhaust	PWL (dB)	—	92.0	92.0	86.0	82.0	78.0	76.0	71.0	62.0	95.8							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	65.8	75.9	77.4	78.8	78.0	77.2	72.0	60.9	**84.9**	No	0	16.0	60/60/60	—	—	GHD Reference Spectra
S_MRF_Roof(	MRF Building - Rooftop General Exhaust	PWL (dB)	—	92.0	92.0	86.0	82.0	78.0	76.0	71.0	62.0	95.8							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	65.8	75.9	77.4	78.8	78.0	77.2	72.0	60.9	**84.9**	No	0	16.0	60/60/60	—	—	GHD Reference Spectra
S_Phase2Lan	Landfill Bulldozer - Future Phase 2 Cell Conditions	PWL (dB)	14.6	88.6	90.6	87.6	85.6	85.6	82.6	78.6	72.6	95.4							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-24.8	62.4	74.5	79.0	82.4	85.6	83.8	79.6	71.5	**90.0**	No	0	7.0	60/0/0	—	—	GHD Reference Spectra
S_Phase2Lan	Landfill Compactor - Future Phase 2 Landfill Conditions	PWL (dB)	31.0	104.0	106.0	101.0	97.0	99.0	95.0	89.0	81.0	109.8							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	77.8	89.9	92.4	93.8	99.0	96.2	90.0	79.9	**102.6**	No	0	7.0	60/0/0	—	—	GHD Reference Spectra
S_TR1	Phase 2 Final Landfill Cell - Inbound/Outbound Truck Route	PWL (dB)	31.0	117.0	112.0	105.0	107.0	104.0	103.0	100.0	91.0	119.0							Referenced from British Standard 5228-1:2009+A1:2014
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								Code of practice for noise and vibration control on construction and open sites (BS:5228)
		PWL (dBA)	—	90.8	95.9	96.4	103.8	104.0	104.2	101.0	89.9	**109.9**	No	0	6.0	—	26/0/0	20	Lorry - 26T 235kW - BS:5228 Table C.11-16
S_Weigh Scal	Weigh Scale - Idling Truck	PWL (dB)	—	96.0	91.0	86.0	93.0	90.0	91.0	85.0	74.0	100.1							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-39.4	69.8	74.9	77.4	89.8	90.0	92.2	86.0	72.9	**96.2**	No	0	5.7	60/0/0	—	—	GHD Reference Spectra
S_Weigh Scal	Weigh Scale - Idling Truck	PWL (dB)	—	96.0	91.0	86.0	93.0	90.0	91.0	85.0	74.0	100.1							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-39.4	69.8	74.9	77.4	89.8	90.0	92.2	86.0	72.9	**96.2**	No	0	5.8	60/0/0	—	—	GHD Reference Spectra
TH	Telescopic Handler	PWL (dB)	110.0	110.0	104.0	97.0	96.0	109.0	97.0	85.0	78.0	115.0							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	70.6	83.8	87.9	88.4	92.8	109.0	98.2	86.0	76.9	**109.5**	No	0	7.3	30/0/0	—	—	BS:5228 Reference Spectra
TP1	Truck-mounted Pump	PWL (dB)	114.0	114.0	108.0	106.0	106.0	105.0	106.0	98.0	94.0	118.6							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	74.6	87.8	91.9	97.4	102.8	105.0	107.2	99.0	92.9	**110.8**	No	0	5.3	12/0/0	—	—	BS:5228 Reference Spectra
TP2	Truck-mounted Pump	PWL (dB)	114.0	114.0	108.0	106.0	106.0	105.0	106.0	98.0	94.0	118.6							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	74.6	87.8	91.9	97.4	102.8	105.0	107.2	99.0	92.9	**110.8**	No	0	5.3	12/0/0	—	—	BS:5228 Reference Spectra
TP3	Truck-mounted Pump	PWL (dB)	114.0	114.0	108.0	106.0	106.0	105.0	106.0	98.0	94.0	118.6							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	74.6	87.8	91.9	97.4	102.8	105.0	107.2	99.0	92.9	**110.8**	No	0	7.0	12/0/0	—	—	BS:5228 Reference Spectra
TP4	Truck-mounted Pump	PWL (dB)	114.0	114.0	108.0	106.0	106.0	105.0	106.0	98.0	94.0	118.6							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	74.6	87.8	91.9	97.4	102.8	105.0	107.2	99.0	92.9	**110.8**	No	0	7.3	12/0/0	—	—	BS:5228 Reference Spectra
TP5	Truck-mounted Pump	PWL (dB)	114.0	114.0	108.0	106.0	106.0	105.0	106.0	98.0	94.0	118.6							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	74.6	87.8	91.9	97.4	102.8	105.0	107.2	99.0	92.9	**110.8**	No	0	5.5	12/0/0	—	—	BS:5228 Reference Spectra
TP6	Truck-mounted Pump	PWL (dB)	114.0	114.0	108.0	106.0	106.0	105.0	106.0	98.0	94.0	118.6							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	74.6	87.8	91.9	97.4	102.8	105.0	107.2	99.0	92.9	**110.8**	No	0	5.1	12/0/0	—	—	BS:5228 Reference Spectra
TP7	Truck-mounted Pump	PWL (dB)	114.0	114.0	108.0	106.0	106.0	105.0	106.0	98.0	94.0	118.6							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	74.6	87.8	91.9	97.4	102.8	105.0	107.2	99.0	92.9	**110.8**	No	0	8.0	12/0/0	—	—	BS:5228 Reference Spectra
TP8	Truck-mounted Pump	PWL (dB)	114.0	114.0	108.0	106.0	106.0	105.0	106.0	98.0	94.0	118.6							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	74.6	87.8	91.9	97.4	102.8	105.0	107.2	99.0	92.9	**110.8**	No	0	7.5	12/0/0	—	—	BS:5228 Reference Spectra
TR1	Construction Truck Route	PWL (dB)	31.0	117.0	112.0	105.0	107.0	104.0	103.0	100.0	91.0	119.0							Referenced from British Standard 5228-1:2009+A1:2014
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								Code of practice for noise and vibration control on construction and open sites (BS:5228)
		PWL (dBA)	—	90.8	95.9	96.4	103.8	104.0	104.2	101.0	89.9	**109.9**	No	0	8.5	—	7/0/0	20	Articulated Dump Truck - BS:5228 Table C.4-5
VC1	Vibratory Compactor	PWL (dB)	112.0	112.0	107.0	103.0	104.0	103.0	103.0	99.0	94.0	116.7							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	72.6	85.8	90.9	94.4	100.8	103.0	104.2	100.0	92.9	**108.7**	No	0	4.8	12/0/0	—	—	BS:5228 Reference Spectra

Table C.3

Noise Source Sound Level Summary
Dart
IWSMS, George Town, Cayman Islands

Cadna A ID	Noise Source Description		1/1 Octave Band Data 32	63	125	250	500	1000	2000	4000	8000	Unadjusted Total Sound Power Level (dBA)	Tonal Penalty Assessment	(dBA)	Height Absolute (m)	Operating Time Day/Eve/Night (min)	Vehicle Volumes Day/Eve/Night (veh/hr)	Speed (km/hr)	Reference/Comments
VR1	Vibratory Roller	PWL (dB)	119.0	119.0	114.0	100.0	99.0	98.0	96.0	93.0	90.0	122.7							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	79.6	92.8	97.9	91.4	95.8	98.0	97.2	94.0	88.9	**104.5**	No	0	4.9	12/0/0	—	—	BS:5228 Reference Spectra
VR2	Vibratory Roller	PWL (dB)	119.0	119.0	114.0	100.0	99.0	98.0	96.0	93.0	90.0	122.7							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	79.6	92.8	97.9	91.4	95.8	98.0	97.2	94.0	88.9	**104.5**	No	0	5.0	12/0/0	—	—	BS:5228 Reference Spectra
W1	Welder	PWL (dB)	98.0	98.0	99.0	100.0	99.0	100.0	97.0	92.0	87.0	107.5							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	58.6	71.8	82.9	91.4	95.8	100.0	98.2	93.0	85.9	**103.9**	No	0	4.9	24/0/0	—	—	BS:5228 Reference Spectra
W2	Welder	PWL (dB)	98.0	98.0	99.0	100.0	99.0	100.0	97.0	92.0	87.0	107.5							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	58.6	71.8	82.9	91.4	95.8	100.0	98.2	93.0	85.9	**103.9**	No	0	6.4	24/0/0	—	—	BS:5228 Reference Spectra
W3	Welder	PWL (dB)	98.0	98.0	99.0	100.0	99.0	100.0	97.0	92.0	87.0	107.5							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	58.6	71.8	82.9	91.4	95.8	100.0	98.2	93.0	85.9	**103.9**	No	0	8.5	24/0/0	—	—	BS:5228 Reference Spectra
W4	Welder	PWL (dB)	98.0	98.0	99.0	100.0	99.0	100.0	97.0	92.0	87.0	107.5							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	58.6	71.8	82.9	91.4	95.8	100.0	98.2	93.0	85.9	**103.9**	No	0	6.5	24/0/0	—	—	BS:5228 Reference Spectra
W5	Welder	PWL (dB)	98.0	98.0	99.0	100.0	99.0	100.0	97.0	92.0	87.0	107.5							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	58.6	71.8	82.9	91.4	95.8	100.0	98.2	93.0	85.9	**103.9**	No	0	5.3	24/0/0	—	—	BS:5228 Reference Spectra
WP	Water Pump	PWL (dB)	104.0	104.0	99.0	93.0	93.0	92.0	87.0	84.0	72.0	108.1							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	64.6	77.8	82.9	84.4	89.8	92.0	88.2	85.0	70.9	**96.1**	No	0	6.8	30/0/0	—	—	BS:5228 Reference Spectra
WWS	Wheel Wash Station	PWL (dB)	101.9	105.4	102.9	97.5	96.2	95.0	98.1	93.3	92.0	109.7							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	62.5	79.2	86.8	88.9	93.0	95.0	99.3	94.3	90.9	**102.8**	No	0	8.0	30/0/0	—	—	BS:5228 Reference Spectra

Appendix D

Baseline Noise Monitoring Data and Photos

Table D.1

Environmental Sound Level Measurements, LAEQ - Validated Background Measurements - NSR1
Dart
Georgetown, Cayman Islands

Day of Week	Date	Time	LAeq [2], [3]	L_{AS10} [2]	L_{AS90} [2]	L_{ASMin} [2]	L_{ASMax} [2]	Daytime Period Average LASeq 11 hour	Evening Period Average LASeq 5 hour	Nighttime Period Average LASeq 8 hour	Daytime Period Average LAS10eq 18 hour	Daytime Period Average LAS90 11 hour	Evening Period Average LAS90 5 hour	Nighttime Period Average LAS90 8 hour	Daily Average LAeq [2], [3]	Daily Average L_{AS90} [2]	Wind Spd (km/h) [1]	Temperature (°C)	Weather	Comments
Tuesday	10/19/2021	1:00 PM	62	64	58	54	78										4	27	Light Rain	Rain
Tuesday	10/19/2021	2:00 PM	63	64	58	53	84										9	27	Light Rain	Rain
Tuesday	10/19/2021	3:00 PM	62	64	58	55	83	62				58					9	28	Light Rain	Rain
Tuesday	10/19/2021	4:00 PM	61	63	58	52	76										11	28	Thunderstorms	Rain
Tuesday	10/19/2021	5:00 PM	62	63	59	53	81										7	28	Clouds	
Tuesday	10/19/2021	6:00 PM	60	62	56	53	71				62				59	54	15	28	Light Rain	Rain
Tuesday	10/19/2021	7:00 PM	58	61	54	47	70										13	28	Light Rain	Rain
Tuesday	10/19/2021	8:00 PM	56	59	50	46	70		58								11	28	Clouds	
Tuesday	10/19/2021	9:00 PM	56	59	51	47	72						50				13	28	Clouds	
Tuesday	10/19/2021	10:00 PM	57	58	48	44	84										13	28	Clouds	
Tuesday	10/19/2021	11:00 PM	53	56	47	45	69										NA	NA	NA	
Wednesday	10/20/2021	12:00 AM	52	55	46	44	69										NA	NA	NA	
Wednesday	10/20/2021	1:00 AM	54	51	44	42	82										NA	NA	NA	
Wednesday	10/20/2021	2:00 AM	49	52	43	42	63			58							NA	NA	NA	
Wednesday	10/20/2021	3:00 AM	52	55	44	42	70							47			NA	NA	NA	
Wednesday	10/20/2021	4:00 AM	56	59	45	43	76										NA	NA	NA	
Wednesday	10/20/2021	5:00 AM	57	61	48	43	73										NA	NA	NA	
Wednesday	10/20/2021	6:00 AM	66	64	52	47	86										11	27	Clouds	
Wednesday	10/20/2021	7:00 AM	66	65	57	53	90										11	27	Clouds	
Wednesday	10/20/2021	8:00 AM	67	65	58	55	89										11	29	Clouds	
Wednesday	10/20/2021	9:00 AM	68	66	59	54	91										22	30	Clouds	Wind >= 20 km/hr
Wednesday	10/20/2021	10:00 AM	64	65	59	54	81										26	30	Scattered Shower	Wind >= 20 km/hr & Rain
Wednesday	10/20/2021	11:00 AM	64	65	58	54	85								60	53	24	30	Scattered Shower	Wind >= 20 km/hr & Rain
Wednesday	10/20/2021	12:00 PM	64	66	60	57	88	65				59					26	30	Clouds	Wind >= 20 km/hr
Wednesday	10/20/2021	1:00 PM	63	65	59	55	79										26	30	Clouds	Wind >= 20 km/hr
Wednesday	10/20/2021	2:00 PM	63	65	59	55	77				64						26	31	Clouds	Wind >= 20 km/hr
Wednesday	10/20/2021	3:00 PM	64	65	59	55	87										22	31	Clouds	Wind >= 20 km/hr
Wednesday	10/20/2021	4:00 PM	65	66	59	55	85										20	30	Clouds	Wind >= 20 km/hr
Wednesday	10/20/2021	5:00 PM	63	64	59	55	86										20	29	Clouds	Wind >= 20 km/hr
Wednesday	10/20/2021	6:00 PM	61	63	57	52	79										19	29	Clouds	
Wednesday	10/20/2021	7:00 PM	59	62	55	49	75										15	29	Clouds	
Wednesday	10/20/2021	8:00 PM	58	61	53	48	69		59				54				13	29	Clouds	
Wednesday	10/20/2021	9:00 PM	58	59	51	47	79										15	28	Clouds	
Wednesday	10/20/2021	10:00 PM	57	59	49	46	82										13	28	Clear	
Wednesday	10/20/2021	11:00 PM	53	56	47	44	67										NA	NA	NA	
Thursday	10/21/2021	12:00 AM	51	54	45	43	68										NA	NA	NA	
Thursday	10/21/2021	1:00 AM	51	53	44	42	70										NA	NA	NA	
Thursday	10/21/2021	2:00 AM	51	53	44	41	68			61				47			NA	NA	NA	
Thursday	10/21/2021	3:00 AM	52	55	43	41	68										NA	NA	NA	
Thursday	10/21/2021	4:00 AM	56	60	45	41	70										NA	NA	NA	
Thursday	10/21/2021	5:00 AM	63	61	48	42	89										NA	NA	NA	
Thursday	10/21/2021	6:00 AM	68	65	52	46	91										4	26	Clouds	
Thursday	10/21/2021	7:00 AM	67	68	57	52	90										7	27	Clouds	
Thursday	10/21/2021	8:00 AM	62	65	57	51	81										9	29	Clouds	
Thursday	10/21/2021	9:00 AM	64	66	56	51	83										13	31	Clouds	
Thursday	10/21/2021	10:00 AM	63	64	56	50	82										11	31	Clouds	
Thursday	10/21/2021	11:00 AM	64	64	57	54	85								60	52	15	32	Clouds	
Thursday	10/21/2021	12:00 PM	65	65	58	55	86	64				57					13	31	Clouds	
Thursday	10/21/2021	1:00 PM	62	64	58	54	77										11	32	Clouds	
Thursday	10/21/2021	2:00 PM	62	64	57	52	78				64						11	31	Clouds	
Thursday	10/21/2021	3:00 PM	63	65	58	53	88										9	30	Clouds	
Thursday	10/21/2021	4:00 PM	64	65	58	54	88										17	30	Clouds	
Thursday	10/21/2021	5:00 PM	61	63	58	54	77										11	30	Clouds	
Thursday	10/21/2021	6:00 PM	61	63	56	50	74										7	29	Clouds	
Thursday	10/21/2021	7:00 PM	59	61	54	49	77										7	29	Clouds	
Thursday	10/21/2021	8:00 PM	58	61	53	49	76		59				53				0	28	Clouds	
Thursday	10/21/2021	9:00 PM	57	59	50	47	75										13	28	Clouds	
Thursday	10/21/2021	10:00 PM	61	58	48	46	89										7	28	Clouds	
Thursday	10/21/2021	11:00 PM	56	57	47	44	79										NA	NA	NA	
Friday	10/22/2021	12:00 AM	51	54	45	44	66										NA	NA	NA	
Friday	10/22/2021	1:00 AM	51	54	44	41	69										NA	NA	NA	
Friday	10/22/2021	2:00 AM	49	52	41	39	65			55				46			NA	NA	NA	
Friday	10/22/2021	3:00 AM	52	55	44	43	69										NA	NA	NA	
Friday	10/22/2021	4:00 AM	54	57	45	43	73										NA	NA	NA	
Friday	10/22/2021	5:00 AM	56	59	46	43	70										NA	NA	NA	
Friday	10/22/2021	6:00 AM	59	63	51	42	75										9	27	Clouds	
Friday	10/22/2021	7:00 AM	64	64	56	51	90										7	27	Clouds	
Friday	10/22/2021	8:00 AM	63	65	57	53	78										11	29	Clouds	
Friday	10/22/2021	9:00 AM	60	63	56	52	73										9	31	Clouds	
Friday	10/22/2021	10:00 AM	60	63	55	50	73										11	31	Clouds	
Friday	10/22/2021	11:00 AM	60	62	55	51	74								58	52	13	31	Clouds	
Friday	10/22/2021	12:00 PM	60	62	55	52	74	61				56					13	31	Scattered Shower	Rain
Friday	10/22/2021	1:00 PM	62	64	56	50	85										13	31	Clouds	
Friday	10/22/2021	2:00 PM	61	63	56	51	81				62						9	32	Clouds	
Friday	10/22/2021	3:00 PM	61	63	56	51	83										9	31	Clouds	
Friday	10/22/2021	4:00 PM	60	62	55	50	76										9	30	Clouds	
Friday	10/22/2021	5:00 PM	62	62	56	53	86										9	30	Tornado	Rain
Friday	10/22/2021	6:00 PM	60	62	56	52	73										7	29	Clouds	
Friday	10/22/2021	7:00 PM	58	60	53	47	72										11	29	Clouds	
Friday	10/22/2021	8:00 PM	59	60	52	47	83		58				53				6	29	Thundershower	Rain
Friday	10/22/2021	9:00 PM	56	59	50	46	76										6	28	Clouds	
Friday	10/22/2021	10:00 PM	55	58	50	45	69										6	28	Clouds	
Friday	10/22/2021	11:00 PM	54	57	48	44	72										NA	NA	NA	
Saturday	10/23/2021	12:00 AM	53	56	47	45	69										NA	NA	NA	
Saturday	10/23/2021	1:00 AM	53	55	46	44	74										NA	NA	NA	
Saturday	10/23/2021	2:00 AM	54	57	45	43	74			59				46			NA	NA	NA	
Saturday	10/23/2021	3:00 AM	52	55	43	42	69										NA	NA	NA	

Table D.1

Environmental Sound Level Measurements, LAEQ - Validated Background Measurements - NSR1
Dart
Georgetown, Cayman Islands

Day of Week	Date	Time	LAeq (2), (3)	L_{AS10} (2)	L_{AS90} (2)	L_{ASMin} (2)	L_{ASMax} (2)	Daytime Period Average LASeq 11 hour	Evening Period Average LASeq 5 hour	Nighttime Period Average LASeq 8 hour	Daytime Period Average LAS10eq 18 hour	Daytime Period Average LAS90 11 hour	Evening Period Average LAS90 5 hour	Nighttime Period Average LAS90 8 hour	Daily Average LAeq (2), (3)	Daily Average L_{AS90} (2)	Wind Spd (km/h) (1)	Temperature (°C)	Weather	Comments
Saturday	10/23/2021	4:00 AM	54	58	45	44	70										NA	NA	NA	
Saturday	10/23/2021	5:00 AM	57	61	46	44	72										NA	NA	NA	
Saturday	10/23/2021	6:00 AM	66	63	49	45	93										6	27	Scattered Shower	Rain
Saturday	10/23/2021	7:00 AM	68	64	53	46	88										6	28	Clouds	
Saturday	10/23/2021	8:00 AM	67	63	53	49	89										11	29	Clouds	
Saturday	10/23/2021	9:00 AM	59	62	55	50	74										19	30	Clouds	
Saturday	10/23/2021	10:00 AM	61	62	55	51	84										19	29	Clouds	
Saturday	10/23/2021	11:00 AM	59	62	54	51	74								59	51	15	31	Clouds	
Saturday	10/23/2021	12:00 PM	61	62	55	51	82	63				55					17	31	Clouds	
Saturday	10/23/2021	1:00 PM	59	61	55	52	76										19	31	Clouds	
Saturday	10/23/2021	2:00 PM	59	61	55	50	69				61						20	31	Clouds	Wind >= 20 km/hr
Saturday	10/23/2021	3:00 PM	60	62	55	50	78										17	31	Clouds	
Saturday	10/23/2021	4:00 PM	59	61	55	51	71										17	30	Clouds	
Saturday	10/23/2021	5:00 PM	59	61	55	50	78										11	31	Clouds	
Saturday	10/23/2021	6:00 PM	59	61	55	50	73										7	28	Scattered Shower	Rain
Saturday	10/23/2021	7:00 PM	59	61	53	48	83										9	29	Clouds	
Saturday	10/23/2021	8:00 PM	57	60	52	47	69		58				53				9	28	Clouds	
Saturday	10/23/2021	9:00 PM	57	59	52	49	71										11	28	Clouds	
Saturday	10/23/2021	10:00 PM	55	58	51	47	70										17	28	Sprinkles	Rain
Saturday	10/23/2021	11:00 PM	56	58	50	44	81										NA	NA	NA	
Sunday	10/24/2021	12:00 AM	55	57	48	46	79										NA	NA	NA	
Sunday	10/24/2021	1:00 AM	52	55	46	45	72										NA	NA	NA	
Sunday	10/24/2021	2:00 AM	49	52	45	44	66			55				47			NA	NA	NA	
Sunday	10/24/2021	3:00 AM	50	53	44	43	70										NA	NA	NA	
Sunday	10/24/2021	4:00 AM	54	56	44	43	74										NA	NA	NA	
Sunday	10/24/2021	5:00 AM	55	59	45	43	71										NA	NA	NA	
Sunday	10/24/2021	6:00 AM	60	60	48	44	84										9	28	Clouds	
Sunday	10/24/2021	7:00 AM	62	61	49	44	86										9	28	Clouds	
Sunday	10/24/2021	8:00 AM	67	62	50	46	89										9	29	Clouds	
Sunday	10/24/2021	9:00 AM	57	60	51	46	73										15	30	Scattered Shower	Rain
Sunday	10/24/2021	10:00 AM	57	60	52	46	71										19	31	Clouds	
Sunday	10/24/2021	11:00 AM	57	59	50	46	74								57	49	17	32	Clouds	
Sunday	10/24/2021	12:00 PM	59	60	51	45	79	61				51					19	32	Clouds	
Sunday	10/24/2021	1:00 PM	57	59	51	46	75										15	32	Clouds	
Sunday	10/24/2021	2:00 PM	57	59	51	46	81				59						20	32	Partly Sunny	Wind >= 20 km/hr
Sunday	10/24/2021	3:00 PM	60	60	51	47	85										17	31	Clouds	
Sunday	10/24/2021	4:00 PM	58	61	52	44	76										NA	NA	NA	
Sunday	10/24/2021	5:00 PM	60	60	52	46	83										15	30	Clouds	
Sunday	10/24/2021	6:00 PM	58	60	52	47	78										13	29	Clouds	
Sunday	10/24/2021	7:00 PM	58	60	51	45	81										9	29	Clouds	
Sunday	10/24/2021	8:00 PM	56	58	49	43	71		57				49				15	29	Clouds	
Sunday	10/24/2021	9:00 PM	54	57	47	44	69										11	29	Clouds	
Sunday	10/24/2021	10:00 PM	56	56	46	43	82										9	29	Clouds	
Sunday	10/24/2021	11:00 PM	51	54	44	42	67										NA	NA	NA	
Monday	10/25/2021	12:00 AM	54	54	44	41	76										NA	NA	NA	
Monday	10/25/2021	1:00 AM	49	51	43	41	69										NA	NA	NA	
Monday	10/25/2021	2:00 AM	49	52	43	41	67			57				45			NA	NA	NA	
Monday	10/25/2021	3:00 AM	52	54	43	42	70										NA	NA	NA	
Monday	10/25/2021	4:00 AM	54	58	44	40	75										NA	NA	NA	
Monday	10/25/2021	5:00 AM	55	59	45	42	69										NA	NA	NA	
Monday	10/25/2021	6:00 AM	65	63	50	44	88										9	28	Clouds	
Monday	10/25/2021	7:00 AM	63	65	57	51	85										9	29	Clouds	
Monday	10/25/2021	8:00 AM	64	64	57	51	87										11	30	Clouds	
Monday	10/25/2021	9:00 AM	65	66	56	51	86										11	31	Clouds	
Monday	10/25/2021	10:00 AM	60	63	55	51	76										13	32	Clouds	
Monday	10/25/2021	11:00 AM	60	62	54	50	81								58	51	13	32	Clouds	
Monday	10/25/2021	12:00 PM	60	62	55	50	76	62				56					13	32	Clouds	
Monday	10/25/2021	1:00 PM	61	63	55	51	79										13	32	Clouds	
Monday	10/25/2021	2:00 PM	60	63	55	51	76				62						17	31	Clouds	
Monday	10/25/2021	3:00 PM	60	63	55	50	73										15	31	Clouds	
Monday	10/25/2021	4:00 PM	61	63	56	51	84										15	31	Clouds	
Monday	10/25/2021	5:00 PM	62	62	57	52	87										15	31	Clouds	
Monday	10/25/2021	6:00 PM	61	61	54	48	88										11	30	Clouds	
Monday	10/25/2021	7:00 PM	57	60	52	47	68										7	29	Clouds	
Monday	10/25/2021	8:00 PM	56	59	50	46	74		57				51				7	29	Clouds	
Monday	10/25/2021	9:00 PM	55	57	49	45	71										6	29	Clouds	
Monday	10/25/2021	10:00 PM	53	56	47	45	74										9	29	Clouds	
Monday	10/25/2021	11:00 PM	52	54	45	43	75										NA	NA	NA	
Tuesday	10/26/2021	12:00 AM	52	53	44	42	75										NA	NA	NA	
Tuesday	10/26/2021	1:00 AM	48	51	44	43	62										NA	NA	NA	
Tuesday	10/26/2021	2:00 AM	46	49	43	42	59			57				46			NA	NA	NA	
Tuesday	10/26/2021	3:00 AM	51	54	43	41	71										NA	NA	NA	
Tuesday	10/26/2021	4:00 AM	53	57	42	40	67										NA	NA	NA	
Tuesday	10/26/2021	5:00 AM	56	60	47	43	72										NA	NA	NA	
Tuesday	10/26/2021	6:00 AM	64	62	52	46	92										4	27	Clouds	
Tuesday	10/26/2021	7:00 AM	71	65	56	50	91										4	27	Clouds	
Tuesday	10/26/2021	8:00 AM	73	71	58	51	92										9	29	Clouds	
Tuesday	10/26/2021	9:00 AM	63	64	56	50	84										7	30	Clouds	
Tuesday	10/26/2021	10:00 AM	63	63	56	50	86										11	31	Clouds	
Tuesday	10/26/2021	11:00 AM	62	64	55	51	87								60	51	13	31	Clouds	
Tuesday	10/26/2021	12:00 PM	61	62	55	49	82	69				56					15	31	Clouds	
Tuesday	10/26/2021	1:00 PM	75	77	56	51	97										13	32	Clouds	
Tuesday	10/26/2021	2:00 PM	64	65	55	50	81				67						11	31	Clouds	
Tuesday	10/26/2021	3:00 PM	66	71	56	50	80										11	31	Clouds	
Tuesday	10/26/2021	4:00 PM	59	62	55	50	70										11	30	Clouds	
Tuesday	10/26/2021	5:00 PM	60	62	55	51	80										9	30	Clouds	
Tuesday	10/26/2021	6:00 PM	60	61	55	49	83										6	29	Clouds	

Table D.1

Environmental Sound Level Measurements, LAEQ - Validated Background Measurements - NSR1
Dart
Georgetown, Cayman Islands

Day of Week	Date	Time	LAeq (2), (3)	L_{AS10} (2)	L_{AS90} (2)	L_{ASMin} (2)	L_{ASMax} (2)	Daytime Period Average LASeq 11 hour	Evening Period Average LASeq 5 hour	Nighttime Period Average LASeq 8 hour	Daytime Period Average LAS10eq 18 hour	Daytime Period Average LAS90 11 hour	Evening Period Average LAS90 5 hour	Nighttime Period Average LAS90 8 hour	Daily Average LAeq (2), (3)	Daily Average L_{AS90} (2)	Wind Spd (km/h) (1)	Temperature (°C)	Weather	Comments
Tuesday	10/26/2021	7:00 PM	60	60	52	47	84										6	29	Clouds	
Tuesday	10/26/2021	8:00 PM	58	59	50	45	83		58				52				4	28	Clear	
Tuesday	10/26/2021	9:00 PM	57	58	49	44	83										4	29	Clear	
Tuesday	10/26/2021	10:00 PM	55	57	50	46	71										6	28	Clear	
Tuesday	10/26/2021	11:00 PM	55	57	51	47	77										NA	NA	NA	
Wednesday	10/27/2021	12:00 AM	53	56	43	42	68										NA	NA	NA	
Wednesday	10/27/2021	1:00 AM	50	52	45	42	59										NA	NA	NA	
Wednesday	10/27/2021	2:00 AM	51	53	46	43	69										NA	NA	NA	
Wednesday	10/27/2021	3:00 AM	51	53	45	43	66			58				47			NA	NA	NA	
Wednesday	10/27/2021	4:00 AM	53	58	45	43	66										NA	NA	NA	
Wednesday	10/27/2021	5:00 AM	55	60	46	42	70										NA	NA	NA	
Wednesday	10/27/2021	6:00 AM	66	63	51	45	91										2	26	Clouds	
Wednesday	10/27/2021	7:00 AM	63	63	56	51	88								58	51	4	27	Clouds	
Wednesday	10/27/2021	8:00 AM	64	65	57	52	83										6	29	Clouds	
Wednesday	10/27/2021	9:00 AM	62	63	55	50	80										11	31	Clouds	
Wednesday	10/27/2021	10:00 AM	61	63	55	50	81				63						13	31	Partly Sunny	
Wednesday	10/27/2021	11:00 AM	61	64	55	51	81	62				56					17	31	Clouds	
Wednesday	10/27/2021	12:00 PM	61	63	55	51	76										15	31	Clouds	
Wednesday	10/27/2021	1:00 PM	60	63	55	50	76										13	31	Clouds	
Wednesday	10/27/2021	2:00 PM	59	62	55	52	72										17	31	Clouds	
Wednesday	10/27/2021	3:00 PM	61	63	56	54	73										13	31	Clouds	

	LAeq (2), (3)	L_{AS10} (2)	L_{AS90} (2)	L_{ASMin} (2)	L_{ASMax} (2)	Daytime Period Average LASeq 11 hour	Evening Period Average LASeq 5 hour	Nighttime Period Average LASeq 8 hour	Daytime Period Average LAS10eq 18 hour	Daytime Period Average LAS90 11 hour	Evening Period Average LAS90 5 hour	Nighttime Period Average LAS90 8 hour
Lowest Daytime one-hour (07:00 - 19:00)	**57**	**59**	**49**	**44**	**70**	**63**	**58**	**58**	**63**	**56**	**52**	**46**
Lowest Evening one-hour (19:00 - 23:00)	**53**	**56**	**46**	**43**	**68**							
Lowest Nighttime one-hour (23:00-07:00)	**46**	**49**	**41**	**39**	**59**			**Max**	**67**	**59**	**54**	**47**
								Min	**59**	**51**	**49**	**45**

Notes:

(1) Weather data downloaded from Time and Date website
(2) Measurements recorded during inclement weather (winds speeds greater than 20 km/h and/or rain) were disregarded.
(3) Boxed data represents the lowest measured Leq during the respective monitoring time period.

Table D.2

Environmental Sound Level Measurements, LAEQ - Validated Background Measurements - NSR2
Dart
Georgetown, Cayman Islands

Time of Week	Date	Time	LAeq (2), (3)	L_{AS10} (2)	L_{AS90} (2)	L_{ASMin} (2)	L_{ASMax} (2)	Daytime Period Average LASeq 11 hour	Evening Period Average LASeq 5 hour	Nighttime Period Average LASeq 8 hour	Daytime Period Average LAS10eq 18 hour	Daytime Period Average LAS90 11 hour	Evening Period Average LAS90 5 hour	Nighttime Period Average LAS90 8 hour	Daily Average LAeq (2), (3)	Daily Average L_{AS90} (2)	Wind Spd (km/h) (1)	Temperature (°C)	Weather	Comments
Friday	10/22/2021	4:00 PM	57	58	44	42	76	56				44					9	30	Clouds	
Friday	10/22/2021	5:00 PM	54	51	44	42	81										9	30	Tornado	Rain
Friday	10/22/2021	6:00 PM	61	56	44	42	83										7	29	Clouds	
Friday	10/22/2021	7:00 PM	62	60	43	42	81				54				52	43	11	29	Clouds	
Friday	10/22/2021	8:00 PM	47	48	42	40	66		58				43				6	29	Thundershower	Rain
Friday	10/22/2021	9:00 PM	45	45	42	41	69										6	28	Clouds	
Friday	10/22/2021	10:00 PM	45	45	42	40	68										6	28	Clouds	
Friday	10/22/2021	11:00 PM	42	43	41	39	59										NA	NA	NA	
Saturday	10/23/2021	12:00 AM	42	42	41	40	48										NA	NA	NA	
Saturday	10/23/2021	1:00 AM	43	43	40	39	65										NA	NA	NA	
Saturday	10/23/2021	2:00 AM	44	46	41	39	61			42				40			NA	NA	NA	
Saturday	10/23/2021	3:00 AM	42	44	40	39	63										NA	NA	NA	
Saturday	10/23/2021	4:00 AM	39	41	37	35	45										NA	NA	NA	
Saturday	10/23/2021	5:00 AM	40	42	37	36	54										NA	NA	NA	
Saturday	10/23/2021	6:00 AM	45	45	40	37	68										6	27	Scattered Shower	Rain
Saturday	10/23/2021	7:00 AM	47	47	42	39	67										6	28	Clouds	
Saturday	10/23/2021	8:00 AM	50	49	44	41	75										11	29	Clouds	
Saturday	10/23/2021	9:00 AM	48	50	45	43	65										19	30	Clouds	
Saturday	10/23/2021	10:00 AM	48	50	45	43	69										19	29	Clouds	
Saturday	10/23/2021	11:00 AM	50	52	46	43	62								47	43	15	31	Clouds	
Saturday	10/23/2021	12:00 PM	50	52	47	43	67	51				46					17	31	Clouds	
Saturday	10/23/2021	1:00 PM	51	52	47	44	69										19	31	Clouds	
Saturday	10/23/2021	2:00 PM	54	53	48	45	79				51						20	31	Clouds	Wind >= 20 km/hr
Saturday	10/23/2021	3:00 PM	55	53	48	45	77										17	31	Clouds	
Saturday	10/23/2021	4:00 PM	53	56	46	43	69										17	30	Clouds	
Saturday	10/23/2021	5:00 PM	52	54	46	43	66										11	31	Clouds	
Saturday	10/23/2021	6:00 PM	47	48	43	41	68										7	28	Scattered Shower	Rain
Saturday	10/23/2021	7:00 PM	45	46	42	41	69										9	29	Clouds	
Saturday	10/23/2021	8:00 PM	45	44	41	40	72		48				42				9	28	Clouds	
Saturday	10/23/2021	9:00 PM	51	47	41	40	83										11	28	Clouds	
Saturday	10/23/2021	10:00 PM	46	47	43	41	62										17	28	Sprinkles	Rain
Saturday	10/23/2021	11:00 PM	45	45	39	37	70										NA	NA	NA	
Sunday	10/24/2021	12:00 AM	41	42	38	37	60										NA	NA	NA	
Sunday	10/24/2021	1:00 AM	39	40	37	36	52										NA	NA	NA	
Sunday	10/24/2021	2:00 AM	37	39	36	35	42			41				38			NA	NA	NA	
Sunday	10/24/2021	3:00 AM	38	41	36	34	45										NA	NA	NA	
Sunday	10/24/2021	4:00 AM	39	39	36	34	58										NA	NA	NA	
Sunday	10/24/2021	5:00 AM	40	41	38	36	54										NA	NA	NA	
Sunday	10/24/2021	6:00 AM	42	44	39	37	62										9	28	Clouds	
Sunday	10/24/2021	7:00 AM	42	43	40	38	54										9	28	Clouds	
Sunday	10/24/2021	8:00 AM	44	46	41	39	63										9	29	Clouds	
Sunday	10/24/2021	9:00 AM	46	48	43	41	57										15	30	Scattered Shower	Rain
Sunday	10/24/2021	10:00 AM	48	48	43	40	70										19	31	Clouds	
Sunday	10/24/2021	11:00 AM	47	49	43	40	65								45	41	17	32	Clouds	
Sunday	10/24/2021	12:00 PM	54	51	44	41	83	49				43					19	32	Clouds	
Sunday	10/24/2021	1:00 PM	52	50	44	41	75										15	32	Clouds	
Sunday	10/24/2021	2:00 PM	50	51	43	42	71				48						20	32	Partly Sunny	Wind >= 20 km/hr
Sunday	10/24/2021	3:00 PM	50	50	44	41	71										17	31	Clouds	
Sunday	10/24/2021	4:00 PM	46	48	44	42	65										NA	NA	NA	
Sunday	10/24/2021	5:00 PM	51	51	43	41	73										15	30	Clouds	
Sunday	10/24/2021	6:00 PM	47	46	43	41	68										13	29	Clouds	
Sunday	10/24/2021	7:00 PM	49	47	43	41	72										9	29	Clouds	
Sunday	10/24/2021	8:00 PM	44	45	42	41	66		46				42				15	29	Clouds	
Sunday	10/24/2021	9:00 PM	45	44	42	40	66										11	29	Clouds	
Sunday	10/24/2021	10:00 PM	44	44	41	40	68										9	29	Clouds	
Sunday	10/24/2021	11:00 PM	43	43	40	39	70										NA	NA	NA	
Monday	10/25/2021	12:00 AM	43	42	39	38	63										NA	NA	NA	
Monday	10/25/2021	1:00 AM	41	42	40	38	52										NA	NA	NA	
Monday	10/25/2021	2:00 AM	41	42	40	39	52			43				40			NA	NA	NA	
Monday	10/25/2021	3:00 AM	42	43	40	39	60										NA	NA	NA	
Monday	10/25/2021	4:00 AM	41	43	40	39	55										NA	NA	NA	
Monday	10/25/2021	5:00 AM	42	43	40	39	55										NA	NA	NA	
Monday	10/25/2021	6:00 AM	46	46	43	41	65										9	28	Clouds	
Monday	10/25/2021	7:00 AM	46	48	44	42	62										9	29	Clouds	
Monday	10/25/2021	8:00 AM	48	50	45	43	64										11	30	Clouds	
Monday	10/25/2021	9:00 AM	67	71	48	43	80										11	31	Clouds	
Monday	10/25/2021	10:00 AM	60	61	46	42	78										13	32	Clouds	
Monday	10/25/2021	11:00 AM	66	64	45	42	87								50	42	13	32	Clouds	
Monday	10/25/2021	12:00 PM	57	61	44	42	70	63				45					13	32	Clouds	
Monday	10/25/2021	1:00 PM	65	69	46	43	79										13	32	Clouds	
Monday	10/25/2021	2:00 PM	68	70	45	43	83				63						17	31	Clouds	
Monday	10/25/2021	3:00 PM	52	56	45	43	71										15	31	Clouds	
Monday	10/25/2021	4:00 PM	50	51	45	43	69										15	31	Clouds	
Monday	10/25/2021	5:00 PM	50	52	43	41	69										15	31	Clouds	
Monday	10/25/2021	6:00 PM	47	49	42	40	67										11	30	Clouds	
Monday	10/25/2021	7:00 PM	45	45	41	39	69										7	29	Clouds	
Monday	10/25/2021	8:00 PM	46	47	39	37	70		45				40				7	29	Clouds	
Monday	10/25/2021	9:00 PM	44	43	40	38	69										6	29	Clouds	

Table D.2

Environmental Sound Level Measurements, LAEQ - Validated Background Measurements - NSR2
Dart
Georgetown, Cayman Islands

Time of Week	Date	Time	LAeq (2), (3)	L_{AS10} (2)	L_{AS90} (2)	L_{ASMin} (2)	L_{ASMax} (2)	Daytime Period Average LASeq 11 hour	Evening Period Average LASeq 5 hour	Nighttime Period Average LASeq 8 hour	Daytime Period Average LAS10eq 18 hour	Daytime Period Average LAS90 11 hour	Evening Period Average LAS90 5 hour	Nighttime Period Average LAS90 8 hour	Daily Average LAeq (2), (3)	Daily Average L_{AS90} (2)	Wind Spd (km/h) (1)	Temperature (°C)	Weather	Comments
Monday	10/25/2021	10:00 PM	42	42	39	38	62										9	29	Clouds	
Monday	10/25/2021	11:00 PM	39	40	37	36	58										NA	NA	NA	
Tuesday	10/26/2021	12:00 AM	40	40	37	36	60										NA	NA	NA	
Tuesday	10/26/2021	1:00 AM	38	39	35	34	55										NA	NA	NA	
Tuesday	10/26/2021	2:00 AM	37	38	35	34	47										NA	NA	NA	
Tuesday	10/26/2021	3:00 AM	60	44	35	34	86			51				37			NA	NA	NA	
Tuesday	10/26/2021	4:00 AM	37	39	36	34	46										NA	NA	NA	
Tuesday	10/26/2021	5:00 AM	41	42	36	35	64										NA	NA	NA	
Tuesday	10/26/2021	6:00 AM	46	47	41	38	64										4	27	Clouds	
Tuesday	10/26/2021	7:00 AM	46	46	42	41	68										4	27	Clouds	
Tuesday	10/26/2021	8:00 AM	48	49	44	42	69										9	29	Clouds	
Tuesday	10/26/2021	9:00 AM	55	51	42	39	74										7	30	Clouds	
Tuesday	10/26/2021	10:00 AM	66	71	46	42	79										11	31	Clouds	
Tuesday	10/26/2021	11:00 AM	66	70	46	41	75										13	31	Clouds	
Tuesday	10/26/2021	12:00 PM	63	65	43	41	79	61				43			48	40	15	31	Clouds	
Tuesday	10/26/2021	1:00 PM	48	52	43	41	65										13	32	Clouds	
Tuesday	10/26/2021	2:00 PM	47	48	42	40	68										11	31	Clouds	
Tuesday	10/26/2021	3:00 PM	47	47	43	41	70				62						11	31	Clouds	
Tuesday	10/26/2021	4:00 PM	60	55	42	40	81										11	30	Clouds	
Tuesday	10/26/2021	5:00 PM	61	59	42	40	82										9	30	Clouds	
Tuesday	10/26/2021	6:00 PM	49	48	42	41	70										6	29	Clouds	
Tuesday	10/26/2021	7:00 PM	44	44	42	41	68										6	29	Clouds	
Tuesday	10/26/2021	8:00 PM	42	43	40	39	61		44				40				4	28	Clear	
Tuesday	10/26/2021	9:00 PM	41	42	39	37	55										4	29	Clear	
Tuesday	10/26/2021	10:00 PM	40	41	37	35	57										6	28	Clear	
Tuesday	10/26/2021	11:00 PM	37	38	35	34	50										NA	NA	NA	
Wednesday	10/27/2021	12:00 AM	36	37	34	33	44										NA	NA	NA	
Wednesday	10/27/2021	1:00 AM	37	39	35	34	46										NA	NA	NA	
Wednesday	10/27/2021	2:00 AM	38	40	36	35	49			41				36			NA	NA	NA	
Wednesday	10/27/2021	3:00 AM	38	39	35	34	56										NA	NA	NA	
Wednesday	10/27/2021	4:00 AM	38	39	35	33	61										NA	NA	NA	
Wednesday	10/27/2021	5:00 AM	43	42	37	35	68										NA	NA	NA	
Wednesday	10/27/2021	6:00 AM	46	46	40	38	72										2	26	Clouds	
Wednesday	10/27/2021	7:00 AM	48	47	42	40	73								56	41	4	27	Clouds	
Wednesday	10/27/2021	8:00 AM	51	52	43	41	76										6	29	Clouds	
Wednesday	10/27/2021	9:00 AM	50	52	43	41	70										11	31	Clouds	
Wednesday	10/27/2021	10:00 AM	62	66	47	44	80				57						13	31	Partly Sunny	
Wednesday	10/27/2021	11:00 AM	49	51	45	43	69	54				45					17	31	Clouds	
Wednesday	10/27/2021	12:00 PM	49	51	44	41	70										15	31	Clouds	
Wednesday	10/27/2021	1:00 PM	52	54	47	42	71										13	31	Clouds	
Wednesday	10/27/2021	2:00 PM	50	51	45	43	73										17	31	Clouds	
Wednesday	10/27/2021	3:00 PM	49	51	45	43	64										13	31	Clouds	

	LAeq (2), (3)	L_{AS10} (2)	L_{AS90} (2)	L_{ASMin} (2)	L_{ASMax} (2)	Daytime Period Average LASeq 11 hour	Evening Period Average LASeq 5 hour	Nighttime Period Average LASeq 8 hour	Daytime Period Average LAS10eq 18 hour	Daytime Period Average LAS90 11 hour	Evening Period Average LAS90 5 hour	Nighttime Period Average LAS90 8 hour
Lowest Daytime one-hour (07:00 - 19:00)	**42**	**43**	**40**	**38**	**54**	**56**	**48**	**44**	**56**	**44**	**41**	**38**
Lowest Evening one-hour (19:00 - 23:00)	**40**	**41**	**37**	**35**	**55**							
Lowest Nighttime one-hour (23:00-07:00)	**36**	**37**	**34**	**33**	**42**			**Max**	**63**	**46**	**43**	**40**
								Min	**48**	**43**	**40**	**36**

Notes:

(1) Weather data downloaded from Time and Date website
(2) Measurements recorded during inclement weather (winds speeds greater than 20 km/h and/or rain) were disregarded.
(3) Boxed data represents the lowest measured Leq during the respective monitoring time period.

Table D.3

Environmental Sound Level Measurements, LAEQ - Validated Background Measurements - NSR3
Dart
Georgetown, Cayman Islands

Day of Week	Date	Time	LAeq [2], [3]	L_{AS10} [2]	L_{AS90} [2]	L_{ASMin} [2]	L_{ASMax} [2]	Daytime Period Average LASeq 11 hour	Evening Period Average LASeq 5 hour	Nighttime Period Average LASeq 8 hour	Daytime Period Average LAS10eq 18 hour	Daytime Period Average LAS90 11 hour	Evening Period Average LAS90 5 hour	Nighttime Period Average LAS90 8 hour	Daily Average LAeq [2], [3]	Daily Average L_{AS90} [2]	Wind Spd (km/h) [1]	Temperature (°C)	Weather	Comments
Tuesday	10/19/2021	4:00 PM	64	60	52	49	86	63				53					11	28	Thunderstorms	Rain
Tuesday	10/19/2021	5:00 PM	63	62	54	52	87										7	28	Clouds	
Tuesday	10/19/2021	6:00 PM	62	58	54	52	91										15	28	Light Rain	Rain
Tuesday	10/19/2021	7:00 PM	57	57	54	51	80										13	28	Light Rain	Rain
Tuesday	10/19/2021	8:00 PM	55	56	53	51	67		60		58		53		58	53	11	28	Clouds	
Tuesday	10/19/2021	9:00 PM	55	56	53	50	67										13	28	Clouds	
Tuesday	10/19/2021	10:00 PM	55	56	51	49	79										13	28	Clouds	
Tuesday	10/19/2021	11:00 PM	55	56	52	49	78										NA	NA	NA	
Wednesday	10/20/2021	12:00 AM	54	55	51	49	79										NA	NA	NA	
Wednesday	10/20/2021	1:00 AM	53	55	51	49	77										NA	NA	NA	
Wednesday	10/20/2021	2:00 AM	52	54	49	47	61										NA	NA	NA	
Wednesday	10/20/2021	3:00 AM	52	54	49	47	66			54				50			NA	NA	NA	
Wednesday	10/20/2021	4:00 AM	52	55	50	48	62										NA	NA	NA	
Wednesday	10/20/2021	5:00 AM	54	57	50	48	66										NA	NA	NA	
Wednesday	10/20/2021	6:00 AM	58	59	52	50	81										11	27	Clouds	
Wednesday	10/20/2021	7:00 AM	64	64	56	54	86										11	27	Clouds	
Wednesday	10/20/2021	8:00 AM	66	67	58	55	86										11	29	Clouds	
Wednesday	10/20/2021	9:00 AM	65	66	58	55	85										22	30	Clouds	Wind >= 20 km/hr
Wednesday	10/20/2021	10:00 AM	67	67	56	53	91										26	30	Scattered Shower	Wind >= 20 km/hr & Rain
Wednesday	10/20/2021	11:00 AM	65	65	56	53	91										24	30	Scattered Shower	Wind >= 20 km/hr & Rain
Wednesday	10/20/2021	12:00 PM	62	64	56	54	81	64				56			59	54	26	30	Clouds	Wind >= 20 km/hr
Wednesday	10/20/2021	1:00 PM	64	64	56	54	85										26	30	Clouds	Wind >= 20 km/hr
Wednesday	10/20/2021	2:00 PM	64	64	56	55	85										26	31	Clouds	Wind >= 20 km/hr
Wednesday	10/20/2021	3:00 PM	64	65	56	54	84				63						22	31	Clouds	Wind >= 20 km/hr
Wednesday	10/20/2021	4:00 PM	63	63	54	52	86										20	30	Clouds	Wind >= 20 km/hr
Wednesday	10/20/2021	5:00 PM	61	62	55	53	84										20	29	Clouds	Wind >= 20 km/hr
Wednesday	10/20/2021	6:00 PM	58	59	55	53	78										19	29	Clouds	
Wednesday	10/20/2021	7:00 PM	60	58	55	53	86										15	29	Clouds	
Wednesday	10/20/2021	8:00 PM	57	57	54	52	83		58				54				13	29	Clouds	
Wednesday	10/20/2021	9:00 PM	56	57	54	52	79										15	28	Clouds	
Wednesday	10/20/2021	10:00 PM	55	56	53	51	79										13	28	Clear	
Wednesday	10/20/2021	11:00 PM	55	56	52	51	73										NA	NA	NA	
Thursday	10/21/2021	12:00 AM	53	55	51	50	73										NA	NA	NA	
Thursday	10/21/2021	1:00 AM	55	56	53	51	73										NA	NA	NA	
Thursday	10/21/2021	2:00 AM	54	56	53	51	63										NA	NA	NA	
Thursday	10/21/2021	3:00 AM	55	56	53	51	71			56				53			NA	NA	NA	
Thursday	10/21/2021	4:00 AM	55	56	52	51	74										NA	NA	NA	
Thursday	10/21/2021	5:00 AM	58	57	52	51	85										NA	NA	NA	
Thursday	10/21/2021	6:00 AM	59	60	53	52	84										4	26	Clouds	
Thursday	10/21/2021	7:00 AM	65	64	54	53	86										7	27	Clouds	
Thursday	10/21/2021	8:00 AM	63	65	55	53	86										9	29	Clouds	
Thursday	10/21/2021	9:00 AM	65	64	55	54	91										13	31	Clouds	
Thursday	10/21/2021	10:00 AM	67	67	55	54	90										11	31	Clouds	
Thursday	10/21/2021	11:00 AM	65	65	55	53	89										15	32	Clouds	
Thursday	10/21/2021	12:00 PM	64	65	54	51	87	65				55			60	53	13	31	Clouds	
Thursday	10/21/2021	1:00 PM	65	64	55	52	90										11	32	Clouds	
Thursday	10/21/2021	2:00 PM	67	65	55	53	96										11	31	Clouds	
Thursday	10/21/2021	3:00 PM	66	64	55	52	91				63						9	30	Clouds	
Thursday	10/21/2021	4:00 PM	63	63	54	52	84										17	30	Clouds	
Thursday	10/21/2021	5:00 PM	64	62	52	51	91										11	30	Clouds	
Thursday	10/21/2021	6:00 PM	57	59	53	51	77										7	29	Clouds	
Thursday	10/21/2021	7:00 PM	59	56	52	51	88										7	29	Clouds	
Thursday	10/21/2021	8:00 PM	61	58	53	52	90		58				52				0	28	Clouds	
Thursday	10/21/2021	9:00 PM	$\boxed{52}$	$\boxed{53}$	51	50	67										13	28	Clouds	
Thursday	10/21/2021	10:00 PM	52	53	51	49	66										7	28	Clouds	
Thursday	10/21/2021	11:00 PM	51	52	50	48	69										NA	NA	NA	
Friday	10/22/2021	12:00 AM	51	52	49	47	60										NA	NA	NA	
Friday	10/22/2021	1:00 AM	50	51	49	47	$\boxed{56}$										NA	NA	NA	
Friday	10/22/2021	2:00 AM	52	53	50	49	58										NA	NA	NA	
Friday	10/22/2021	3:00 AM	51	52	50	48	63			55				50			NA	NA	NA	
Friday	10/22/2021	4:00 AM	52	54	50	48	61										NA	NA	NA	
Friday	10/22/2021	5:00 AM	54	56	51	49	71										NA	NA	NA	
Friday	10/22/2021	6:00 AM	62	60	52	51	92										9	27	Clouds	
Friday	10/22/2021	7:00 AM	65	67	56	52	86										7	27	Clouds	
Friday	10/22/2021	8:00 AM	66	69	54	52	83										11	29	Clouds	
Friday	10/22/2021	9:00 AM	69	72	56	53	88										9	31	Clouds	
Friday	10/22/2021	10:00 AM	73	75	64	61	85										11	31	Clouds	
Friday	10/22/2021	11:00 AM	71	73	58	56	87										13	31	Clouds	
Friday	10/22/2021	12:00 PM	69	74	58	54	84	68				57			60	53	13	31	Scattered Shower	Rain
Friday	10/22/2021	1:00 PM	66	67	54	51	86										13	31	Clouds	
Friday	10/22/2021	2:00 PM	66	67	54	52	89										9	32	Clouds	
Friday	10/22/2021	3:00 PM	64	63	52	50	91				68						9	31	Clouds	
Friday	10/22/2021	4:00 PM	63	63	52	49	86										9	30	Clouds	
Friday	10/22/2021	5:00 PM	61	62	53	51	83										9	30	Tornado	Rain
Friday	10/22/2021	6:00 PM	62	60	53	51	89										7	29	Clouds	
Friday	10/22/2021	7:00 PM	58	57	53	51	82										11	29	Clouds	
Friday	10/22/2021	8:00 PM	54	55	52	50	70		58				52				6	29	Thundershower	Rain
Friday	10/22/2021	9:00 PM	54	55	52	50	68										6	28	Clouds	
Friday	10/22/2021	10:00 PM	52	53	51	49	71										6	28	Clouds	
Friday	10/22/2021	11:00 PM	52	54	50	49	60										NA	NA	NA	
Saturday	10/23/2021	12:00 AM	51	52	50	49	64										NA	NA	NA	
Saturday	10/23/2021	1:00 AM	53	54	50	48	69										NA	NA	NA	
Saturday	10/23/2021	2:00 AM	51	52	50	48	58										NA	NA	NA	
Saturday	10/23/2021	3:00 AM	52	54	50	49	59			54				51			NA	NA	NA	
Saturday	10/23/2021	4:00 AM	54	55	51	49	68										NA	NA	NA	
Saturday	10/23/2021	5:00 AM	55	56	51	50	71										NA	NA	NA	
Saturday	10/23/2021	6:00 AM	58	59	51	50	78										6	27	Scattered Shower	Rain

Table D.3

Environmental Sound Level Measurements, LAEQ - Validated Background Measurements - NSR3
Dart
Georgetown, Cayman Islands

Day of Week	Date	Time	LAeq (2), (3)	L_{AS10} (2)	L_{AS90} (2)	L_{ASMin} (2)	L_{ASMax} (2)	Daytime Period Average LASeq 11 hour	Evening Period Average LASeq 5 hour	Nighttime Period Average LASeq 8 hour	Daytime Period Average LAS10eq 18 hour	Daytime Period Average LAS90 11 hour	Evening Period Average LAS90 5 hour	Nighttime Period Average LAS90 8 hour	Daily Average LAeq (2), (3)	Daily Average L_{AS90} (2)	Wind Spd (km/h) (1)	Temperature (°C)	Weather	Comments
Saturday	10/23/2021	7:00 AM	59	59	52	50	80										6	28	Clouds	
Saturday	10/23/2021	8:00 AM	65	65	55	53	86										11	29	Clouds	
Saturday	10/23/2021	9:00 AM	61	62	54	51	82										19	30	Clouds	
Saturday	10/23/2021	10:00 AM	63	62	53	51	86										19	29	Clouds	
Saturday	10/23/2021	11:00 AM	65	66	55	53	88										15	31	Clouds	
Saturday	10/23/2021	12:00 PM	62	63	53	51	85	62				54			58	52	17	31	Clouds	
Saturday	10/23/2021	1:00 PM	63	63	54	52	87										19	31	Clouds	
Saturday	10/23/2021	2:00 PM	60	60	53	51	81				61						20	31	Clouds	Wind >= 20 km/hr
Saturday	10/23/2021	3:00 PM	60	61	55	51	81										17	31	Clouds	
Saturday	10/23/2021	4:00 PM	62	61	53	51	87										17	30	Clouds	
Saturday	10/23/2021	5:00 PM	60	60	53	51	87										11	31	Clouds	
Saturday	10/23/2021	6:00 PM	59	59	54	51	80										7	28	Scattered Shower	Rain
Saturday	10/23/2021	7:00 PM	55	56	53	51	69										9	29	Clouds	
Saturday	10/23/2021	8:00 PM	54	54	52	50	74		56				52				9	28	Clouds	
Saturday	10/23/2021	9:00 PM	56	55	51	49	84										11	28	Clouds	
Saturday	10/23/2021	10:00 PM	54	53	50	48	82										17	28	Sprinkles	Rain
Saturday	10/23/2021	11:00 PM	54	54	52	50	69										NA	NA	NA	
Sunday	10/24/2021	12:00 AM	54	55	52	51	71										NA	NA	NA	
Sunday	10/24/2021	1:00 AM	53	53	51	50	68										NA	NA	NA	
Sunday	10/24/2021	2:00 AM	52	53	51	49	63			54				51			NA	NA	NA	
Sunday	10/24/2021	3:00 AM	52	54	49	47	63										NA	NA	NA	
Sunday	10/24/2021	4:00 AM	54	56	51	49	63										NA	NA	NA	
Sunday	10/24/2021	5:00 AM	55	58	53	51	64										NA	NA	NA	
Sunday	10/24/2021	6:00 AM	58	59	53	51	83										9	28	Clouds	
Sunday	10/24/2021	7:00 AM	55	57	52	50	68										9	28	Clouds	
Sunday	10/24/2021	8:00 AM	58	56	51	48	83										9	29	Clouds	
Sunday	10/24/2021	9:00 AM	57	59	52	50	74										15	30	Scattered Shower	Rain
Sunday	10/24/2021	10:00 AM	57	59	54	52	69										19	31	Clouds	
Sunday	10/24/2021	11:00 AM	61	63	57	53	71										17	32	Clouds	
Sunday	10/24/2021	12:00 PM	57	59	54	51	71	68				55			58	53	19	32	Clouds	
Sunday	10/24/2021	1:00 PM	56	58	53	51	72										15	32	Clouds	
Sunday	10/24/2021	2:00 PM	70	68	53	51	96				65						20	32	Partly Sunny	Wind >= 20 km/hr
Sunday	10/24/2021	3:00 PM	72	73	58	53	94										17	31	Clouds	
Sunday	10/24/2021	4:00 PM	72	73	55	51	92										NA	NA	NA	
Sunday	10/24/2021	5:00 PM	72	65	54	52	104										15	30	Clouds	
Sunday	10/24/2021	6:00 PM	56	58	54	52	72										13	29	Clouds	
Sunday	10/24/2021	7:00 PM	56	58	54	51	67										9	29	Clouds	
Sunday	10/24/2021	8:00 PM	55	56	53	51	66		55				53				15	29	Clouds	
Sunday	10/24/2021	9:00 PM	54	56	53	51	60										11	29	Clouds	
Sunday	10/24/2021	10:00 PM	54	56	52	50	61										9	29	Clouds	
Sunday	10/24/2021	11:00 PM	52	53	50	48	58										NA	NA	NA	
Monday	10/25/2021	12:00 AM	50	52	48	46	63										NA	NA	NA	
Monday	10/25/2021	1:00 AM	53	55	48	46	70										NA	NA	NA	
Monday	10/25/2021	2:00 AM	55	56	53	50	72			58				51			NA	NA	NA	
Monday	10/25/2021	3:00 AM	58	56	52	50	82										NA	NA	NA	
Monday	10/25/2021	4:00 AM	60	58	51	49	81										NA	NA	NA	
Monday	10/25/2021	5:00 AM	61	59	52	50	81										NA	NA	NA	
Monday	10/25/2021	6:00 AM	62	62	54	52	87										9	28	Clouds	
Monday	10/25/2021	7:00 AM	64	64	56	53	86										9	29	Clouds	
Monday	10/25/2021	8:00 AM	66	67	57	54	86										11	30	Clouds	
Monday	10/25/2021	9:00 AM	64	65	56	54	87										11	31	Clouds	
Monday	10/25/2021	10:00 AM	66	67	55	52	86										13	32	Clouds	
Monday	10/25/2021	11:00 AM	62	64	54	51	83										13	32	Clouds	
Monday	10/25/2021	12:00 PM	63	63	55	52	85	64				55			61	54	13	32	Clouds	
Monday	10/25/2021	1:00 PM	63	64	55	53	84										13	32	Clouds	
Monday	10/25/2021	2:00 PM	62	63	55	52	82				63						17	31	Clouds	
Monday	10/25/2021	3:00 PM	65	66	56	54	84										15	31	Clouds	
Monday	10/25/2021	4:00 PM	62	62	56	53	85										15	31	Clouds	
Monday	10/25/2021	5:00 PM	61	62	55	53	81										15	31	Clouds	
Monday	10/25/2021	6:00 PM	61	60	55	53	84										11	30	Clouds	
Monday	10/25/2021	7:00 PM	62	59	55	53	89										7	29	Clouds	
Monday	10/25/2021	8:00 PM	60	58	53	52	84		60				54				7	29	Clouds	
Monday	10/25/2021	9:00 PM	58	56	53	52	85										6	29	Clouds	
Monday	10/25/2021	10:00 PM	59	55	51	50	84										9	29	Clouds	
Monday	10/25/2021	11:00 PM	57	56	52	50	83										NA	NA	NA	
Tuesday	10/26/2021	12:00 AM	59	56	53	52	83										NA	NA	NA	
Tuesday	10/26/2021	1:00 AM	59	56	52	50	83										NA	NA	NA	
Tuesday	10/26/2021	2:00 AM	56	53	50	49	83			59				51			NA	NA	NA	
Tuesday	10/26/2021	3:00 AM	57	52	49	48	84										NA	NA	NA	
Tuesday	10/26/2021	4:00 AM	58	55	50	49	85										NA	NA	NA	
Tuesday	10/26/2021	5:00 AM	60	58	50	48	85										NA	NA	NA	
Tuesday	10/26/2021	6:00 AM	63	61	52	50	85										4	27	Clouds	
Tuesday	10/26/2021	7:00 AM	63	64	53	52	85										4	27	Clouds	
Tuesday	10/26/2021	8:00 AM	66	65	54	52	90										9	29	Clouds	
Tuesday	10/26/2021	9:00 AM	74	76	55	52	98										7	30	Clouds	
Tuesday	10/26/2021	10:00 AM	71	72	54	51	96										11	31	Clouds	
Tuesday	10/26/2021	11:00 AM	74	76	55	53	98										13	31	Clouds	
Tuesday	10/26/2021	12:00 PM	72	74	55	52	94	72				55			64	53	15	31	Clouds	
Tuesday	10/26/2021	1:00 PM	73	74	54	52	98										13	32	Clouds	
Tuesday	10/26/2021	2:00 PM	73	74	56	52	98				71						11	31	Clouds	
Tuesday	10/26/2021	3:00 PM	73	75	56	53	94										11	31	Clouds	
Tuesday	10/26/2021	4:00 PM	71	72	54	52	91										11	30	Clouds	
Tuesday	10/26/2021	5:00 PM	72	65	54	52	102										9	30	Clouds	
Tuesday	10/26/2021	6:00 PM	58	58	54	52	79										6	29	Clouds	
Tuesday	10/26/2021	7:00 PM	60	62	54	53	74										6	29	Clouds	
Tuesday	10/26/2021	8:00 PM	58	55	53	52	85		57				53				4	28	Clear	
Tuesday	10/26/2021	9:00 PM	53	54	52	51	64										4	29	Clear	

Table D.3

Environmental Sound Level Measurements, LAEQ - Validated Background Measurements - NSR3
Dart
Georgetown, Cayman Islands

Day of Week	Date	Time	LAeq (2), (3)	L_{AS10} (2)	L_{AS90} (2)	L_{ASMin} (2)	L_{ASMax} (2)	Daytime Period Average LASeq 11 hour	Evening Period Average LASeq 5 hour	Nighttime Period Average LASeq 8 hour	Daytime Period Average LAS10eq 18 hour	Daytime Period Average LAS90 11 hour	Evening Period Average LAS90 5 hour	Nighttime Period Average LAS90 8 hour	Daily Average LAeq (2), (3)	Daily Average L_{AS90} (2)	Wind Spd (km/h) (1)	Temperature (°C)	Weather	Comments
Tuesday	10/26/2021	10:00 PM	52	53	50	49	67										6	28	Clear	
Tuesday	10/27/2021	11:00 PM	51	52	49	47	77										NA	NA	NA	
Wednesday	10/27/2021	12:00 AM	50	51	47	46	70										NA	NA	NA	
Wednesday	10/27/2021	1:00 AM	52	53	50	49	68										NA	NA	NA	
Wednesday	10/27/2021	2:00 AM	53	53	49	48	76			64				49			NA	NA	NA	
Wednesday	10/27/2021	3:00 AM	51	53	48	46	68										NA	NA	NA	
Wednesday	10/27/2021	4:00 AM	52	55	48	46	68										NA	NA	NA	
Wednesday	10/27/2021	5:00 AM	69	63	50	47	95										NA	NA	NA	
Wednesday	10/27/2021	6:00 AM	70	71	53	50	94										2	26	Clouds	
Wednesday	10/27/2021	7:00 AM	70	71	54	51	92								62	52	4	27	Clouds	
Wednesday	10/27/2021	8:00 AM	69	69	55	53	93										6	29	Clouds	
Wednesday	10/27/2021	9:00 AM	67	68	55	53	87										11	31	Clouds	
Wednesday	10/27/2021	10:00 AM	70	71	56	53	92				68						13	31	Partly Sunny	
Wednesday	10/27/2021	11:00 AM	65	66	54	52	88	67				55					17	31	Clouds	
Wednesday	10/27/2021	12:00 PM	66	66	54	52	87										15	31	Clouds	
Wednesday	10/27/2021	1:00 PM	65	66	54	52	86										13	31	Clouds	
Wednesday	10/27/2021	2:00 PM	63	65	55	53	82										17	31	Clouds	
Wednesday	10/27/2021	3:00 PM	67	65	54	52	87										13	31	Clouds	

	LAeq (2), (3)	L_{AS10} (2)	L_{AS90} (2)	L_{ASMin} (2)	L_{ASMax} (2)	Daytime Period Average LASeq 11 hour	Evening Period Average LASeq 5 hour	Nighttime Period Average LASeq 8 hour	Daytime Period Average LAS10eq 18 hour	Daytime Period Average LAS90 11 hour	Evening Period Average LAS90 5 hour	Nighttime Period Average LAS90 8 hour
Lowest Daytime one-hour (07:00 - 19:00)	**55**	**56**	**51**	**48**	**68**	**66**	**58**	**57**	**65**	**55**	**53**	**51**
Lowest Evening one-hour (19:00 - 23:00)	**52**	**53**	**50**	**49**	**60**							
Lowest Nighttime one-hour (23:00-07:00)	**50**	**51**	**47**	**46**	**56**			**Max**	**71**	**57**	**54**	**53**
								Min	**58**	**53**	**52**	**49**

Notes:

(1) Weather data downloaded from Time and Date website
(2) Measurements recorded during inclement weather (winds speeds greater than 20 km/h and/or rain) were disregarded.
(3) Boxed data represents the lowest measured Leq during the respective monitoring time period.

Table D.4

Environmental Sound Level Measurements, LAEQ - Validated Background Measurements - NSR4
Dart
Georgetown, Cayman Islands

Day of Week	Date	Time	LAeq (2), (3)	L_{AS10} (2)	L_{AS90} (2)	L_{ASMin} (2)	L_{ASMax} (2)	Daytime Period Average LASeq 11 hour	Evening Period Average LASeq 5 hour	Nighttime Period Average LASeq 8 hour	Daytime Period Average LASeq 18 hour	Daytime Period Average LAS90 11 hour	Evening Period Average LAS90 5 hour	Nightttime Period Average LAS90 8 hour	Daily Average LAeq (2), (3)	Daily Average L_{AS90} (2)	Wind Spd (km/h) (1)	Temperature (°C)	Weather	Comments
Tuesday	10/19/2021	10:00 AM	59	61	52	51	74										NA	NA	NA	
Tuesday	10/19/2021	11:00 AM	61	64	52	50	84										9	28	Thunderstorms	Rain
Tuesday	10/19/2021	12:00 PM	61	64	51	48	85										6	27	Thunderstorms	Rain
Tuesday	10/19/2021	1:00 PM	60	60	51	48	87	60				50					4	27	Light Rain	Rain
Tuesday	10/19/2021	2:00 PM	62	61	50	47	86										9	27	Light Rain	Rain
Tuesday	10/19/2021	3:00 PM	58	59	50	47	79										9	28	Light Rain	Rain
Tuesday	10/19/2021	4:00 PM	63	62	49	45	88				60				56	46	11	28	Thunderstorms	Rain
Tuesday	10/19/2021	5:00 PM	58	61	47	43	78										7	28	Clouds	
Tuesday	10/19/2021	6:00 PM	54	53	45	42	73										15	28	Light Rain	Rain
Tuesday	10/19/2021	7:00 PM	55	57	43	39	76										13	28	Light Rain	Rain
Tuesday	10/19/2021	8:00 PM	53	53	42	38	74		53				42				11	28	Clouds	
Tuesday	10/19/2021	9:00 PM	51	52	41	38	68										13	28	Clouds	
Tuesday	10/19/2021	10:00 PM	48	46	40	37	74										13	28	Clouds	
Tuesday	10/19/2021	11:00 PM	44	45	39	36	68										NA	NA	NA	
Wednesday	10/20/2021	12:00 AM	43	43	38	36	67										NA	NA	NA	
Wednesday	10/20/2021	1:00 AM	39	41	37	35	50										NA	NA	NA	
Wednesday	10/20/2021	2:00 AM	39	41	37	35	53			51				39			NA	NA	NA	
Wednesday	10/20/2021	3:00 AM	42	42	36	35	58										NA	NA	NA	
Wednesday	10/20/2021	4:00 AM	43	44	36	34	65										NA	NA	NA	
Wednesday	10/20/2021	5:00 AM	46	47	40	37	64										NA	NA	NA	
Wednesday	10/20/2021	6:00 AM	60	60	45	40	88										11	27	Clouds	
Wednesday	10/20/2021	7:00 AM	65	60	49	46	93										11	27	Clouds	
Wednesday	10/20/2021	8:00 AM	58	62	51	48	76										11	29	Clouds	
Wednesday	10/20/2021	9:00 AM	57	59	51	49	75										22	30	Clouds	Wind >= 20 km/hr
Wednesday	10/20/2021	10:00 AM	60	61	52	49	82										26	30	Scattered Shower	Wind >= 20 km/hr & Rain
Wednesday	10/20/2021	11:00 AM	60	62	51	47	84								54	44	24	30	Scattered Shower	Wind >= 20 km/hr & Rain
Wednesday	10/20/2021	12:00 PM	63	64	50	47	88	61				50					26	30	Clouds	Wind >= 20 km/hr
Wednesday	10/20/2021	1:00 PM	60	60	50	47	86										26	30	Clouds	Wind >= 20 km/hr
Wednesday	10/20/2021	2:00 PM	56	58	50	47	76				60						26	31	Clouds	Wind >= 20 km/hr
Wednesday	10/20/2021	3:00 PM	57	59	50	46	76										22	31	Clouds	Wind >= 20 km/hr
Wednesday	10/20/2021	4:00 PM	62	63	49	44	88										20	30	Clouds	Wind >= 20 km/hr
Wednesday	10/20/2021	5:00 PM	58	60	47	44	77										20	29	Clouds	Wind >= 20 km/hr
Wednesday	10/20/2021	6:00 PM	55	58	46	41	78										19	29	Clouds	
Wednesday	10/20/2021	7:00 PM	54	54	43	39	73										15	29	Clouds	
Wednesday	10/20/2021	8:00 PM	55	54	42	39	81		54				43				13	29	Clouds	
Wednesday	10/20/2021	9:00 PM	56	50	42	38	85										15	28	Clouds	
Wednesday	10/20/2021	10:00 PM	47	47	39	36	73										13	28	Clear	
Wednesday	10/20/2021	11:00 PM	60	46	36	35	91										NA	NA	NA	
Thursday	10/21/2021	12:00 AM	40	42	35	34	63										NA	NA	NA	
Thursday	10/21/2021	1:00 AM	39	41	35	33	55										NA	NA	NA	
Thursday	10/21/2021	2:00 AM	39	41	35	34	54			52				39			NA	NA	NA	
Thursday	10/21/2021	3:00 AM	39	41	35	34	57										NA	NA	NA	
Thursday	10/21/2021	4:00 AM	42	44	36	34	58										NA	NA	NA	
Thursday	10/21/2021	5:00 AM	46	47	38	36	69										NA	NA	NA	
Thursday	10/21/2021	6:00 AM	56	60	45	41	73										4	26	Clouds	
Thursday	10/21/2021	7:00 AM	64	60	49	45	92										7	27	Clouds	
Thursday	10/21/2021	8:00 AM	66	65	51	46	91										9	29	Clouds	
Thursday	10/21/2021	9:00 AM	57	60	51	47	77										13	31	Clouds	
Thursday	10/21/2021	10:00 AM	62	61	51	48	90										11	31	Clouds	
Thursday	10/21/2021	11:00 AM	59	61	49	45	79								53	44	15	32	Clouds	
Thursday	10/21/2021	12:00 PM	63	63	49	44	87	61				51					13	31	Clouds	
Thursday	10/21/2021	1:00 PM	57	59	52	49	70										11	32	Clouds	
Thursday	10/21/2021	2:00 PM	57	59	53	51	75				60						11	31	Clouds	
Thursday	10/21/2021	3:00 PM	59	61	53	50	82										9	30	Clouds	
Thursday	10/21/2021	4:00 PM	62	63	51	45	84										17	30	Clouds	
Thursday	10/21/2021	5:00 PM	57	59	47	42	78										11	30	Clouds	
Thursday	10/21/2021	6:00 PM	59	60	46	40	87										7	29	Clouds	
Thursday	10/21/2021	7:00 PM	52	52	44	38	72										7	29	Clouds	
Thursday	10/21/2021	8:00 PM	62	56	43	40	94		58				43				0	28	Clouds	
Thursday	10/21/2021	9:00 PM	50	50	41	36	70										13	28	Clouds	
Thursday	10/21/2021	10:00 PM	50	50	39	36	72										7	28	Clouds	
Thursday	10/21/2021	11:00 PM	43	45	36	34	57										NA	NA	NA	
Friday	10/22/2021	12:00 AM	40	43	35	33	55										NA	NA	NA	
Friday	10/22/2021	1:00 AM	39	42	35	34	54										NA	NA	NA	
Friday	10/22/2021	2:00 AM	41	42	35	34	58			49				38			NA	NA	NA	
Friday	10/22/2021	3:00 AM	41	42	35	34	56										NA	NA	NA	
Friday	10/22/2021	4:00 AM	43	44	36	34	61										NA	NA	NA	
Friday	10/22/2021	5:00 AM	47	47	39	36	73										NA	NA	NA	
Friday	10/22/2021	6:00 AM	57	59	43	39	81										9	27	Clouds	
Friday	10/22/2021	7:00 AM	58	60	49	44	77										7	27	Clouds	
Friday	10/22/2021	8:00 AM	61	63	52	49	85										11	29	Clouds	
Friday	10/22/2021	9:00 AM	60	60	50	45	85										9	31	Clouds	
Friday	10/22/2021	10:00 AM	57	58	50	47	78										11	31	Clouds	
Friday	10/22/2021	11:00 AM	58	60	51	49	77								53	44	13	31	Clouds	
Friday	10/22/2021	12:00 PM	61	62	49	45	87	60				50					13	31	Scattered Shower	Rain
Friday	10/22/2021	1:00 PM	59	60	51	48	81										13	31	Clouds	
Friday	10/22/2021	2:00 PM	62	59	51	48	85				59						9	32	Clouds	
Friday	10/22/2021	3:00 PM	63	64	49	43	87										9	31	Clouds	
Friday	10/22/2021	4:00 PM	61	63	49	46	82										9	30	Clouds	
Friday	10/22/2021	5:00 PM	56	58	48	45	74										9	30	Tornado	Rain
Friday	10/22/2021	6:00 PM	55	56	47	43	74										7	29	Clouds	
Friday	10/22/2021	7:00 PM	53	54	46	44	71										11	29	Clouds	
Friday	10/22/2021	8:00 PM	50	51	43	39	75		52				45				6	29	Thundershower	Rain
Friday	10/22/2021	9:00 PM	49	49	43	40	70										6	28	Clouds	
Friday	10/22/2021	10:00 PM	48	50	43	41	68										6	28	Clouds	
Friday	10/22/2021	11:00 PM	46	47	41	38	73										NA	NA	NA	
Saturday	10/23/2021	12:00 AM	45	46	40	37	66										NA	NA	NA	

Table D.4

Environmental Sound Level Measurements, LAEQ - Validated Background Measurements - NSR4
Dart
Georgetown, Cayman Islands

Day of Week	Date	Time	LAeq (2), (3)	L_{AS10} (2)	L_{AS90} (2)	L_{ASMin} (2)	L_{ASMax} (2)	Daytime Period Average LASeq 11 hour	Evening Period Average LASeq 5 hour	Nighttime Period Average LASeq 8 hour	Daytime Period Average LASeq 18 hour	Daytime Period Average LAS90 11 hour	Evening Period Average LAS90 5 hour	Nighttime Period Average LAS90 8 hour	Daily Average LAeq (2), (3)	Daily Average L_{AS90} (2)	Wind Spd (km/h) (1)	Temperature (°C)	Weather	Comments
Saturday	10/23/2021	1:00 AM	45	45	39	37	68										NA	NA	NA	
Saturday	10/23/2021	2:00 AM	43	45	39	36	58			50				41			NA	NA	NA	
Saturday	10/23/2021	3:00 AM	42	44	39	37	55										NA	NA	NA	
Saturday	10/23/2021	4:00 AM	42	44	38	36	54										NA	NA	NA	
Saturday	10/23/2021	5:00 AM	44	46	40	37	65										NA	NA	NA	
Saturday	10/23/2021	6:00 AM	57	61	45	41	77										6	27	Scattered Shower	Rain
Saturday	10/23/2021	7:00 AM	58	61	48	45	75										6	28	Clouds	
Saturday	10/23/2021	8:00 AM	59	62	49	45	78										11	29	Clouds	
Saturday	10/23/2021	9:00 AM	59	59	49	47	83										19	30	Clouds	
Saturday	10/23/2021	10:00 AM	57	59	50	46	78										19	29	Clouds	
Saturday	10/23/2021	11:00 AM	64	66	52	48	86										15	31	Clouds	
Saturday	10/23/2021	12:00 PM	72	72	53	49	93	64				50			54	45	17	31	Clouds	
Saturday	10/23/2021	1:00 PM	64	64	50	47	80										19	31	Clouds	
Saturday	10/23/2021	2:00 PM	56	58	49	46	77				63						20	31	Clouds	Wind >= 20 km/hr
Saturday	10/23/2021	3:00 PM	60	59	49	46	84										17	31	Clouds	
Saturday	10/23/2021	4:00 PM	58	58	48	45	85										17	30	Clouds	
Saturday	10/23/2021	5:00 PM	66	59	48	44	96										11	31	Clouds	
Saturday	10/23/2021	6:00 PM	56	57	47	43	78										7	28	Scattered Shower	Rain
Saturday	10/23/2021	7:00 PM	51	51	44	40	71										9	29	Clouds	
Saturday	10/23/2021	8:00 PM	52	52	42	39	71		53				44				9	28	Clouds	
Saturday	10/23/2021	9:00 PM	53	50	42	37	80										11	28	Clouds	
Saturday	10/23/2021	10:00 PM	52	52	46	43	71										17	28	Sprinkles	Rain
Saturday	10/23/2021	11:00 PM	49	50	41	38	74										NA	NA	NA	
Sunday	10/24/2021	12:00 AM	45	47	41	39	59										NA	NA	NA	
Sunday	10/24/2021	1:00 AM	43	44	38	35	63										NA	NA	NA	
Sunday	10/24/2021	2:00 AM	40	42	36	35	57			46				39			NA	NA	NA	
Sunday	10/24/2021	3:00 AM	41	43	37	34	58										NA	NA	NA	
Sunday	10/24/2021	4:00 AM	42	43	37	35	63										NA	NA	NA	
Sunday	10/24/2021	5:00 AM	43	45	39	36	65										NA	NA	NA	
Sunday	10/24/2021	6:00 AM	50	50	41	37	70										9	28	Clouds	
Sunday	10/24/2021	7:00 AM	56	60	42	38	74										9	28	Clouds	
Sunday	10/24/2021	8:00 AM	55	57	42	38	74										9	29	Clouds	
Sunday	10/24/2021	9:00 AM	53	53	43	40	72										15	30	Scattered Shower	Rain
Sunday	10/24/2021	10:00 AM	58	57	43	39	84										19	31	Clouds	
Sunday	10/24/2021	11:00 AM	54	54	44	41	73										17	32	Clouds	
Sunday	10/24/2021	12:00 PM	53	54	44	41	73	55				43			50	41	19	32	Clouds	
Sunday	10/24/2021	1:00 PM	54	55	44	41	74										15	32	Clouds	
Sunday	10/24/2021	2:00 PM	50	51	44	41	69				55						20	32	Partly Sunny	Wind >= 20 km/hr
Sunday	10/24/2021	3:00 PM	52	53	44	41	79										17	31	Clouds	
Sunday	10/24/2021	4:00 PM	55	56	44	40	75										NA	NA	NA	
Sunday	10/24/2021	5:00 PM	56	57	44	40	79										15	30	Clouds	
Sunday	10/24/2021	6:00 PM	55	56	45	41	76										13	29	Clouds	
Sunday	10/24/2021	7:00 PM	55	57	43	40	71										9	29	Clouds	
Sunday	10/24/2021	8:00 PM	51	50	42	40	74		52				43				15	29	Clouds	
Sunday	10/24/2021	9:00 PM	49	48	41	39	69										11	29	Clouds	
Sunday	10/24/2021	10:00 PM	47	46	40	37	69										9	29	Clouds	
Sunday	10/24/2021	11:00 PM	42	44	38	36	58										NA	NA	NA	
Monday	10/25/2021	12:00 AM	46	44	38	37	71										NA	NA	NA	
Monday	10/25/2021	1:00 AM	41	42	38	36	62										NA	NA	NA	
Monday	10/25/2021	2:00 AM	42	44	38	37	60			57				41			NA	NA	NA	
Monday	10/25/2021	3:00 AM	43	46	39	37	61										NA	NA	NA	
Monday	10/25/2021	4:00 AM	44	46	39	37	65										NA	NA	NA	
Monday	10/25/2021	5:00 AM	47	49	41	38	62										NA	NA	NA	
Monday	10/25/2021	6:00 AM	66	61	46	42	91										9	28	Clouds	
Monday	10/25/2021	7:00 AM	65	67	52	47	86										9	29	Clouds	
Monday	10/25/2021	8:00 AM	63	64	51	48	89										11	30	Clouds	
Monday	10/25/2021	9:00 AM	58	59	50	48	79										11	31	Clouds	
Monday	10/25/2021	10:00 AM	60	57	50	47	88										13	32	Clouds	
Monday	10/25/2021	11:00 AM	60	61	50	47	83										13	32	Clouds	
Monday	10/25/2021	12:00 PM	61	62	48	46	84	61				50			54	45	13	32	Clouds	
Monday	10/25/2021	1:00 PM	60	61	51	48	86										13	32	Clouds	
Monday	10/25/2021	2:00 PM	60	63	51	47	82				62						17	31	Clouds	
Monday	10/25/2021	3:00 PM	62	65	51	49	82										15	31	Clouds	
Monday	10/25/2021	4:00 PM	62	65	49	45	86										15	31	Clouds	
Monday	10/25/2021	5:00 PM	59	64	47	43	77										15	31	Clouds	
Monday	10/25/2021	6:00 PM	55	56	45	40	73										11	30	Clouds	
Monday	10/25/2021	7:00 PM	56	59	44	40	76										7	29	Clouds	
Monday	10/25/2021	8:00 PM	48	48	41	38	69		53				42				7	29	Clouds	
Monday	10/25/2021	9:00 PM	54	52	40	37	80										6	29	Clouds	
Monday	10/25/2021	10:00 PM	48	47	38	35	73										9	29	Clouds	
Monday	10/25/2021	11:00 PM	43	44	36	35	68										NA	NA	NA	
Tuesday	10/26/2021	12:00 AM	43	44	39	37	66										NA	NA	NA	
Tuesday	10/26/2021	1:00 AM	39	41	36	35	54										NA	NA	NA	
Tuesday	10/26/2021	2:00 AM	39	40	35	34	56			51				38			NA	NA	NA	
Tuesday	10/26/2021	3:00 AM	40	42	35	34	57										NA	NA	NA	
Tuesday	10/26/2021	4:00 AM	40	43	35	34	53										NA	NA	NA	
Tuesday	10/26/2021	5:00 AM	46	48	38	35	70										NA	NA	NA	
Tuesday	10/26/2021	6:00 AM	60	62	44	38	86										4	27	Clouds	
Tuesday	10/26/2021	7:00 AM	67	67	51	45	93										4	27	Clouds	
Tuesday	10/26/2021	8:00 AM	60	64	50	48	76										9	29	Clouds	
Tuesday	10/26/2021	9:00 AM	58	60	51	46	78										7	30	Clouds	
Tuesday	10/26/2021	10:00 AM	56	58	51	47	72										11	31	Clouds	
Tuesday	10/26/2021	11:00 AM	57	59	51	44	76										13	31	Clouds	
Tuesday	10/26/2021	12:00 PM	62	62	49	45	87	61				51			53	44	15	31	Clouds	
Tuesday	10/26/2021	1:00 PM	59	62	53	49	77										13	32	Clouds	
Tuesday	10/26/2021	2:00 PM	62	65	53	50	83				62						11	31	Clouds	
Tuesday	10/26/2021	3:00 PM	63	66	55	48	77										11	31	Clouds	

Table D.4

Environmental Sound Level Measurements, LAEQ - Validated Background Measurements - NSR4
Dart
Georgetown, Cayman Islands

Day of Week	Date	Time	LAeq [(2), (3)]	L_{AS10} [(2)]	L_{AS90} [(2)]	L_{ASMin} [(2)]	L_{ASMax} [(2)]	Daytime Period Average LASeq 11 hour	Evening Period Average LASeq 5 hour	Nighttime Period Average LASeq 8 hour	Daytime Period Average LASeq 18 hour	Daytime Period Average LAS90 11 hour	Evening Period Average LAS90 5 hour	Nighttime Period Average LAS90 8 hour	Daily Average LAeq [(2), (3)]	Daily Average L_{AS90} [(2)]	Wind Spd (km/h) [(1)]	Temperature (°C)	Weather	Comments
Tuesday	10/26/2021	4:00 PM	61	64	50	47	82										11	30	Clouds	
Tuesday	10/26/2021	5:00 PM	61	65	48	44	82										9	30	Clouds	
Tuesday	10/26/2021	6:00 PM	56	58	46	43	73										6	29	Clouds	
Tuesday	10/26/2021	7:00 PM	55	56	44	40	73										6	29	Clouds	
Tuesday	10/26/2021	8:00 PM	53	53	41	35	73		54				43				4	28	Clear	
Tuesday	10/26/2021	9:00 PM	52	53	40	36	72										4	29	Clear	
Tuesday	10/26/2021	10:00 PM	48	46	37	34	73										6	28	Clear	
Tuesday	10/26/2021	11:00 PM	41	44	35	34	56										NA	NA	NA	
Wednesday	10/27/2021	12:00 AM	42	45	36	35	52										NA	NA	NA	
Wednesday	10/27/2021	1:00 AM	40	42	35	34	54										NA	NA	NA	
Wednesday	10/27/2021	2:00 AM	44	43	37	36	68			51				40			NA	NA	NA	
Wednesday	10/27/2021	3:00 AM	42	44	36	35	57										NA	NA	NA	
Wednesday	10/27/2021	4:00 AM	44	46	36	35	66										NA	NA	NA	
Wednesday	10/27/2021	5:00 AM	49	49	40	37	72										NA	NA	NA	
Wednesday	10/27/2021	6:00 AM	59	61	47	41	80								53	45	2	26	Clouds	
Wednesday	10/27/2021	7:00 AM	63	67	51	47	76										4	27	Clouds	
Wednesday	10/27/2021	8:00 AM	59	63	51	48	75										6	29	Clouds	
Wednesday	10/27/2021	9:00 AM	57	58	49	47	82				63						11	31	Clouds	
Wednesday	10/27/2021	10:00 AM	58	60	51	48	80	61				52					13	31	Partly Sunny	
Wednesday	10/27/2021	11:00 AM	62	64	54	47	86										17	31	Clouds	
Wednesday	10/27/2021	12:00 PM	62	63	48	45	86										15	31	Clouds	
Wednesday	10/27/2021	1:00 PM	62	64	54	49	86										13	31	Clouds	

	LAeq [(2), (3)]	L_{AS10} [(2)]	L_{AS90} [(2)]	L_{ASMin} [(2)]	L_{ASMax} [(2)]	Daytime Period Average LASeq 11 hour	Evening Period Average LASeq 5 hour	Nighttime Period Average LASeq 8 hour	Daytime Period Average LAS10eq 18 hour	Daytime Period Average LAS90 11 hour	Evening Period Average LAS90 5 hour	Nighttime Period Average LAS90 8 hour
Lowest Daytime one-hour (07:00 - 19:00)	**52**	**53**	**42**	**38**	**70**	**61**	**54**	**51**	**60**	**50**	**43**	**39**
Lowest Evening one-hour (19:00 - 23:00)	**47**	**46**	**37**	**34**	**68**							
Lowest Nighttime one-hour (23:00-07:00)	**39**	**40**	**35**	**33**	**50**			**Max**	**63**	**52**	**45**	**41**
								Min	**55**	**43**	**42**	**38**

Notes:

(1) Weather data downloaded from Time and Date website
(2) Measurements recorded during inclement weather (winds speeds greater than 20 km/h and/or rain) were disregarded.
(3) Boxed data represents the lowest measured Leq during the respective monitoring time period.

Figure D.1 NSR1 (Lakeside Development) Monitoring Location

Figure D.2 NSR2 (Residence on Parkside Close) Monitoring Location

Figure D.3 NSR3 (Residence on Seymour Road) Monitoring Location

Figure D.4 **NSR4 (Cayman International School) Monitoring Location**

Appendix 13.A

Traffic Statement

GRAND CAYMAN PROPOSED INTEGRATED SOLID WASTE MANAGEMENT SYSTEM
ReGen

TRAFFIC STATEMENT

June 2023

Final

GRAND CAYMAN PROPOSED INTEGRATED SOLID WASTE MANAGEMENT SYSTEM TRAFFIC STATEMENT

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INDEX OF FIGURES

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LIST OF ACRONYMS

ADT	Average Daily Traffic
Base Year	Year of Data Collection (2022)
BOB	Bank of Butterfield (roundabout)
CIG	Cayman Islands Government
DEH	Department of Environmental Health
EB	Eastbound
EIA	Environmental Impact Assessment
GTLF	George Town Landfill
HGV	Heavy Goods Vehicle
ISWMS	Integrated Solid Waste Management System
LOS	Level of Service
Medium-Term Year	Planned opening year plus 10 years (2036)
NB	Northbound
Near-Term Assessment Year	Planned opening year plus 5 years (2031)
NRA	National Roads Authority
NSR	North Sound Road
Opening Year	Planned opening year of ReGen facilities (2026)
SB	Southbound
SR	Seymour Road
TIA	Traffic Impact Analysis
ToR	Terms of Reference (for the EIA)
TS	Traffic Statement
WB	Westbound
WTE	Waste to Energy Facility
WWTW	Waste Water Treatment Works

GRAND CAYMAN PROPOSED INTEGRATED SOLID WASTE MANAGEMENT SYSTEM TRAFFIC STATEMENT

1.0 INTRODUCTION

An Environmental Impact Assessment (EIA) is being undertaken for the proposed Grand Cayman Integrated Solid Waste Management System (ISWMS), commonly referred to as the ISWMS Project. The facility is part of an overall ISWMS for the entire Cayman Islands. The project is being developed by the DECCO Consortium (ReGen) in collaboration with the Cayman Islands Government (CIG). This Traffic Statement (TS) has been undertaken as part of the EIA process for the purposes of assessing the likely impacts of the ISWMS development in Grand Cayman on the surrounding road network. This report has been prepared with input from the National Roads Authority (NRA) and the Department of Environmental Health (DEH) which operates the existing George Town Landfill (GTLF) on Grand Cayman.

The proposed ReGen facilities in Grand Cayman (ReGen facilities) are mostly located on land adjacent the existing GTLF site with some of the facility utilising land previously occupied by the GTLF. The land is currently brownfield site and was previously used as part of the landfill. The site is accessed at the north end of Seymour Road in the Industrial Park area of George Town. The ReGen facilities are expected to open in 2026.

The TS is organized to set out the existing situation, present the proposed development and determine what impact, if any, the site-generated traffic will have on the surrounding road network. This report summarises the traffic study, analysis of existing and predicted future traffic flows and outlines the potential traffic and transport impacts of the facility.

A Scoping Report was prepared which outlined the proposed methodology for this traffic impact assessment. This was issued to NRA for review on October 25th, 2021. Comments were received from the NRA on December 6th, 2021 and November 16th, 2022. The Scoping Report is included in **Appendix A**. The comments from the NRA have been incorporated in the preparation of this TS report.

The Terms of Reference (ToR) for the EIA were finalised on October 7th, 2021. Section 5.8 of the ToR outlines the traffic and transport assessment that will be undertaken as part of the EIA. This document has been referenced where necessary during the preparation of this traffic impact assessment and is included in **Appendix B**.

2.0 BACKGROUND AND EXISTING CONDITIONS

The proposed ReGen facilities in Grand Cayman are located at the north end of Seymour Road (SR) in the Industrial Park area of George Town. The facilities are accessible only via SR, a cul-de-sac road off North Sound Road.

2.1 STUDY AREA

The study area for this impact assessment consists of an area stretching from the north end of Seymour Road at the entrance to the site, south along Seymour Road and encompass the intersection of Seymour Road with North Sound Road. The study area also extends east to the intersection of North Sound Road and Dorcy Drive and west to the approach to the 'Bank of Butterfield' (BOB) roundabout, where North Sound Road intersects with the Esterley Tibbetts Highway and Godfrey Nixon Way. The BOB roundabout was modelled to measure its impact on the roads within the study area.

All roads within the study area are two-way single carriageway roads. The intersection of Seymour Road and North Sound Road (NSR), and the intersection of NSR and Dorcy Drive (DD) are both unsignalised mini-roundabouts. The Bank of Butterfield (BOB) roundabout, a large two-lane roundabout exists at the western extent of the study area, where the North Sound Road intersects with the Esterley Tibbetts Highway and Godfrey Nixon Way. Refer to the **Figure 1** showing the study area and location plan.

This study will aim to quantify the impact of ReGen associated traffic on Seymour Road, North Sound Road, Dorcy Drive and BOB Roundabout.

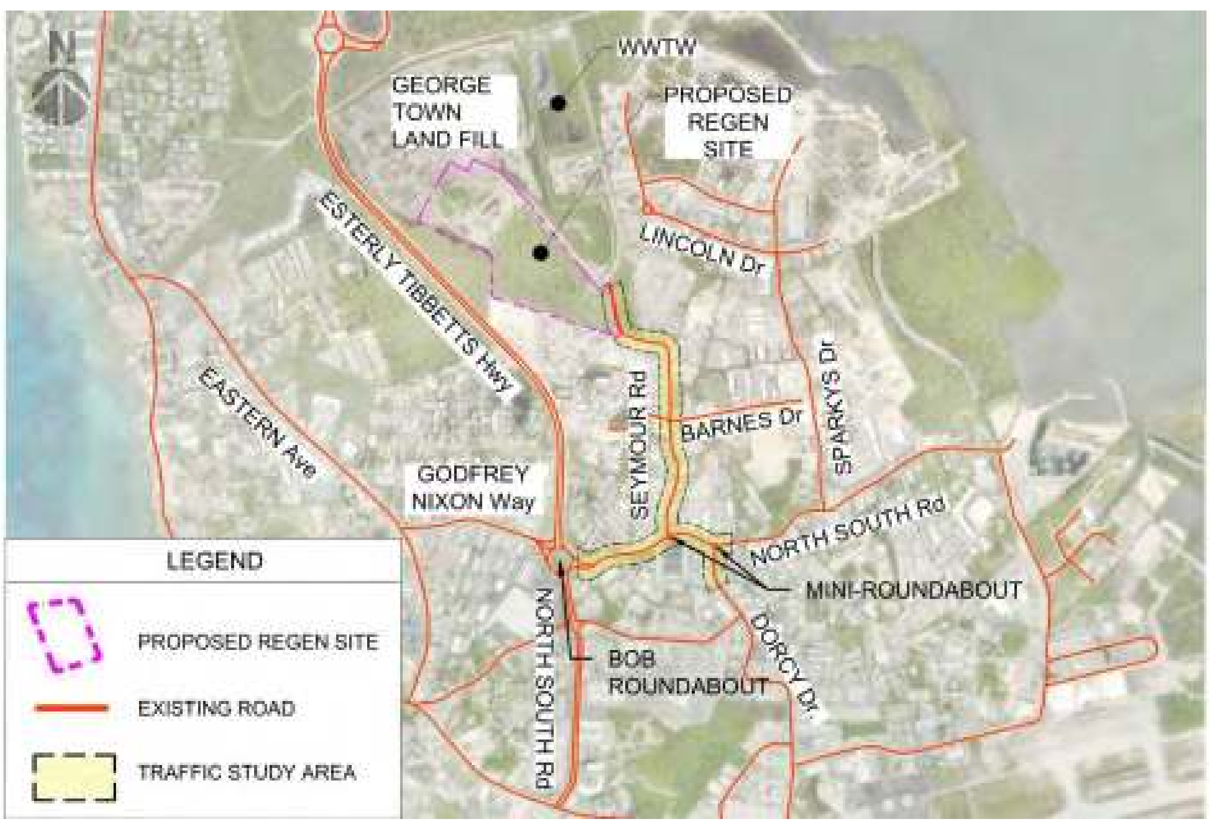

Figure 1 – Study Area location plan showing existing road network

2.1.1 Public Transport

An existing bus service exists within the study area. According to the Public Transport Unit within CIG (CaymanTransport.ky), bus 5A travels along North South Road passing the south end of Seymour Road. The frequency of the bus service is not known. There are no bus stops within the study area, however the bus service in Cayman typically stops upon request of the passengers.

2.1.2 Pedestrian / Bicycle Facilities

There are currently limited pedestrian facilities within the study area. There are isolated sections of sidewalks along both sides of North Sound Road. There is a limited section of sidewalk on one side of Seymour Road at a concrete batching facility.

There are no dedicated facilities for bicycles within the study area.

2.2 Traffic Data

Data of the existing traffic flows on the surrounding road network within the study area was gathered by way of a combination of automatic traffic counters[1] and turning movement counts undertaken by APEC staff. Existing traffic data was also provided by the NRA, mainly from a 2017 island-wide traffic count study.

2.2.1 Existing Traffic Volumes - Automatic Traffic Counters

Traffic data from automatic traffic counters was collected at seven locations between December 2 and 16, 2022.

- North Sound Road (East of BOB roundabout / Agave) – 7 complete days of data (5 weekdays)
- North Sound Road (East of Tony's Toys Lot) – 7 complete days of data (4 weekdays)
- North Sound Road (Paramount / between SR & DD) – 9 complete days of data (6 weekdays)
- Dorcy Drive (Ashley furniture) – 8 complete days of data (6 weekdays)
- North Sound Road (East of Dorcy Drive intersection) – 11 complete days of data (7 weekdays)
- Seymour Road (North of intersection with NSR) – 16 complete days of data (12 weekdays)
- Seymour Road (South of GTLF entrance) – 16 complete days of data (12 weekdays)

In addition, reference has been made to traffic flow data from 2012 on Seymour Road at the GTLF entrance.

Refer to **Figure 2** for traffic count locations.

[1] PicoCount 2500 counter with pneumatic road tubes

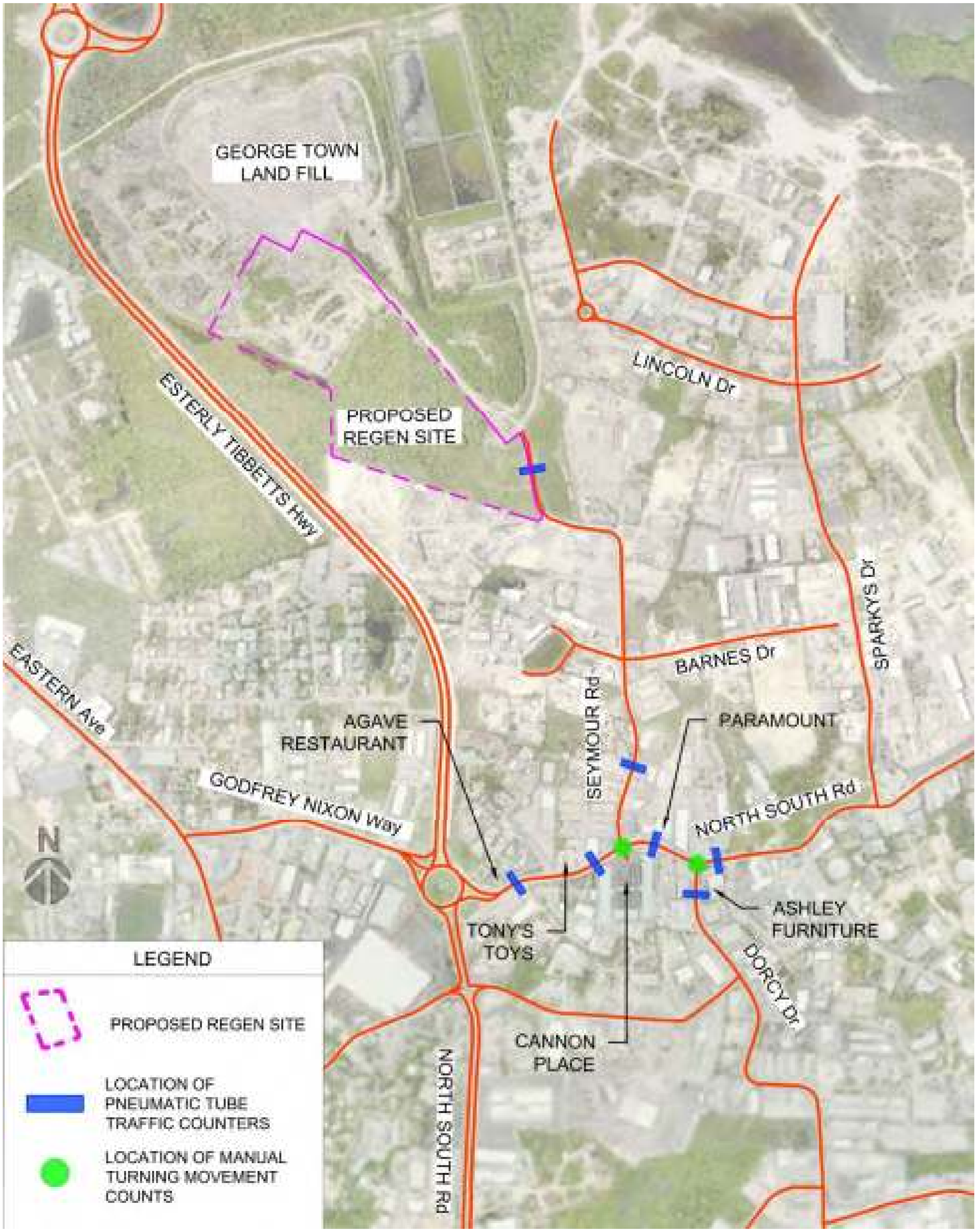

Figure 2 – Traffic Count Location Plan

The baseline traffic flow in the study area was established to assess the impact of the proposed ReGen facilities on the surrounding road network. **Table 1** through **Table 7** present a summary of the morning (AM) and afternoon / evening (PM) peak traffic flows recorded from the automatic traffic counts.

	Eastbound	Westbound	Combined
Average Weekday AM Peak 08:30 – 09:30	518	496	1014
Average Weekday PM Peak 17:45 – 18:45 [2]	373	272	645
Average Weekday ADT	5816	4654	10470

Table 1 – North Sound Road (Agave) Traffic Volume [2]

	Eastbound [2]	Westbound	Combined
Average Weekday AM Peak 09:00 – 10:00	50	511	561
Average Weekday PM Peak 18:30 – 19:30	82	439	521
Average Weekday ADT	1222	5760	6982

Table 2 – North Sound Road (East of Tony's Toys Lot) Traffic Volume [2]

	Eastbound	Westbound [2]	Combined
Average Weekday AM Peak 06:45 – 07:45	469	219	688
Average Weekday PM Peak 12:30 – 13:30	516	101	617
Average Weekday ADT	6782	2142	8924

Table 3 – North Sound Road (Paramount) Traffic Volume [2]

[2] Some traffic flow data was not recorded by the automatic traffic counters due to slow-moving nature of traffic during peak periods and the counters missing these vehicles. The automatic count data was supplemented by data from the NRA and manual turning movement counts. This may lead to slight alterations in peak traffic periods

	Northbound [2]	Southbound	Combined
Average Weekday AM Peak 07:15 – 08:15	308	284	592
Average Weekday PM Peak 18:00 – 19:00	214	226	440
Average Weekday ADT	2809	3779	6588

Table 4 – Dorcy Drive (Ashley furniture) Traffic Volume [2]

	Eastbound	Westbound	Combined
Average Weekday AM Peak 06:45 – 07:45	292	214	506
Average Weekday PM Peak 12:30 – 13:30	211	200	411
Average Weekday ADT	3006	2646	5652

Table 5 – North Sound Road (East of Dorcy Drive intersection) Traffic Volume [2]

	Northbound	Southbound	Combined
Average Weekday AM Peak 06:45 – 07:45	205	164	389
Average Weekday PM Peak 12:00 – 13:00	134	200	334
Average Weekday ADT	1908	2648	4556

Table 6 – Seymour Road (north of intersection with North Sound Road) Traffic Volume

	Northbound	Southbound	Combined
Average Weekday AM Peak 06:45 – 07:45	55	50	105
Average Weekday PM Peak 14:45 – 15:45	44	62	106
Average Weekday ADT	531	656	1187

Table 7 – Seymour Road (south of GTLF Entrance) Traffic Volume

The data from the automatic traffic counters have been included in **Appendix C**.

The data gathered from the automatic counters and provided by the NRA were used to establish the morning (AM) and afternoon / evening (PM) peak periods. These were later verified by way of manual traffic counts at intersections within the study area – refer to **Section 2.2.3**.

2.2.2 TRAFFIC SPEEDS

The automatic traffic data was interrogated to calculate the average travel speed at each of the counter locations. The following table summarises the average travel speed and the posted speed limit at each counter location.

There are no visible speed limit signs within the study area. The speed limits shown were taken from The Traffic (Speed Limits in Grand Cayman) Regulations, 2016. There was no speed limit shown for Seymour Road. It has been assumed that the speed limit on Seymour Road is a continuation of the applicable speed limit on North Sound Road.

	Average Travel Speed (mph)	Posted Speed Limit (mph)
North Sound Road (East of BOB roundabout / Agave)	22.1	25
North Sound Road (East of Tony's Toys Lot)	19.1	25
North Sound Road (Paramount / between SR & DD)	19.4	25
Dorcy Drive (Ashley furniture)	19.1	25
North Sound Road (East of Dorcy Drive intersection)	20.3	25
Seymour Road (North of intersection with NSR)	16.9	25
Seymour Road (South of GTLF entrance)	18.7	25

Table 8 – Average Travel Speed & Posted Speed Limit

The data from the automatic traffic counters have been included in **Appendix C**.

2.2.3 Existing Traffic Volumes – Manual Turning Movement Counts

Manual turning movement counts were undertaken on three dates as follows:

- North Sound Road / Seymour Road mini-roundabout – December 15, 2022 (AM peak)
- North Sound Road / Seymour Road mini-roundabout – January 26, 2023 (PM peak)
- North Sound Road / Dorcy Drive mini-roundabout – March 15, 2023 (AM peak)
- North Sound Road / Dorcy Drive mini-roundabout – December 14, 2022 (PM peak)

Refer to **Figure 2** for traffic count locations.

The traffic data gathered during the manual turning movement counts is summarised in the figures below.

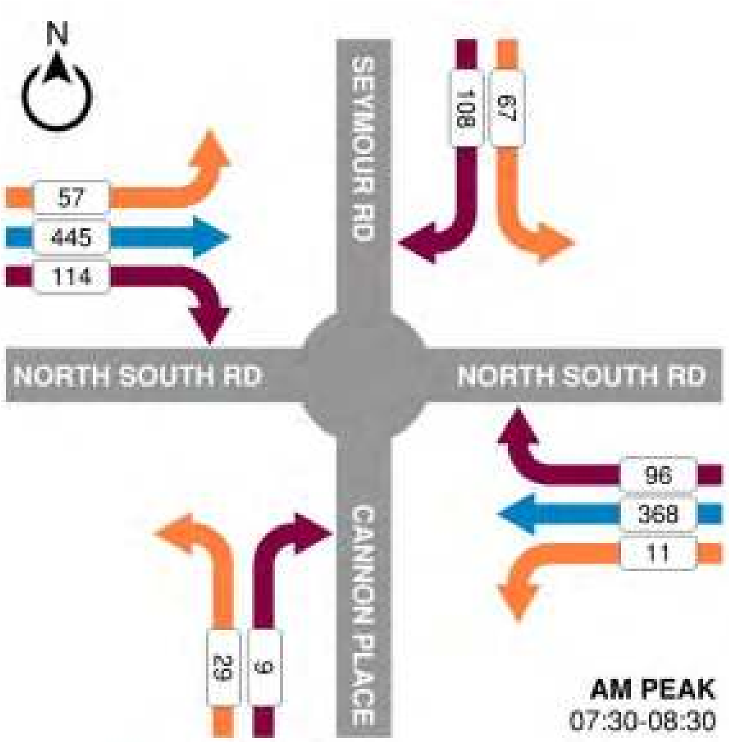

Figure 3 – Intersection of North Sound Road & Seymour Road – AM Peak

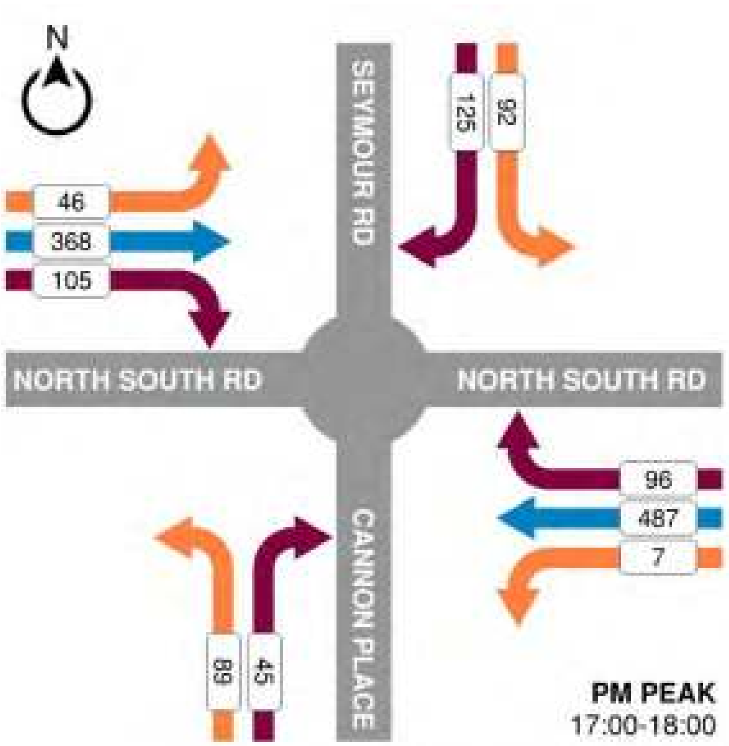

Figure 4 – Intersection of North Sound Road & Seymour Road – PM Peak

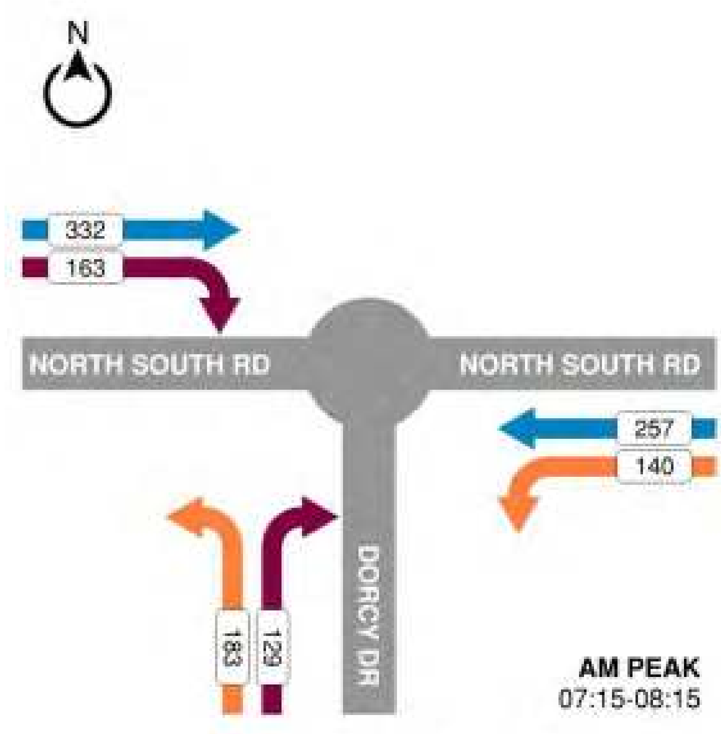

Figure 5 – Intersection of North Sound Road & Dorcy Drive – AM Peak

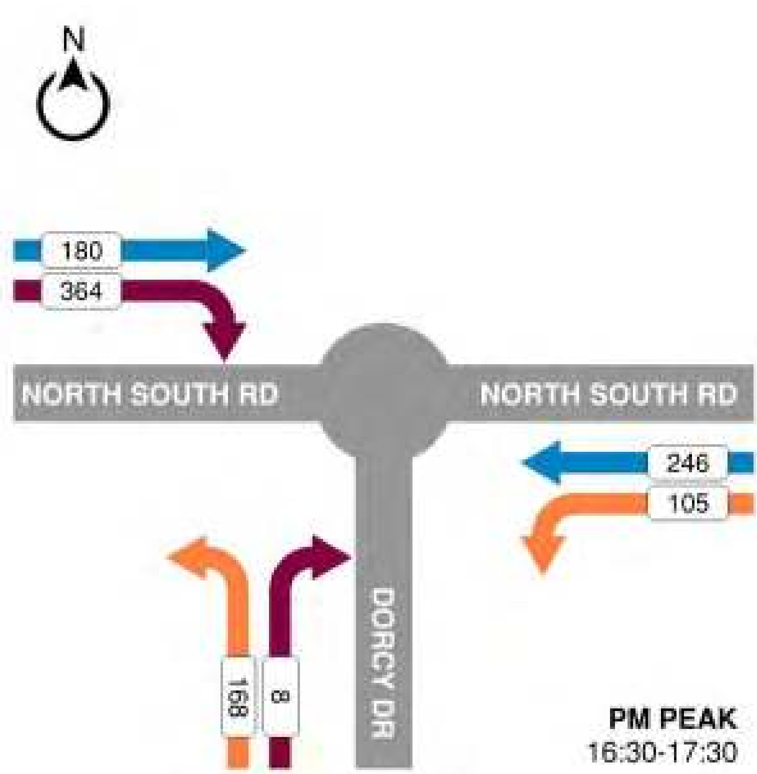

Figure 6 – Intersection of North Sound Road & Dorcy Drive – PM Peak

2.2.4 Traffic Classification

The results from the manual traffic counts were interrogated to quantify the classification of vehicles at each of the intersection approaches. The following tables summarise the vehicle classification.

	Bicycles / Motorcycles	Cars / Pickups	Buses	Trucks / HGVs
Percentage	2%	93%	1%	4%

Table 9 – North Sound Road (West of intersection with SR) Traffic Classification

	Bicycles / Motorcycles	Cars / Pickups	Buses	Trucks / HGVs
Percentage	1%	90%	0%	9%

Table 10 – Seymour Road (at intersection with NSR) Traffic Classification

	Bicycles / Motorcycles	Cars / Pickups	Buses	Trucks / HGVs
Percentage	2%	91%	1%	6%

Table 11 – North Sound Road (between SR and DD intersections) Traffic Classification

	Bicycles / Motorcycles	Cars / Pickups	Buses	Trucks / HGVs
Percentage	1%	91%	1%	8%

Table 12 – Dorcy Drive (at intersection with NSR) Traffic Classification

	Bicycles / Motorcycles	Cars / Pickups	Buses	Trucks / HGVs
Percentage	2%	90%	1%	7%

Table 13 – North Sound Road (East of Intersection with DD) Traffic Classification

This manual traffic count data is included in **Appendix D**.

The results from the automatic traffic counter located south of the entrance to the GTLF were interrogated to quantify the classification of vehicles. The following table summarise the vehicle classification.

	Bicycles / Motorcycles	Cars / Pickups	Buses	Trucks / HGVs
Percentage	2%	76%	1%	21%

Table 14 – Seymour Road (South of GTLF entrance) Traffic Classification

2.2.5 Existing Traffic Volumes – NRA Traffic Counts

Existing traffic flow data has been received from the NRA[3] for the following locations in and around the study area:

- North Sound Road (South of Godfrey Nixon Way) – 2019
- Esterley Tibbetts Highway (by Lakeside Development) - 2019
- Godfrey Nixon Way (east of Eastern Avenue) – 2019
- North Sound Road (Tony's Toys Lot) – 2017
- Dorcy Drive (south of Ashley furniture) – 2017
- North Sound Road (East of Dorcy Drive intersection) – 2017
- Intersection Turning Movement Count for Bank of Butterfield roundabout - 2016
- Intersection Turning Movement Count for North Sound Road / Dorcy Drive - 2016

The turning movement count data for Bank of Butterfield roundabout have been included in **Appendix E**.

Traffic data from the 2016 turning movement count at Bank of Butterfield roundabout were used to establish peak period traffic flows through the intersection. The data from 2016 were increased in line with NRA established growth rates (see **Section 4.2**) to provide 'base year', 2022, traffic flows. The classification of vehicles utilising the roundabout intersection was taken from the data provided by the 2016 count. Refer to **Figure 7** and **Figure 8** summarising the calculated AM and PM peak flow data for the 2022 Base Year.

[3] Additional traffic data was received from the NRA but was deemed not relevant for this traffic study

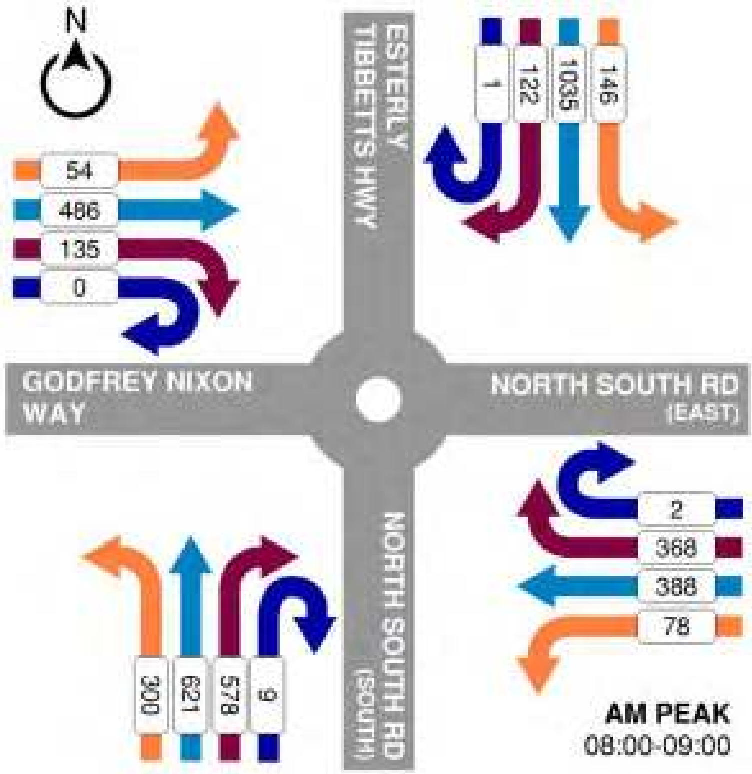

Figure 7 – Bank of Butterfield roundabout – AM Peak

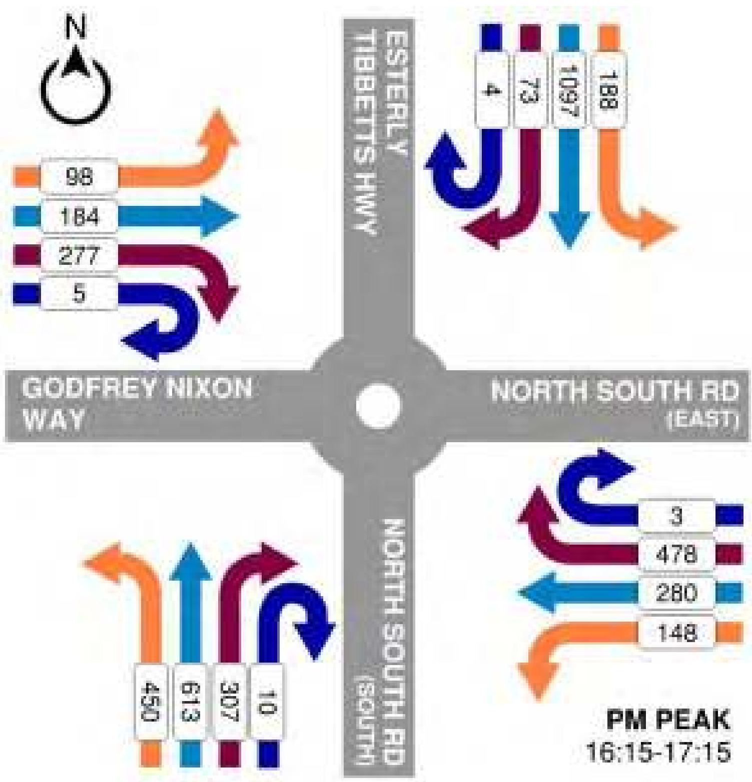

Figure 8 – Bank of Butterfield roundabout – PM Peak

2.2.6 Existing / Base Year Peak Hour Traffic Flow Analysis

Analysis has been undertaken of the existing traffic flows within the study area to establish the current Level of Service (LOS) on the surrounding roads. This analysis is based on several available data sets:

- Turning Movement Count data for 'Bank of Butterfield' roundabout made available by the NRA - 2016
- Manual Traffic Count undertaken at North Sound Road / Seymour Road mini-roundabout - 2022
- Manual Traffic Count undertaken at North Sound Road / Dorcy Drive mini-roundabout - 2022

Interrogation of the available data has established the traffic flows on the surrounding road network during both the morning (AM) and afternoon / evening (PM) peak hours. While the peak periods of each intersection do not necessarily match, the worst-case peak has been used to provide a robust analysis. The vehicle classification information from the available data was used to apportion heavy goods vehicles (HGVs), buses, bicycle / motorcycles, and passenger cars on the road network within the analysis models. The focus of this analysis review will be on roads within the study area.

Level of service (LOS) is a term used to qualitatively describe the operating conditions of a roadway based on measures related to speed and travel time, freedom to manoeuvre, traffic interruptions, and comfort and convenience. The LOS ranges from A (least congested) to F (most congested). **Table 14** shows the definitions of each level of service.

Level of Service	General Operating Conditions
A	Free flow
B	Reasonably free flow
C	Stable flow
D	Approaching unstable flow
E	Unstable flow
F	Forced or breakdown flow

Table 14 - General Definitions of Levels of Service

Based on previous discussions with the NRA, the minimum LOS standard for roads within the Cayman Islands is LOS "D". Any step below LOS "D" would require mitigation action to improve the traffic flow.

The traffic flow data was analysed using Sidra Intersection[4], version 7 using Highway Capacity Manual 2010 capacity calculations. The three main intersections on the surrounding road network were analysed individually and as well as part of the overall North Sound Road network. Refer to **Figure 9** through **Figure**

[4] Sidra Intersection is a software package used for intersection and network capacity, level of service and performance analysis, and signalised intersection and network timing calculations by traffic design, operations, and planning professionals.

16 showing the resulting Level of Service for each approach / lane of each intersection during both the AM and PM peak hours.

The LOS is colour-coded on the following diagrams as follows:

LOS A LOS B LOS C LOS D LOS E LOS F

The approach / lane LOS for the BOB roundabout during the AM peak is shown in **Figure 9**. The results show that the North Sound Road (East) approach, as well as other approaches, experience LOS F during the AM peak period. Additional results from the Sidra analysis show that the 95% percentile queue length on the North Sound Road (East) approach is 154 vehicles, equating to an estimated distance of 0.7 miles. The analysis shows that this intersection is currently operating above capacity during the AM peak period.

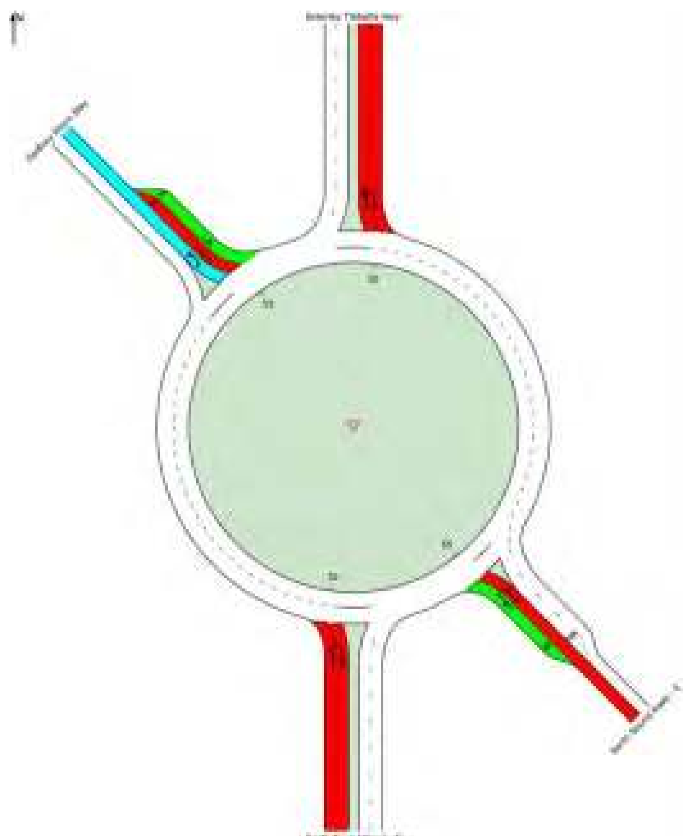

Figure 9 - Sidra Model – Bank of Butterfield roundabout - 2022 - AM Peak - Lane LOS

The approach / lane LOS for the BOB roundabout during the PM peak is shown in **Figure 10**. The results show that the North Sound Road (East) approach, as well as other approaches, experience LOS F during the PM peak period. Additional results from the Sidra analysis show that the 95% percentile queue length on the North Sound Road (East) approach is 375 vehicles, equating to an estimated distance of nearly 1.7 miles – longer than the entire length of North Sound Road therefore shows that the queue extends onto other roads upstream. The analysis shows that this intersection is currently operating beyond capacity during the PM peak period.

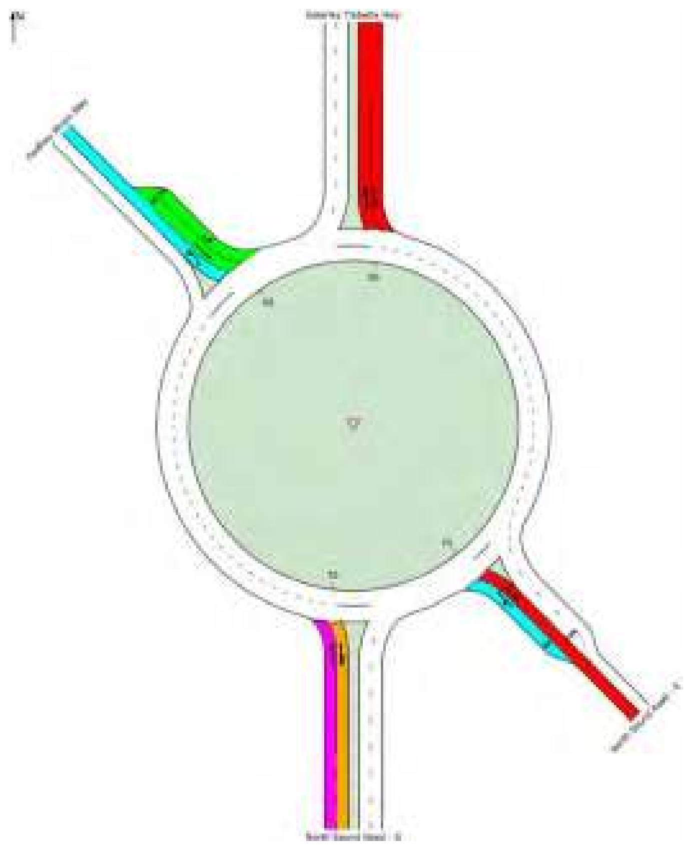

Figure 10 - Sidra Model – Bank of Butterfield roundabout - 2022 - PM Peak - Lane LOS

The approach / lane LOS for the North Sound Road / Seymour Road mini-roundabout during the AM peak is shown in **Figure 11.** The results indicate that all roundabout approaches operate at LOS A during the AM peak period.

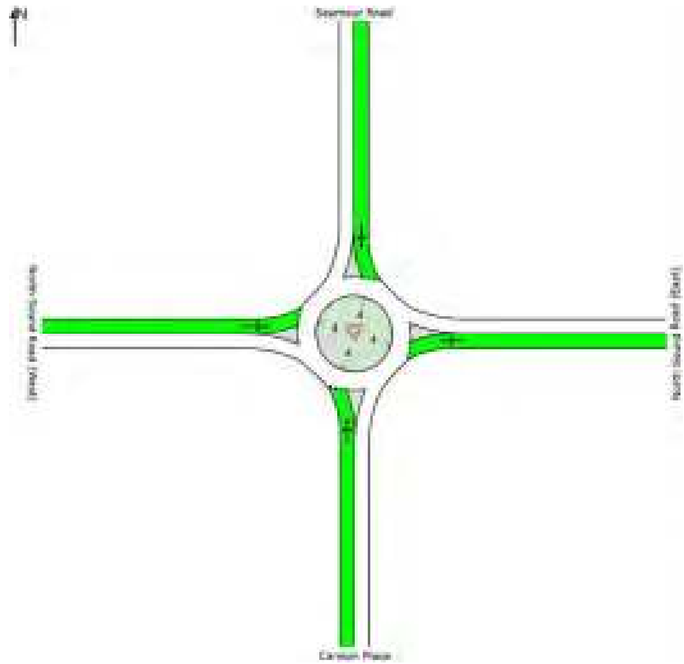

Figure 11 - Sidra Model – Seymour Road roundabout - 2022 - AM Peak - Lane LOS

The approach / lane LOS for the North Sound Road / Seymour Road mini-roundabout during the PM peak is shown in **Figure 12.** The results show that the Seymour Road approach experiences LOS B, with the remaining approaches operating at LOS A during the PM peak period.

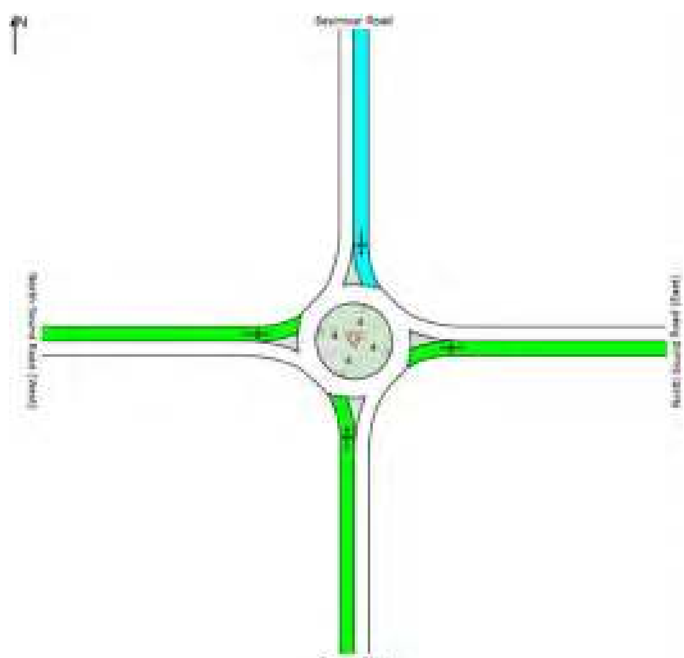

Figure 12 - Sidra Model – Seymour Road roundabout - 2022 - PM Peak - Lane LOS

The approach / lane LOS for the North Sound Road / Dorcy Drive mini-roundabout during the AM peak is shown in **Figure 13**. The results show that all approaches operate at LOS A during the AM peak period.

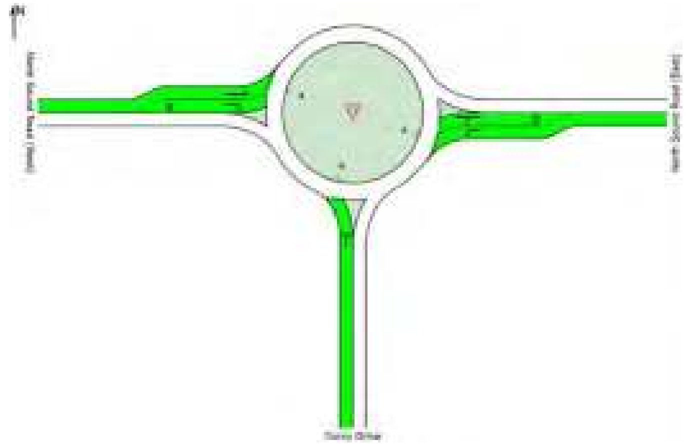

Figure 13 - Sidra Model – Dorcy Drive roundabout - 2022 - AM Peak - Lane LOS

The approach / lane LOS for the North Sound Road / Dorcy Drive mini-roundabout during the PM peak is shown in **Figure 14**. The results show that all approaches also operate at LOS A during the PM peak period.

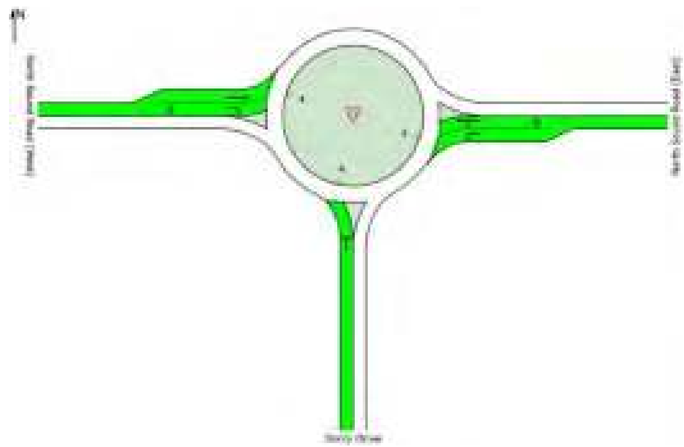

Figure 14 - Sidra Model – Dorcy Drive roundabout - 2022 - PM Peak - Lane LOS

The analysis of the surrounding road network as a whole, which includes the three intersections above, shows that much of the network is affected by the BOB roundabout. During the AM peak the queue length (circa 0.7 miles) on the North Sound Road (East) approach to the BOB roundabout affects the upstream intersections as can be seen in **Figure 15**. The queue length results in a LOS F for the section of North Sound Road between BOB roundabout and Seymour Road, and LOS B for a section of North Sound Road east of Seymour Road.

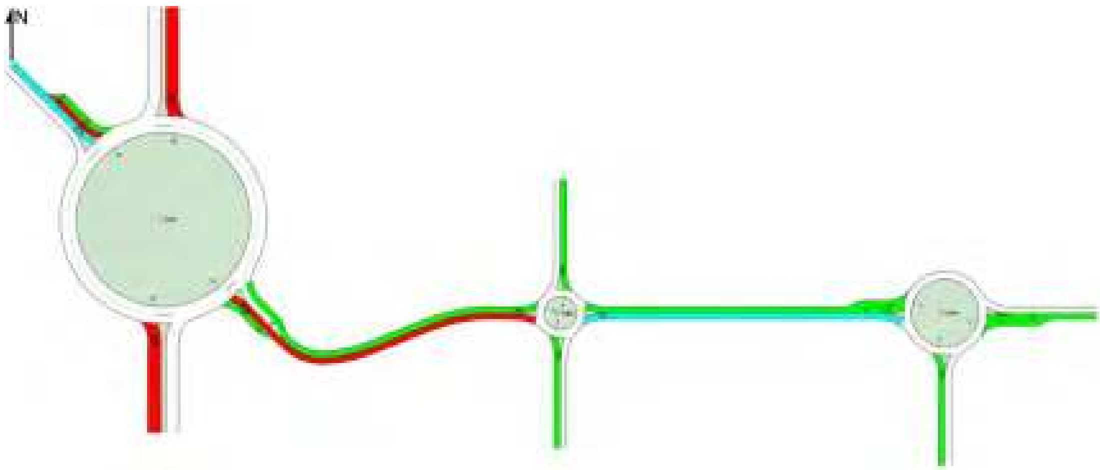

Figure 15 – Sidra Model - North Sound Road Network - 2022 - AM Peak - Lane LOS

The analysis of the surrounding road network also shows that much of the network is affected by the BOB roundabout during the PM peak period. The queue length (circa 1.7 miles) on the North Sound Road (East) approach to the BOB roundabout affects the upstream intersections as can be seen in **Figure 16**. The queue length results in a LOS F on North Sound Road. Further, empirical evidence would suggest that this queue and resulting capacity issues are experienced further upstream on North Sound Road and on side roads – Seymour Road and Dorcy Drive.

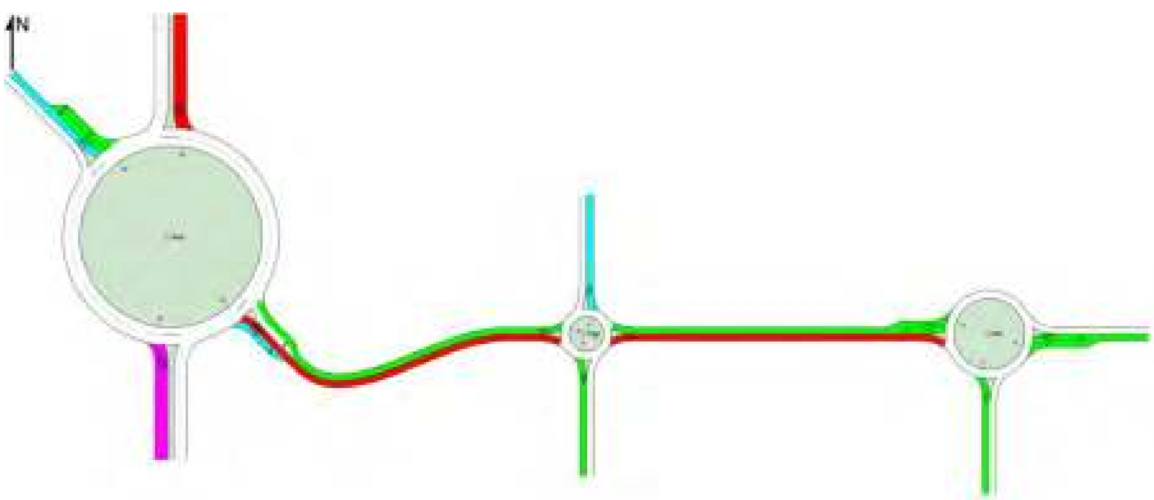

Figure 16 – Sidra Model - North Sound Road Network - 2022 - PM Peak - Lane LOS

2.3 OPERATION OF EXISTING GTLF FACILITY

In order to estimate the volume of vehicles accessing the proposed ReGen facilities, it is necessary to undertake some analysis of the current operation and usage of the GTLF. There are two main types of waste generator that use the existing GTLF, namely civic amenity drop-offs by the public, and waste collection provided by the DEH Waste Collection Service (WCS) or private waste haulers.

The civic amenity drop-off area is for use by the general public with any light / medium vehicles such as a car, pickup or van. The public can dispose of any form of waste including household, vegetation, construction, metal, etc. in large skips located adjacent to the entrance to the landfill. Once filled, these skips are transported to and disposed of in the main landfill area. Household hazardous waste, car batteries etc. are collected separately and stored at the GTLF for later transportation overseas.

The posted operational hours for acceptance of bulk waste are 07:00 to 18:30 Monday to Saturday. The civic amenity drop-off area is open 24 hours, seven days per week. DEH has previously noted that, on infrequent occasions, the GTLF landfill is opened on Sundays for bulk waste when special demolition projects are underway that require access to the landfill.

The automatic traffic count undertaken in December 2022 gathered traffic flow data on Seymour Road just south of the existing entrance to the GTLF. **Table 7** on page **7** summarises the traffic flow along that section of Seymour Road. The data shows that on average 50 - 60 vehicles arrive and depart the GTLF during the AM and PM peak periods. The traffic data from 2012, reinforced with the data from 2022 shows that the peak traffic flows associated with the GTLF occur mostly outside the peak traffic periods of the surrounding intersections / roads.

3.0 PROPOSED DEVELOPMENT

The proposed ReGen facilities comprise a multi-element development, including an energy recovery facility (ERF) and supporting non-ERF waste processing, treatment, and disposal facilities. Additional features of the ISWMS facilities include a green waste and mulching / composting facility, a household waste recycling centre (HWRC), a Materials Recycling Facility (MRF), a construction & demolition (C&D) waste processing facility, an end-of-life vehicle (ELV) and scrap metal processing facility, a landfill gas facility, a residual waste landfill (RWL) and administration & maintenance facilities. The ReGen facilities are expected to open in **2026**.

The ReGen facilities are located on land occupied by the GTLF and adjacent lands, some of which were previously used for landfill purposes. Refer to **Figure 17** showing the proposed site layout of the facility.

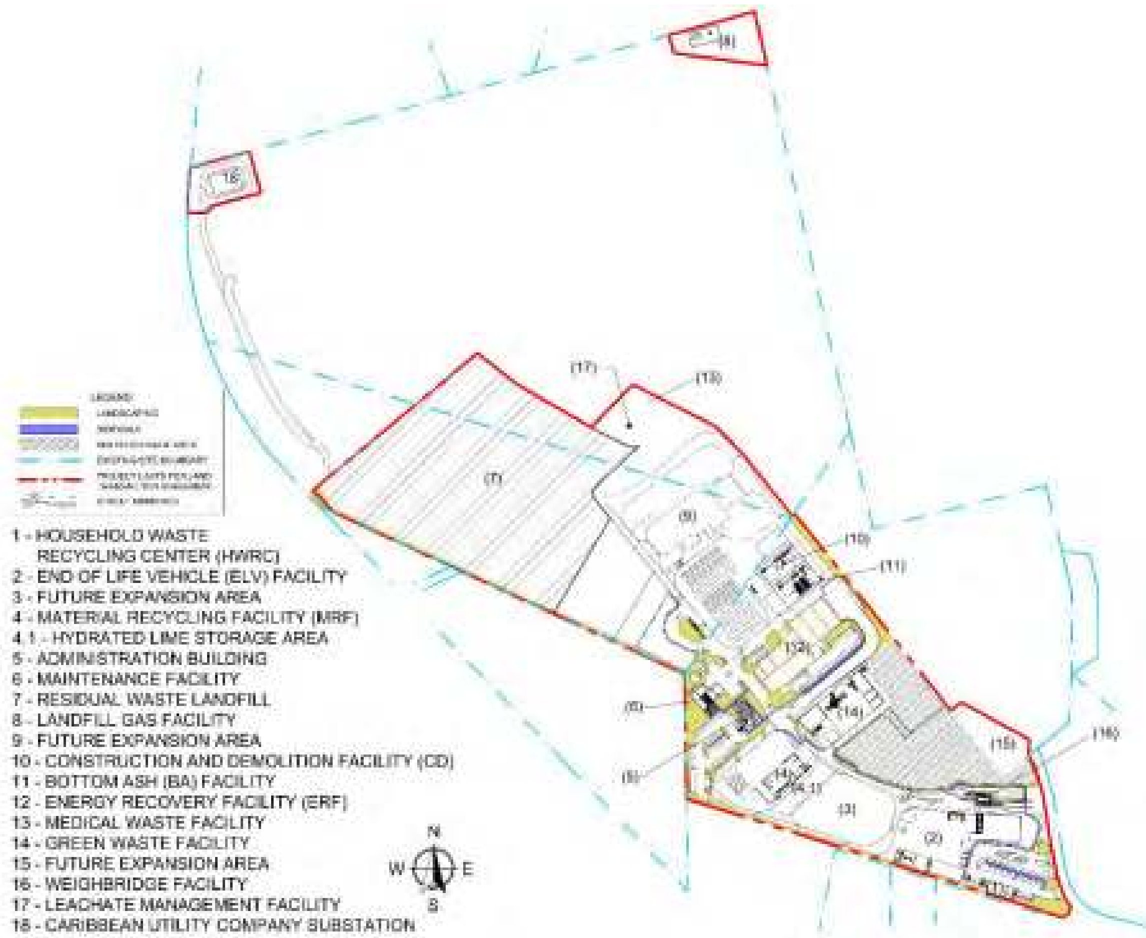

Figure 17 - Proposed Integrated Solid Waste Management Facility Layout

The proposed working hours for the ReGen facilities will vary based on the specific work demands and needs, as well as differing hours for both the public and companies using the facilities. The hours have not been finalised, however - the following information was included in the ToR for the EIA and / or has been advised by the facilities design team:

- ERF – the ERF will be functioning 24/7 (except for of approx. 10 days of planned annual maintenance) with opening hours from 04:00 - 18:00 Monday to Friday, 06:00-16:00 Saturday and Bank Holidays, and closed Sunday, Good Friday & Christmas Day
- MRF, C&D, ELV, RWL and Green Waste Facilities – will generally operate normal business hours
- Medical Waste Facility – will be open for 2 days per week, as required
- HWRC – will be open to the public for 52 hrs per week but the hours will include weekends

According to the ToR for the EIA and based on discussions with the facilities design team, there are expected to be some 70 full-time staff working on the ReGen site. This is comparable to the exsiting staffing levels at the GTLF, which is currently at 99. Staff parking, including disabled parking, will be provided on site. The site layout has been designed to allow free flow of vehicles that access both the public and back-of-house areas. Vehicle swept path movements have been tested using Autodesk's Vehicle Tracking software to ensure that sufficient space has been provided for turning manoeuvres. Pedestrian sidewalks will be provided throughout much of the site to ensure safe access for staff and patrons. There are no plans currently to modify or augment the current public transport provisions within the study area.

As per of the overall ISWMS proposal, the waste management procedures for the sister islands (Cayman Brac and Little Cayman) will change. It is proposed that waste will be collected and bulked in Cayman Brac before shipping to Grand Cayman for treatment at the ReGen facilities. As a worst-case estimate, it is expected that shipments will occur weekly with up to 10 truck movements per shipment to transport the waste from the port in George Town to the ReGen site at the opening year and up to 19 truck movements forecast by 2050. .

4.0 FUTURE CONDITIONS

4.1 Trip Generation / Attraction

In order to assess the impact of the ReGen facilities on the surrounding road network, it is first necessary to estimate the likely facility trip generation during the peak hour. The proposed ReGen public / private agreement will not alter how waste is collected on Grand Cayman. It will arrive at the expanded facility in the same manner as currently managed. It is therefore assumed that the trips generated by the ReGen facilities will be similar to the trips currently generated by the GTLF.

4.2 Assessment Year Horizons

As part of the impact assessment of the proposed ReGen facilities, the analysis has identified three assessment year horizons in order to fully evaluate the potential impacts. These horizons are the Opening Year of the facility, the Near-Term Year (5 years after opening) and Medium-Term Year (10 years after opening). It is expected that the Opening Year of the facility will be **2026**, therefore giving a Near-Term assessment year of **2031** and Medium-Term Year assessment of **2036**. The Base Year for traffic flow is **2022**, the year traffic data was predominately gathered.

In addition to the ReGen related trips, other factors combine to generate future traffic flows. These include background traffic increases based on population growth and increased car ownership. The NRA developed a Travel Demand Model (TDM) following their island-wide traffic study in 2017. Based on this model and the anticipated population growth on island, the NRA predicts annual growth in traffic flow to be 4% on arterial roads such as the Esterley Tibbetts Highway and the 4 lane North Sound Road continuing south, and 2% on other roads. Based on this, the traffic flows on the surrounding arterial and other road network can be expected to increase from the Base Year by the growth rates outlined in **Table 15**. It is anticipated that waste generation and the traffic flows on Seymour Road associated with the ReGen facilities will increase in a similar manner to those outlined above, at 2% per annum.

Based on a comparison of the recent traffic count data with data from a 2012 traffic count on Seymour Road (at the GTLF entrance), it has been noted that traffic flows to / from the GTLF have increased at an average rate of 3.6% per annum for the past 10 years. This is likely due to an increase in waste generation from ongoing development and population increase. In order to provide a robust analysis it has been assumed that the traffic associated with landfill facility will continue to grow at 4% per annum. It has also been assumed that the staff levels will remain the same and not reduce as preliminary staffing estimates suggest.

The forecast increase in traffic flow at the GTLF entrance (due to 4% growth in landfill related traffic and the additional staff) approximately equates to a 3% growth rate on the Seymour Road traffic at the NSR / SR roundabout - a 3% growth rate has therefore been employed locally on the associated approaches to this intersection. Refer to **Table 15** for the forecast growth for the assessment years and **Table 16** for the HGV forecast growth

Assessment Year Horizon	Growth Rate		
	Arterial Roads (4% per annum)	Other Roads (2% per annum)	Seymour Road (3% per annum)
Opening Year 2026	17%	8%	13%
Near-Term 2031	42%	20%	30%
Medium-Term Year 2036	73%	32%	51%

Table 15 – Assessment Year Growth Rates

Assessment Year Horizon	Grand Cayman Traffic (4% per annum)	Sister Island Trans-shipment	ReGen Traffic (HGV Classification)
Base Year 2022	-	-	21%
Opening Year 2026	17%	10	22%
Near-Term 2031	42%	12	22%
Medium-Term Year 2036	73%	14	22%

Table 16 – Assessment Year GTLF HGV Classification

4.3 Trip Distribution

It is expected that traffic accessing the ReGen facilities will travel to the site in a similar manner as they currently access the GTLF site. Waste collections will not alter significantly from the current arrangement. For this reason, it is assumed that trip distribution on the surrounding road network will be in line with current distribution of traffic associated with the GTLF.

4.4 Proposed Road Developments in Study Area

The Airport Connector Road is a new two-way median divided road that will connect the Esterley Tibbetts Highway (south of Camana Bay) to the north end of Sparky Drive. The road will travel adjacent the northern boundary of the ReGen facilities, however no access will be available to the site from the road. Part of this road is currently under construction. The expected completion date of this road is not known. It is expected that this road will divert a significant proportion of the traffic to the airport and eastern parts of the Industrial Area that is currently traveling along North Sound Road. An assessment of any rearrangement of traffic distribution is outside the scope of this report.

This TS does not include an assessment of future developments within the study area other than the ReGen facilities. It is assumed that any such development will be subject to separate assessment and permitting process, however it is assumed that traffic flow from any such development will be in line with background growth as outlined above.

4.5 Future Traffic Data

The following section presents the predicted traffic flows within the study area and adjacent intersection for the three assessment years outlined above. The traffic flows have been calculated using the traffic data presented in **Sections 2.2.3** and **0** and the growth rates identified in **Table 15**.

Traffic impact assessments such as this would typically measure impacts of a proposed development based on two scenarios – with and without development. These scenarios draw traffic flow comparisons between the scenario where the development is realised and a scenario where the development does not proceed. In the case of the proposed ReGen facilities, the with and without development scenarios are the same. This is due to the prediction that traffic flows generated by the ReGen facilities are expected to be similar as those generated by the GTLF site. For this reason, the future traffic flows presented here are confined to the horizon years outlined above, based on the predicted growth in traffic flows on surrounding road network.

4.5.1 Opening Year – 2026

The following figures summarise the predicted peak hour traffic flows on intersections within the study area during the Opening Year, 2026.

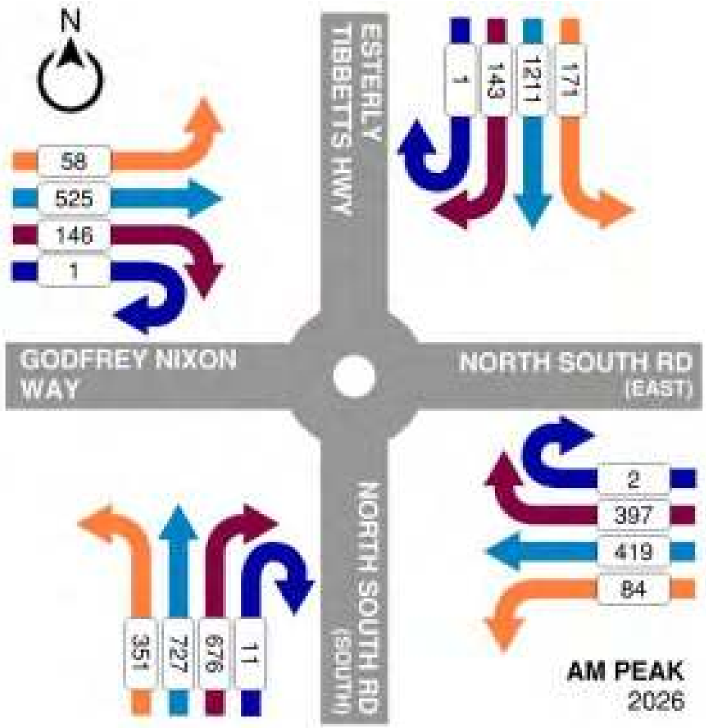

Figure 18 – Bank of Butterfield roundabout – AM Peak – 2026

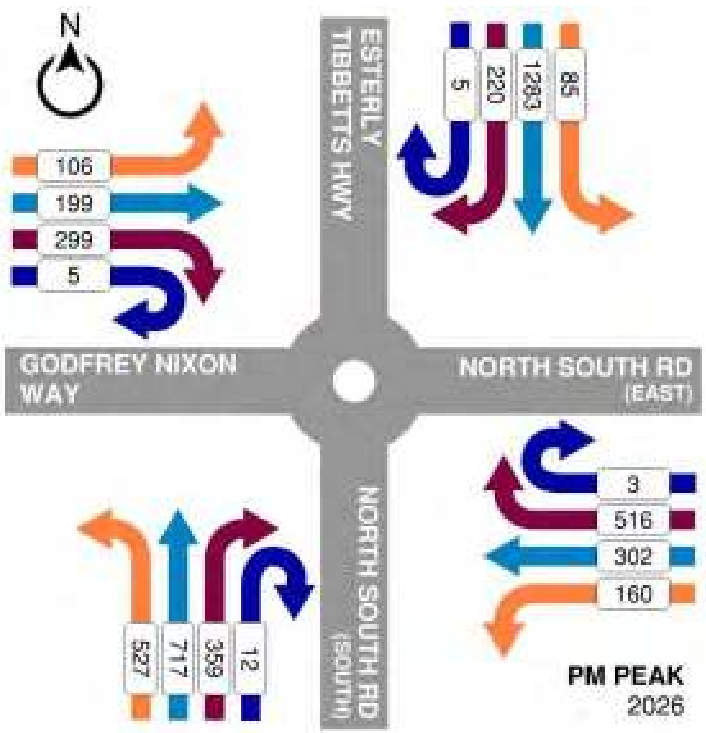

Figure 19 – Bank of Butterfield roundabout – PM Peak - 2026

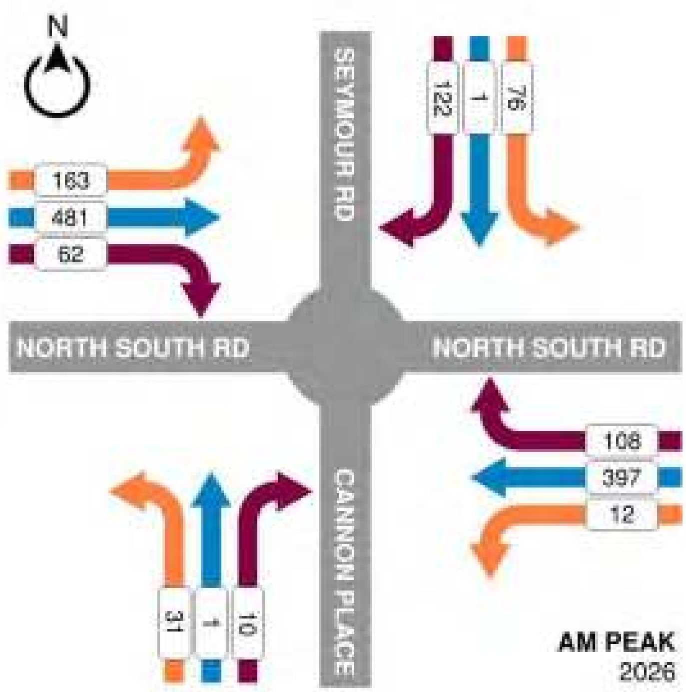

Figure 20 – Intersection of North Sound Road & Seymour Road – AM Peak - 2026

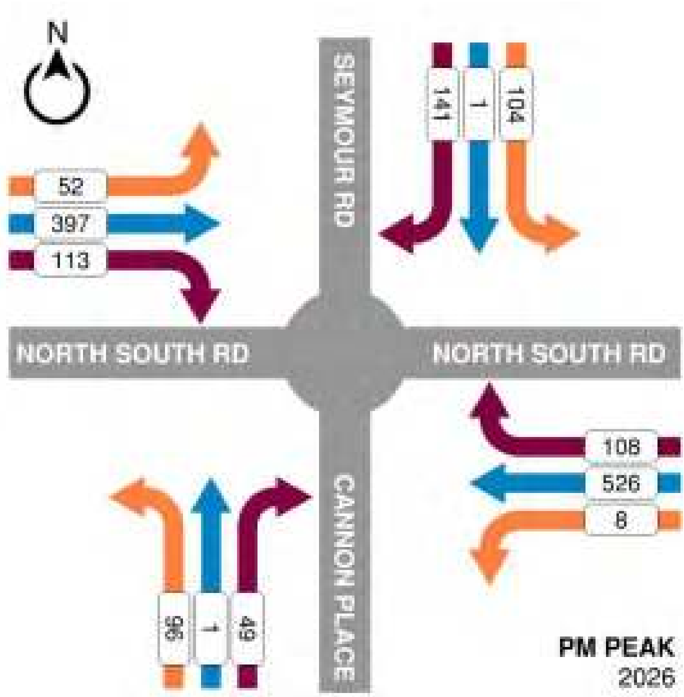

Figure 21 – Intersection of North Sound Road & Seymour Road – PM Peak - 2026

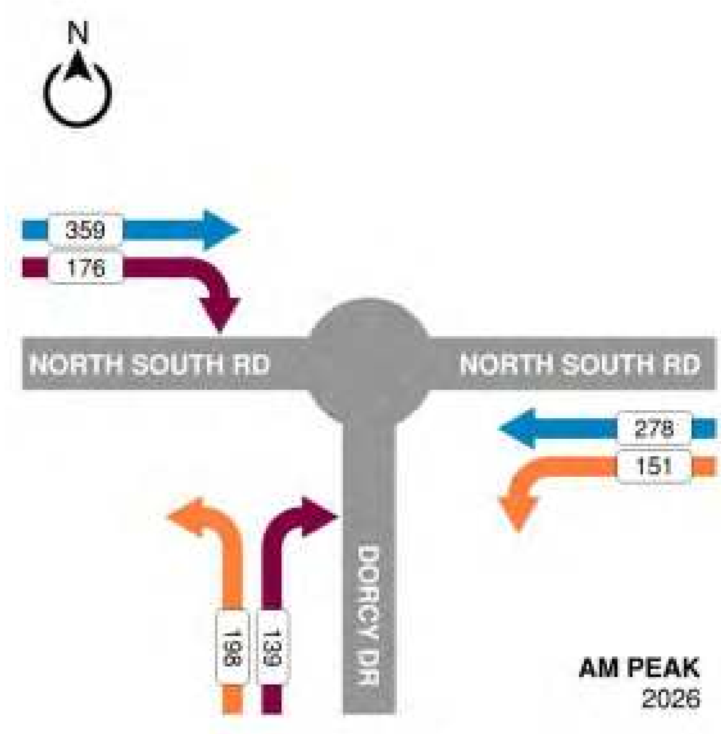

Figure 22 – Intersection of North Sound Road & Dorcy Drive – AM Peak - 2026

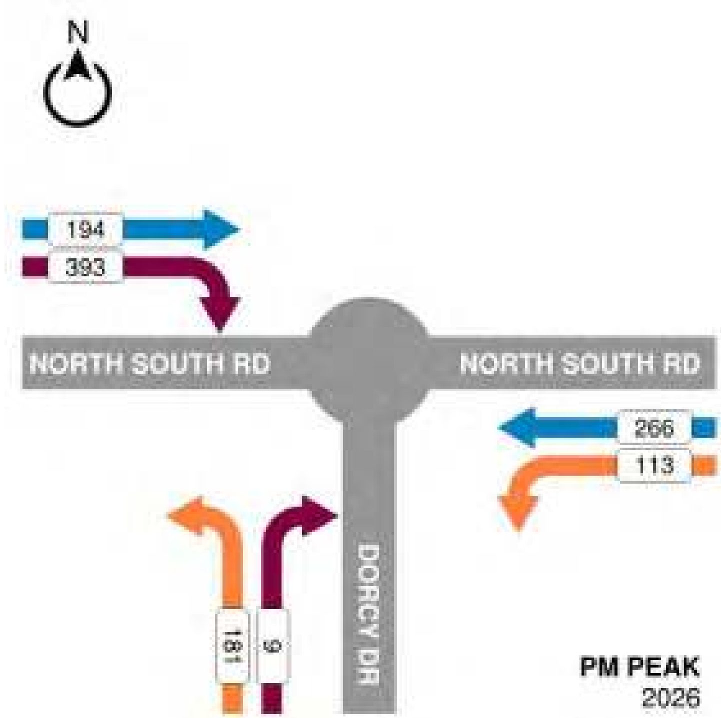

Figure 23 – Intersection of North Sound Road & Dorcy Drive – PM Peak - 2026

4.5.2 NEAR-TERM YEAR – 2031

The following figures summarise the predicted peak hour traffic flows on intersections within the study area during the Near-Term Year, 2031.

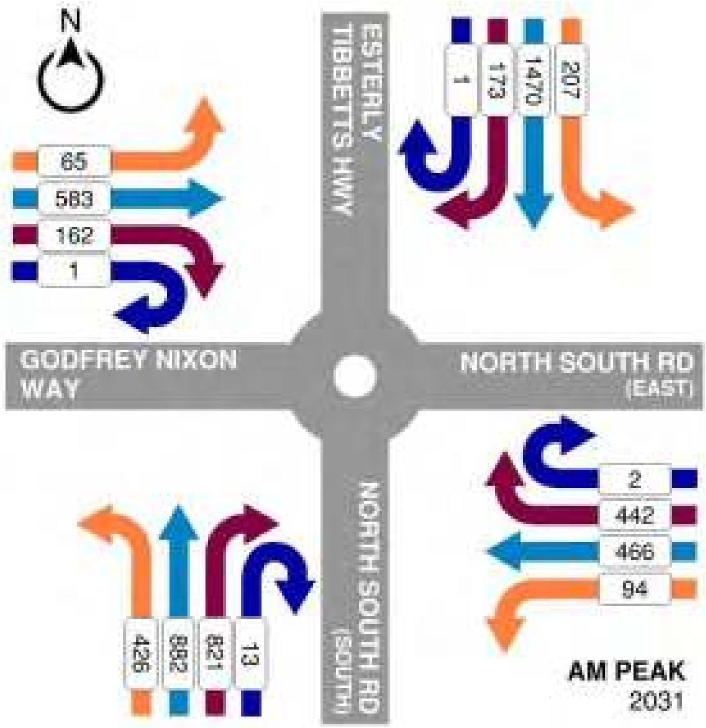

Figure 24 – Bank of Butterfield roundabout – AM Peak - 2031

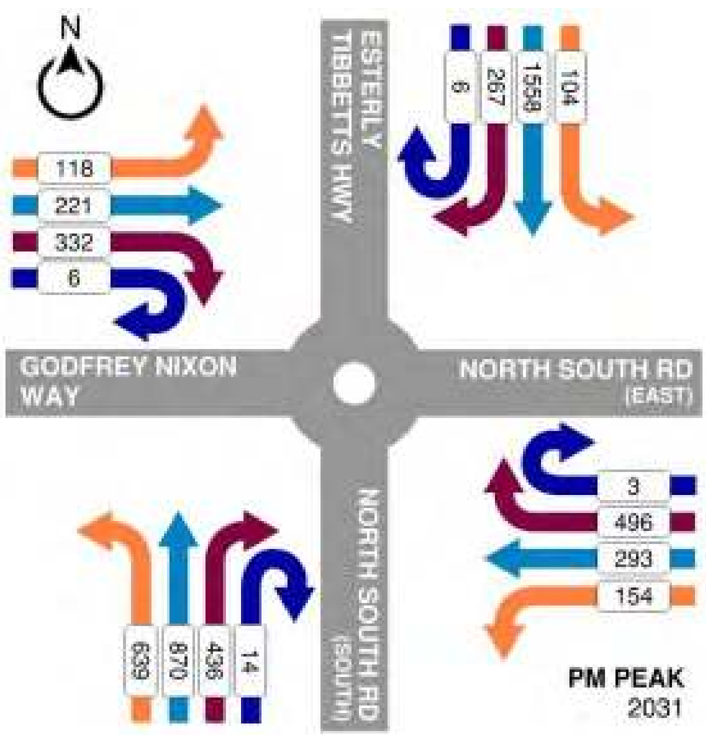

Figure 25 – Bank of Butterfield roundabout – PM Peak - 2031

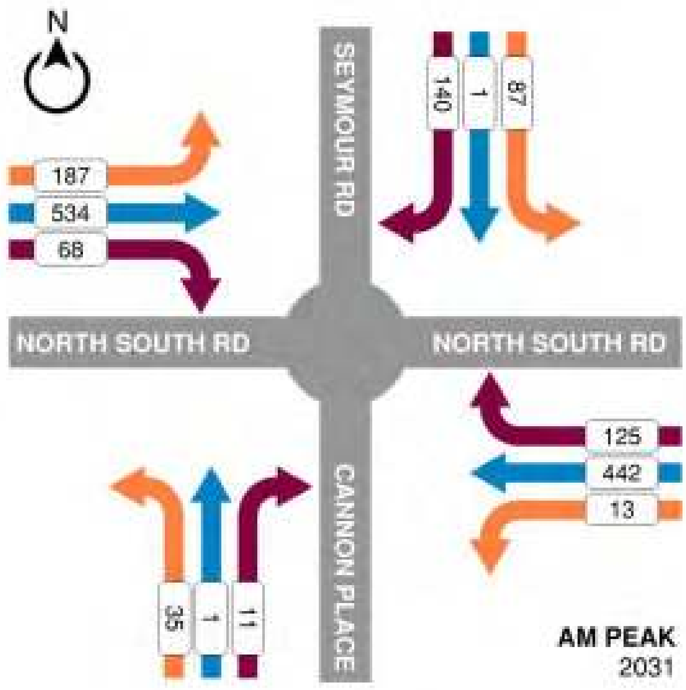

Figure 26 – Intersection of North Sound Road & Seymour Road – AM Peak - 2031

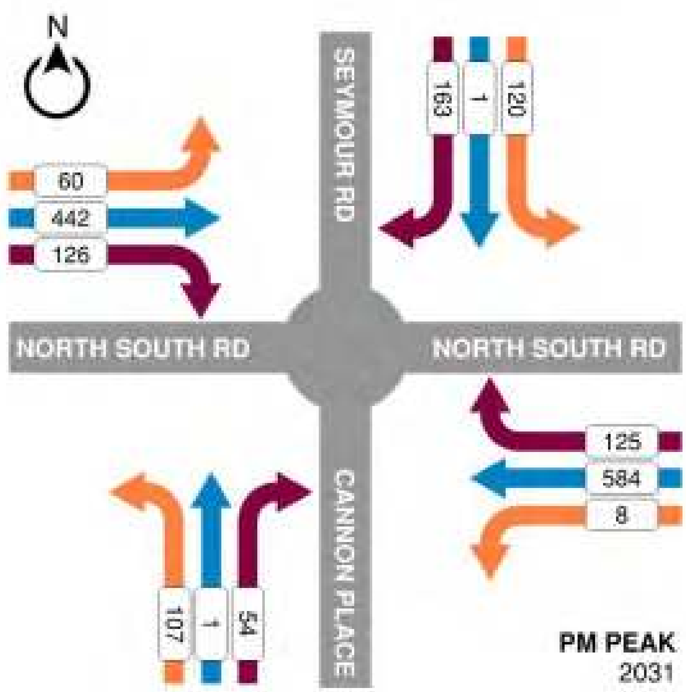

Figure 27 – Intersection of North Sound Road & Seymour Road – PM Peak - 2031

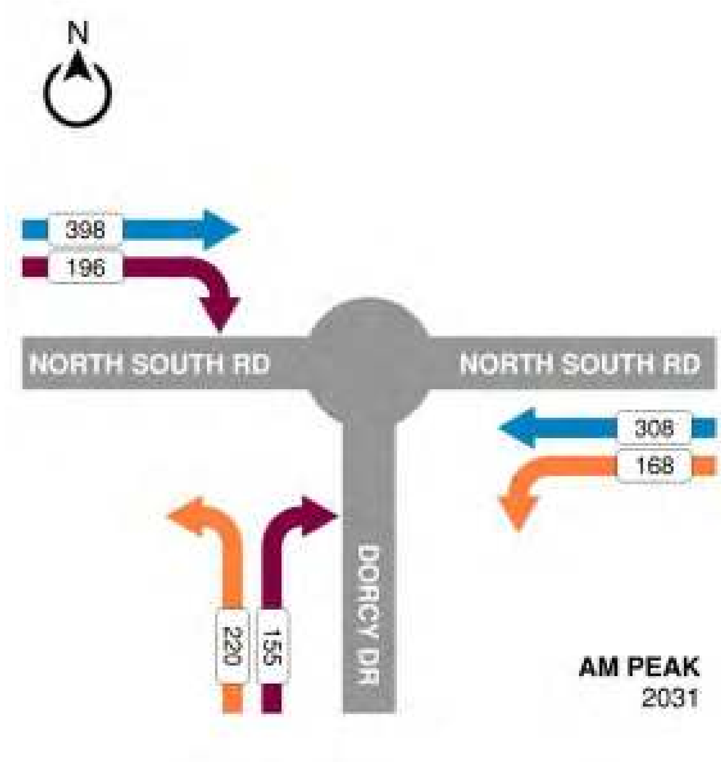

Figure 28 – Intersection of North Sound Road & Dorcy Drive – AM Peak - 2031

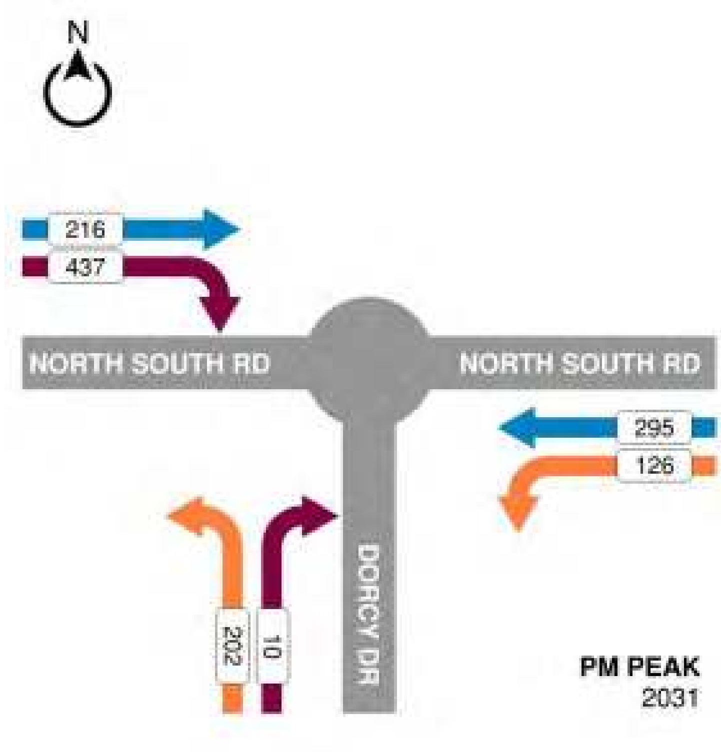

Figure 29 – Intersection of North Sound Road & Dorcy Drive – PM Peak - 2031

4.5.3 MEDIUM-TERM YEAR – 2036

The following figures summarise the predicted peak hour traffic flows on intersections within the study area during the Medium-Term Year, 2036.

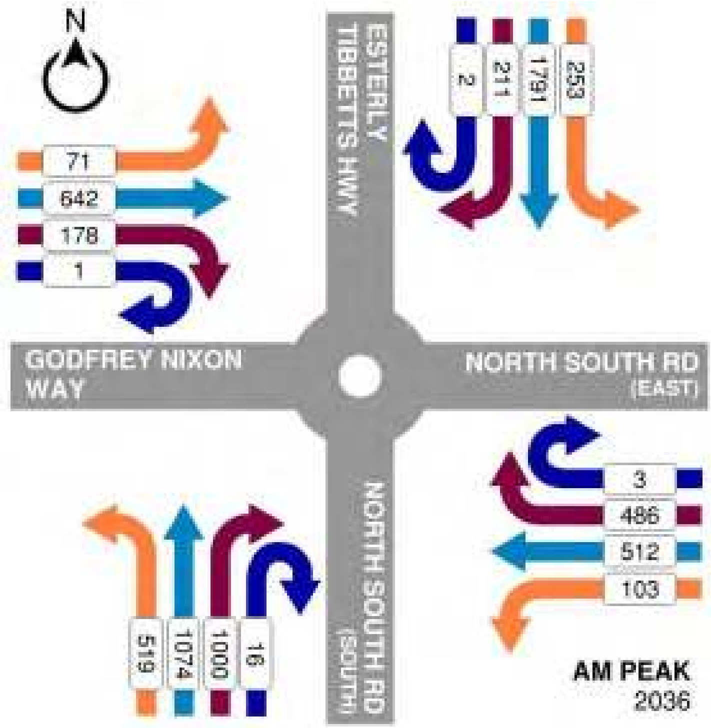

Figure 30 – Bank of Butterfield roundabout – AM Peak - 2036

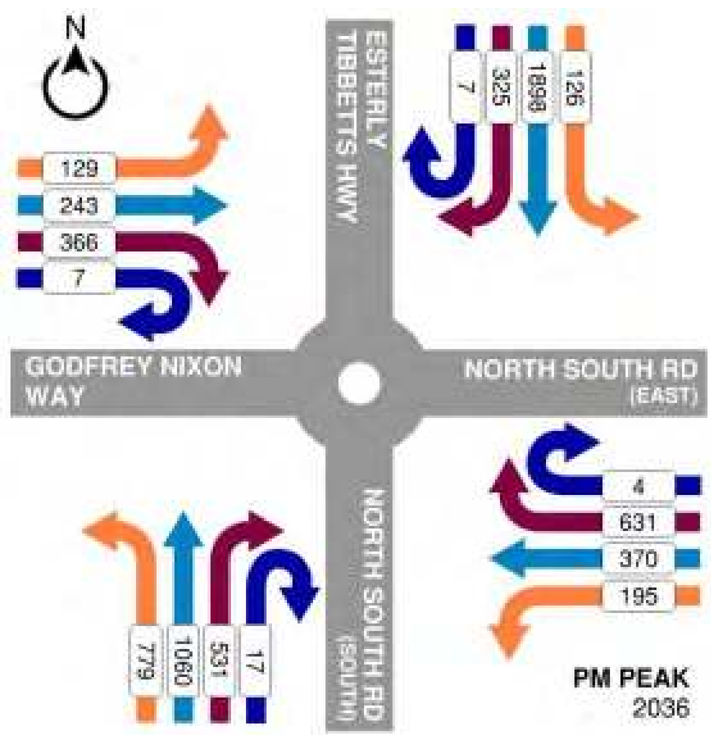

Figure 31 – Bank of Butterfield roundabout – PM Peak - 2036

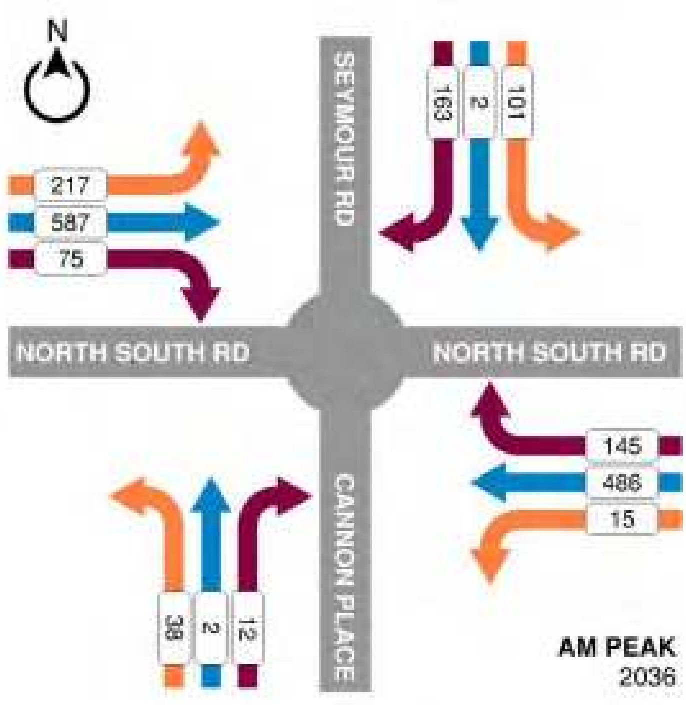

Figure 32 – Intersection of North Sound Road & Seymour Road – AM Peak - 2036

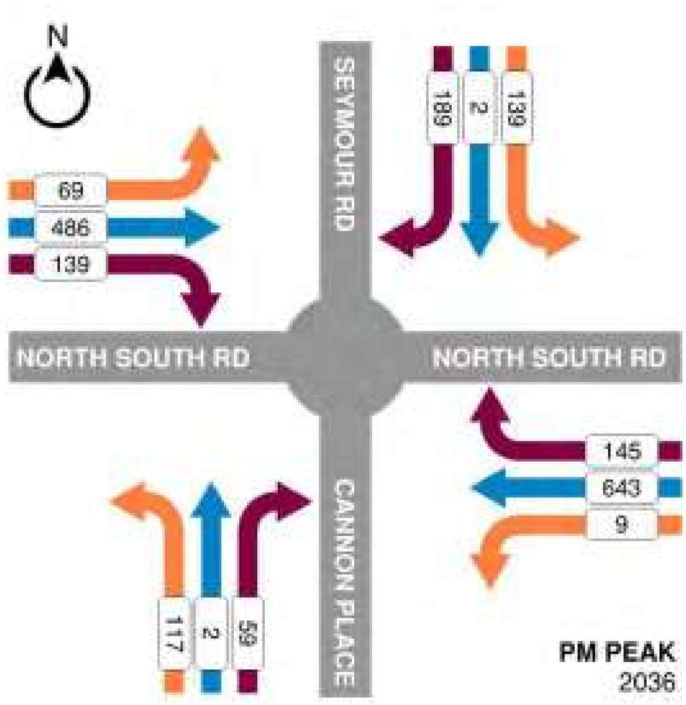

Figure 33 – Intersection of North Sound Road & Seymour Road – PM Peak - 2036

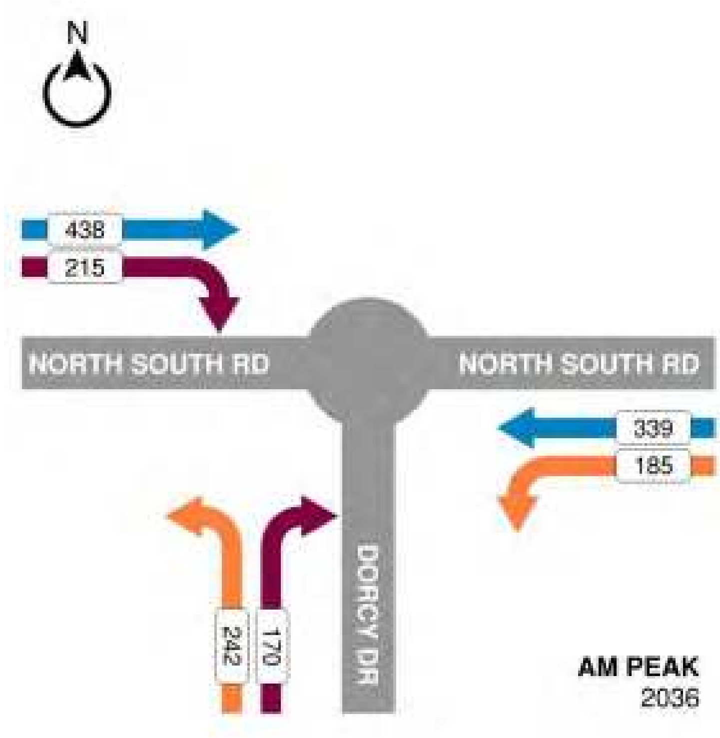

Figure 34 – Intersection of North Sound Road & Dorcy Drive – AM Peak - 2036

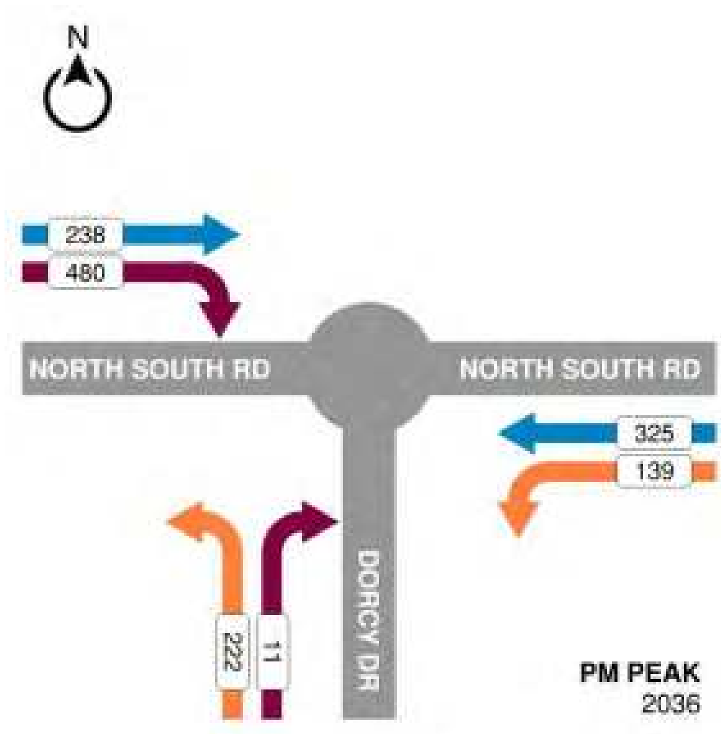

Figure 35 – Intersection of North Sound Road & Dorcy Drive – PM Peak - 2036

4.6 TRAFFIC ANALYSIS

Analysis of the predicted future traffic flows on the surrounding network has been undertaken. As outlined above, the predicted future traffic flows are due to background growth on the network and are not directly related to the development of the ReGen facilities – they are predicted to occur whether the ReGen facilities are constructed or not.

Traffic analysis has been undertaken for the three Assessment Horizons – Opening Year (2026), Near-Term Year (2031) and the Medium-Term Year (2036). The traffic flow data was analysed using Sidra Intersection software, as it was for the Base Year Peak Hour Traffic Flow Analysis in **Section 2.2.6**. Findings are presented based on the analysis undertaken.

A reminder that the LOS is colour-coded on the following diagrams as follows:

LOS A LOS B LOS C LOS D LOS E LOS F

4.6.1 OPENING YEAR ASSESSMENT HORIZON - 2026

The three main intersections on the surrounding road network were analysed individually and as well as part of the overall North Sound Road network. Refer to **Figure 36** through **Figure 43** showing the predicted Level of Service for each approach / lane to each intersection for the 2026 Near-Term assessment horizon.

The approach / lane LOS for BOB roundabout during the AM and PM peaks are shown in **Figure 36** and **Figure 37**, respectively. The results show that most approaches to the intersection will continue to experience significant capacity issues due to background traffic growth. In particular, the northbound approach for North Sound Road (South) degrades from LOS D & E in 2022 to LOS F in 2026.

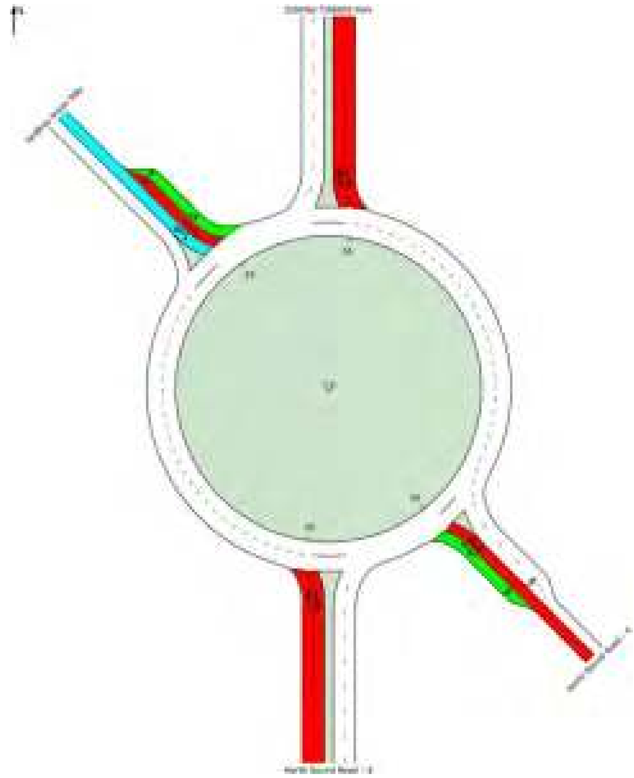

Figure 36 - Sidra Model – Bank of Butterfield roundabout - 2026 - AM Peak - Lane LOS

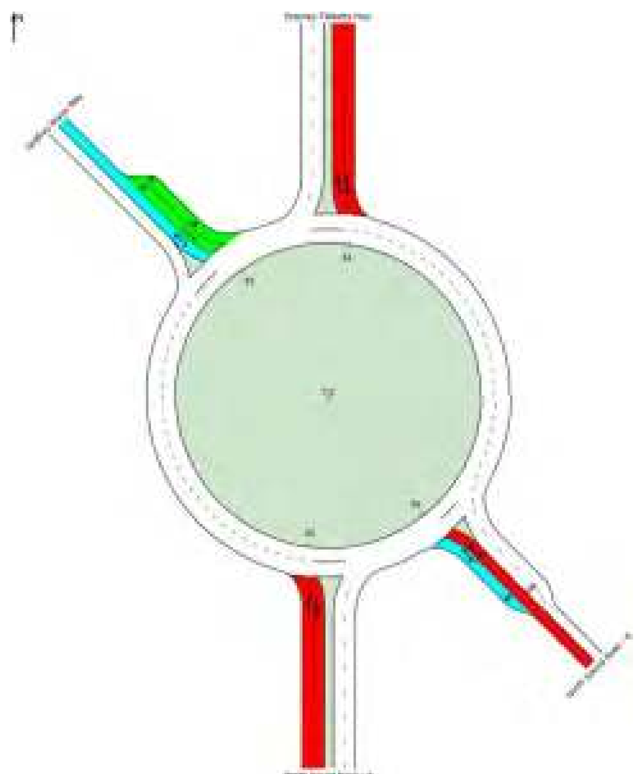

Figure 37 - Sidra Model – Bank of Butterfield roundabout - 2026 - PM Peak - Lane LOS

The approach / lane LOS for the North Sound Road / Seymour Road mini-roundabout during the AM and PM peaks are shown in **Figure 38** and **Figure 39.** The results show that the Seymour Road and North Sound Road (East) approaches are predicted to degrade in the peak periods in the coming years.

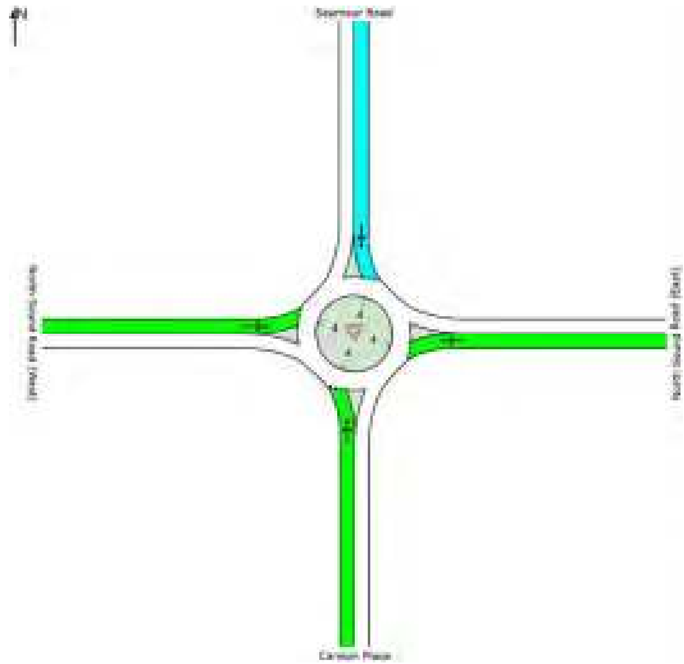

Figure 38 - Sidra Model – Seymour Road roundabout - 2026 - AM Peak - Lane LOS

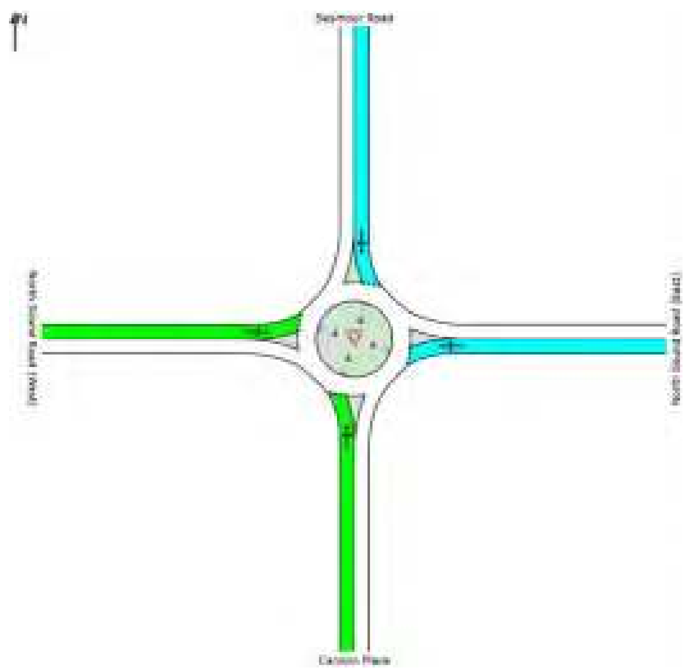

Figure 39 - Sidra Model – Seymour Road roundabout - 2026 - PM Peak - Lane LOS

The approach / lane LOS for the North Sound Road / Dorcy Drive mini-roundabout during the AM and PM peaks are shown in **Figure 40** and **Figure 41.** The results show that all approaches are predicted to continue to operate at LOS A during the peak periods.

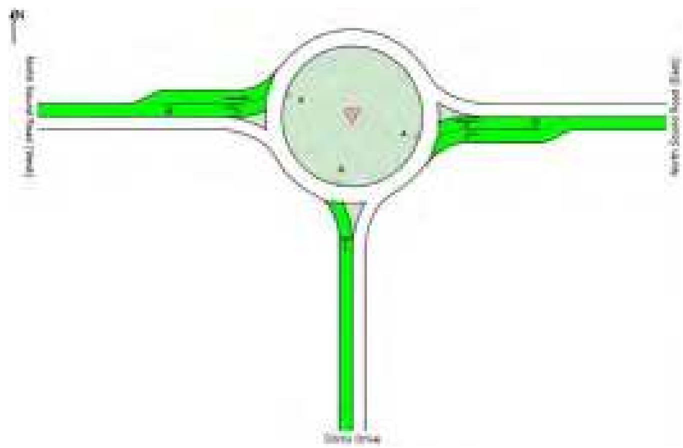

Figure 40 - Sidra Model – Dorcy Drive roundabout - 2026 - AM Peak - Lane LOS

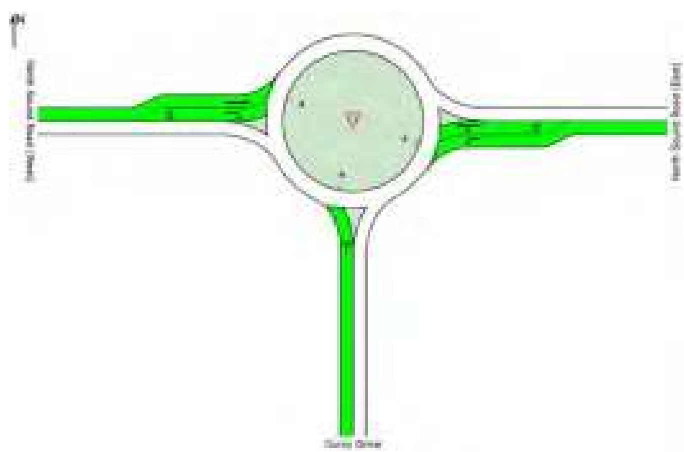

Figure 41 - Sidra Model – Dorcy Drive roundabout - 2026 - PM Peak - Lane LOS

The analysis of the North Sound Road network as a whole, which includes the three intersections, shows that the network will continue to be affected by the capacity issues at BOB roundabout. Refer to **Figure 42** for the AM peak hour analysis results and **Figure 43** for the PM peak hour results. Interrogation of the analysis results shows that the 95% percentile queue length on the North Sound Road (East) approach is predicted to increase to 220 vehicles during the AM peak hour, equating to an estimated distance of over 1.0 mile and 441 vehicles during the AM peak hour, equating to an estimated distance of nearly 2.0 miles. This will significantly impact the operation of North Sound Road through the study area.

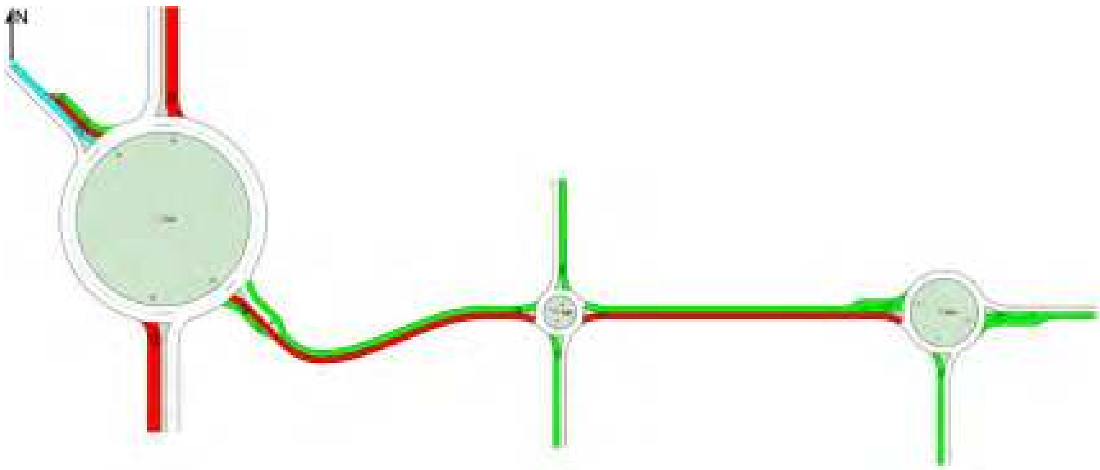

Figure 42 – Sidra Model - North Sound Road Network - 2026 - AM Peak - Lane LOS

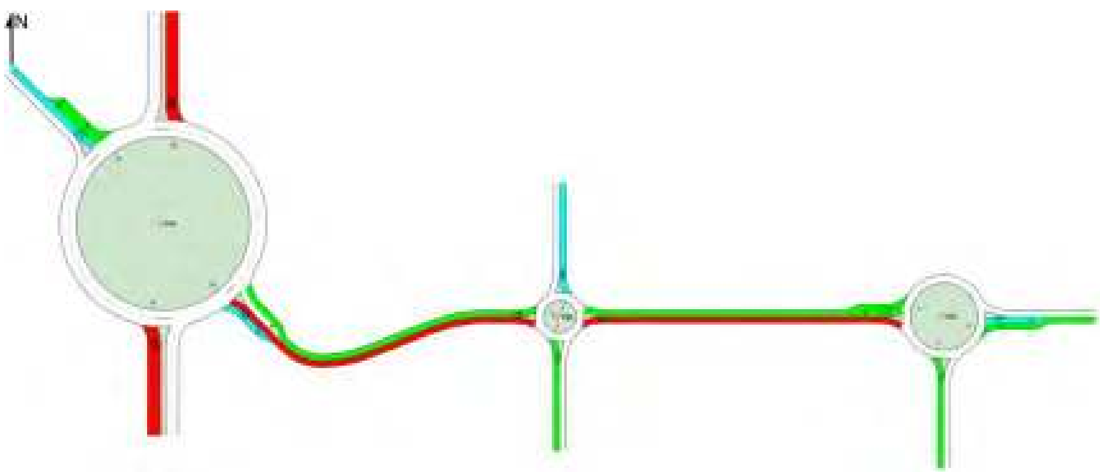

Figure 43 – Sidra Model - North Sound Road Network – 2026 - PM Peak - Lane LOS

4.6.2 Near-Term Assessment Horizon - 2031

The three main intersections on the surrounding road network were analysed individually and as well as part of the overall North Sound Road network. Refer to **Figure 44** through **Figure 51** showing the predicted Level of Service for each approach / lane to each intersection for the 2031 Near-Term assessment horizon.

The approach / lane LOS for BOB roundabout during the AM and PM peaks are shown in **Figure 44** and **Figure 45**, respectively. The results show that the North Sound Road (East) approach, as well as other approaches, will continue to experience significant capacity issues due to background traffic growth.

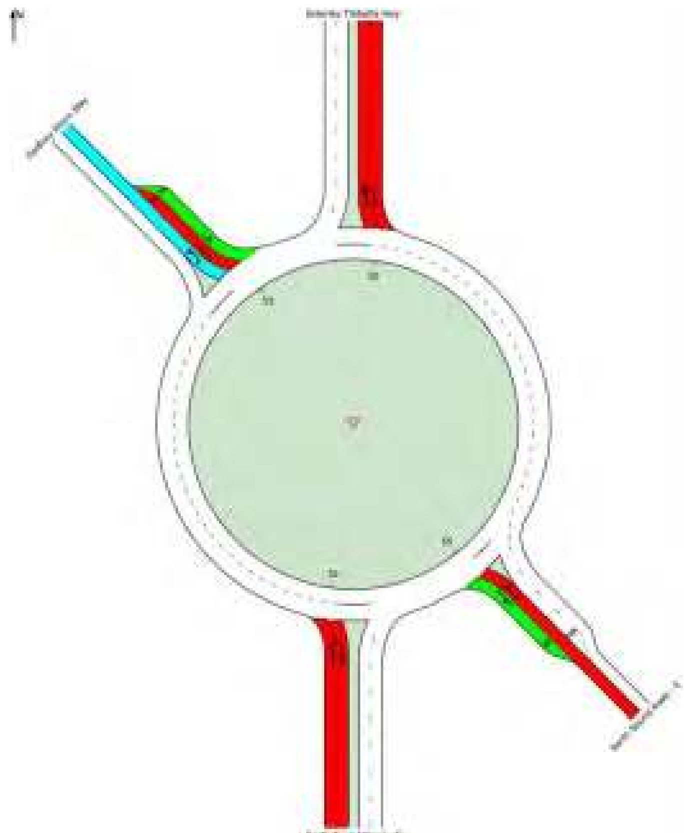

Figure 44 - Sidra Model – Bank of Butterfield roundabout - 2031 - AM Peak - Lane LOS

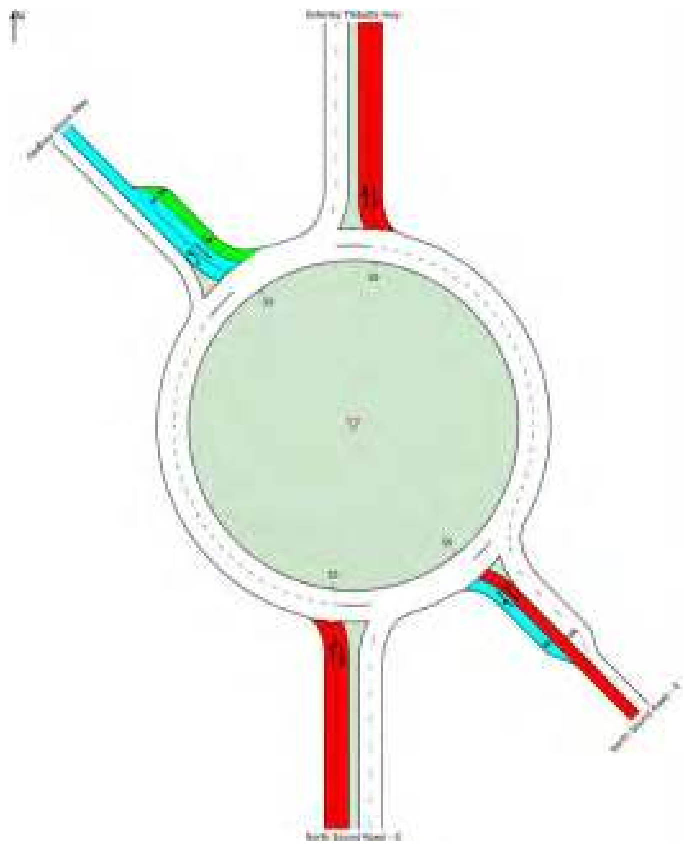

Figure 45 - Sidra Model – Bank of Butterfield roundabout - 2031 - PM Peak - Lane LOS

The approach / lane LOS for the North Sound Road / Seymour Road mini-roundabout during the AM and PM peaks are shown in **Figure 46** and **Figure 47**. The results show that the Seymour Road and North Sound Road (East) approaches are predicted to experience LOS B with other approaches operating at LOS A.

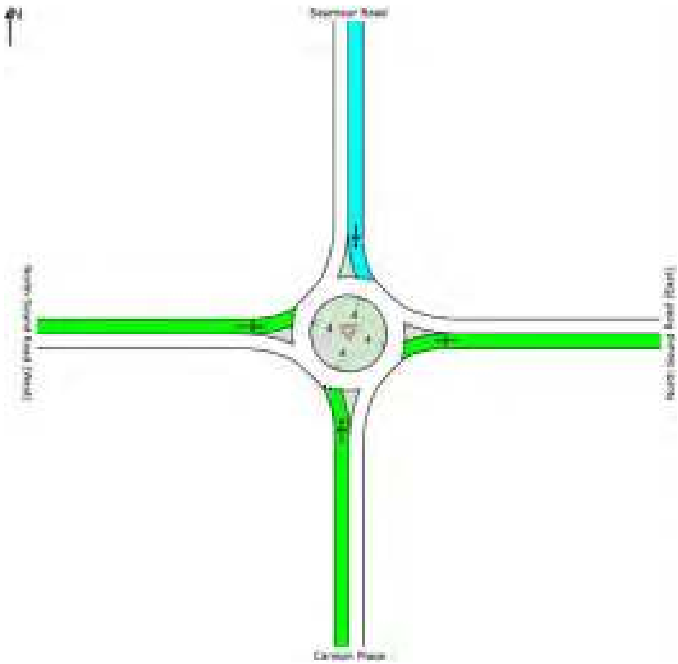

Figure 46 - Sidra Model – Seymour Road roundabout - 2031 - AM Peak - Lane LOS

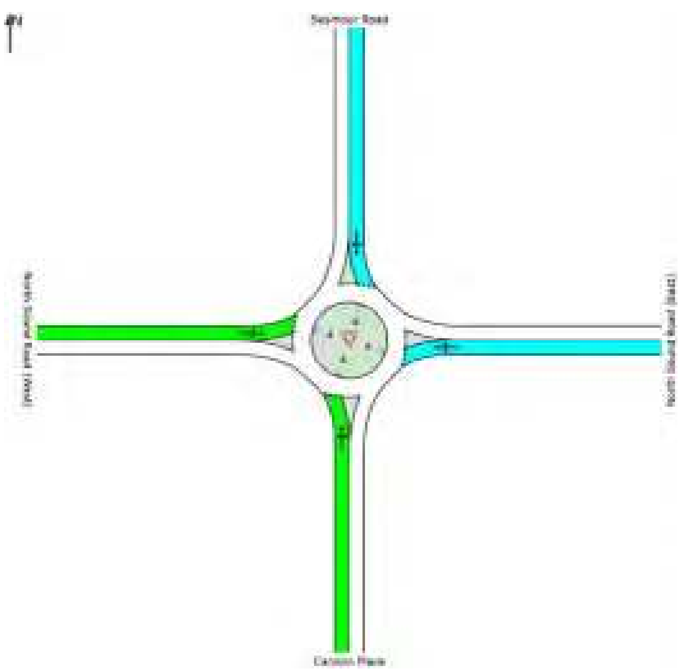

Figure 47 - Sidra Model – Seymour Road roundabout - 2031 - PM Peak - Lane LOS

The approach / lane LOS for the North Sound Road / Dorcy Drive mini-roundabout during the AM and PM peaks are shown in **Figure 48** and **Figure 49**. The results show all approaches will continue to operate at LOS A during the peak periods.

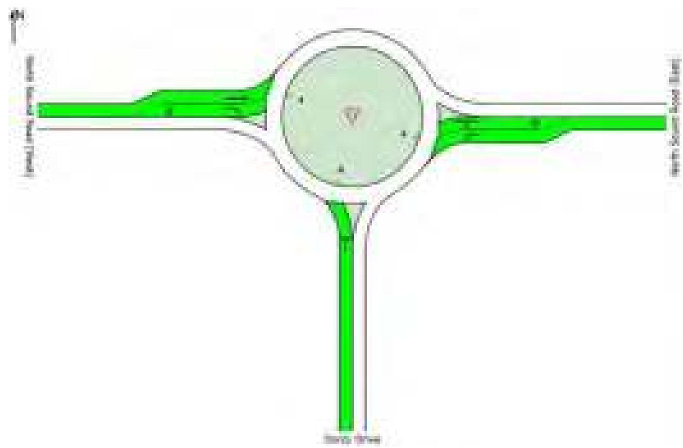

Figure 48 - Sidra Model – Dorcy Drive roundabout - 2031 - AM Peak - Lane LOS

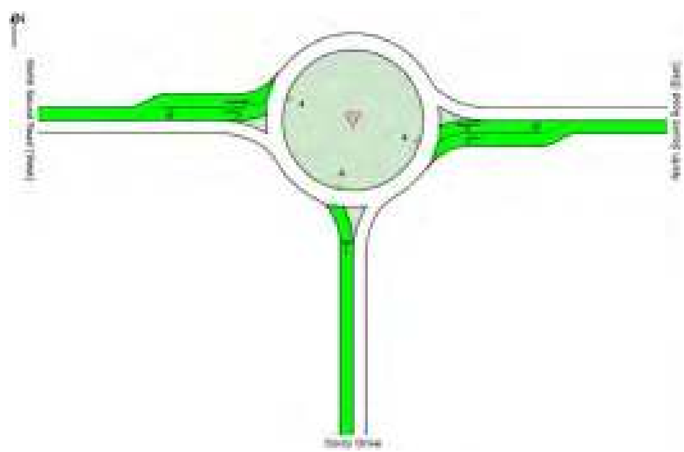

Figure 49 - Sidra Model – Dorcy Drive roundabout - 2031 - PM Peak - Lane LOS

The analysis of the North Sound Road network as a whole shows that the network will continue to be affected by the capacity issues at BOB roundabout. Refer to **Figure 50** for the AM peak hour analysis results and **Figure 51** for the PM peak hour results.

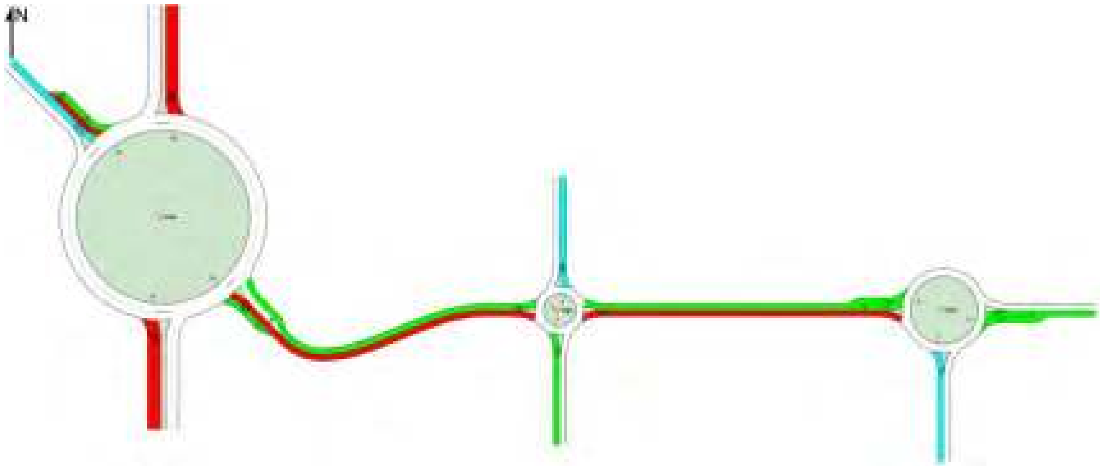

Figure 50 – Sidra Model - North Sound Road Network - 2031 - AM Peak - Lane LOS

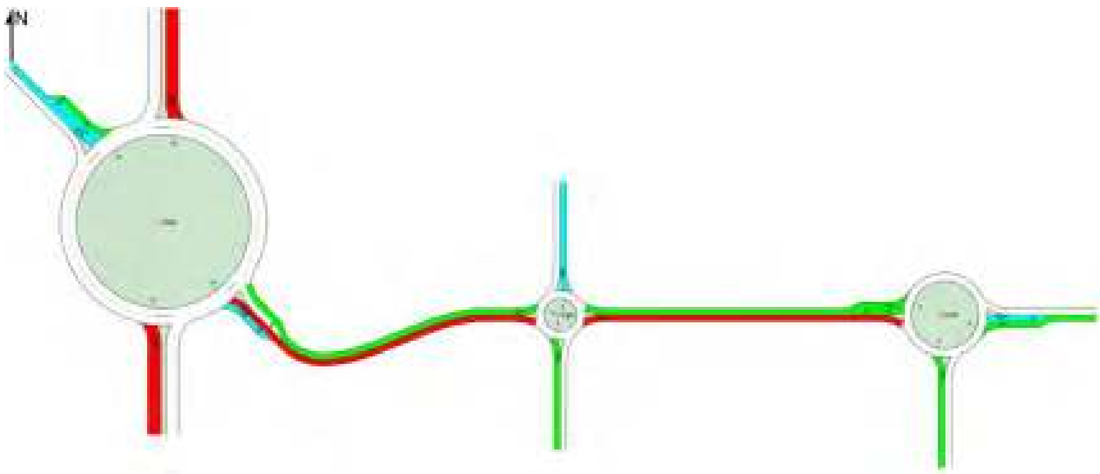

Figure 51 – Sidra Model - North Sound Road Network – 2031 - PM Peak - Lane LOS

4.6.3 Medium-Term Year Assessment Horizon- 2036

The three main intersections on the surrounding road network were analysed individually and as well as part of the overall North Sound Road network. Refer to **Figure 52** through **Figure 59** showing the predicted Level of Service for each approach / lane to each intersection for the 2036 Near-Term assessment horizon.

The approach / lane LOS for BOB roundabout during the AM and PM peaks are shown in **Figure 52** and **Figure 53**, respectively. The results show that the North Sound Road (East) approach, as well as other approaches, will continue to experience significant capacity issues due to background traffic growth.

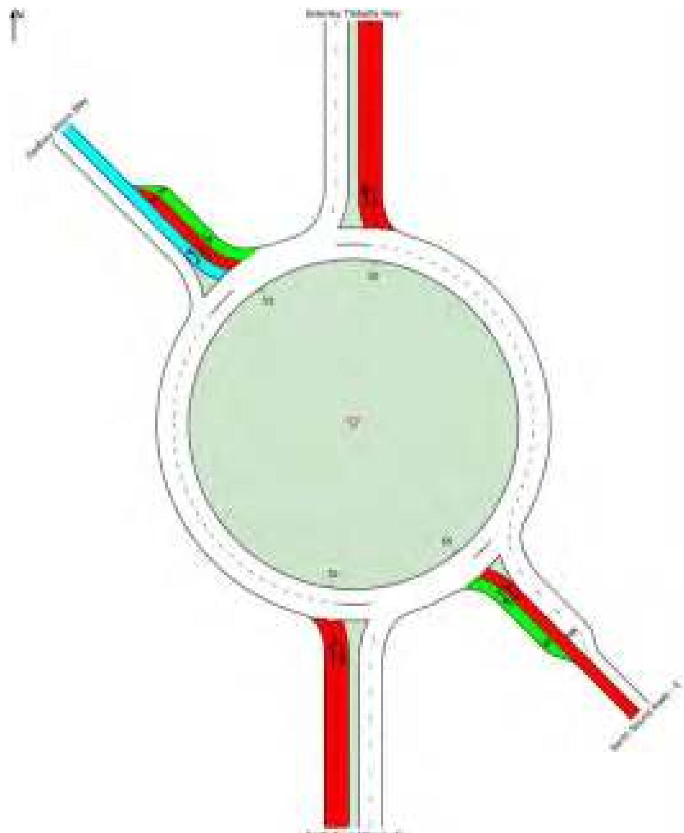

Figure 52 - Sidra Model – Bank of Butterfield roundabout - 2036 - AM Peak - Lane LOS

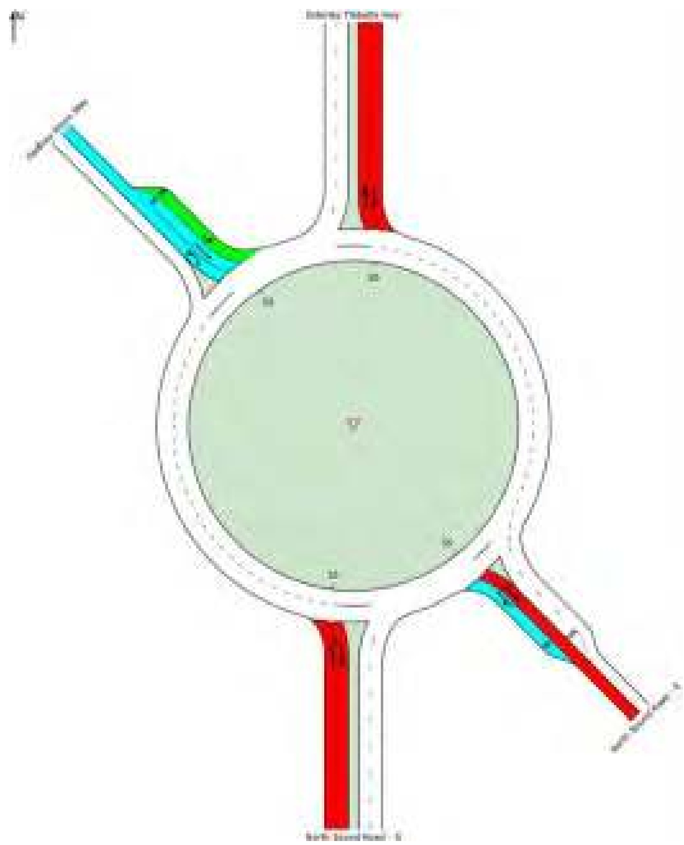

Figure 53 - Sidra Model – Bank of Butterfield roundabout - 2036 - PM Peak - Lane LOS

The approach / lane LOS for the North Sound Road / Seymour Road mini-roundabout during the AM and PM peaks are shown in **Figure** 54 and **Figure 55**. The results show that most approaches will reduce to LOS B during the peak periods, with the North Sound Road (East) approach degrading to LOS E during the PM peak.

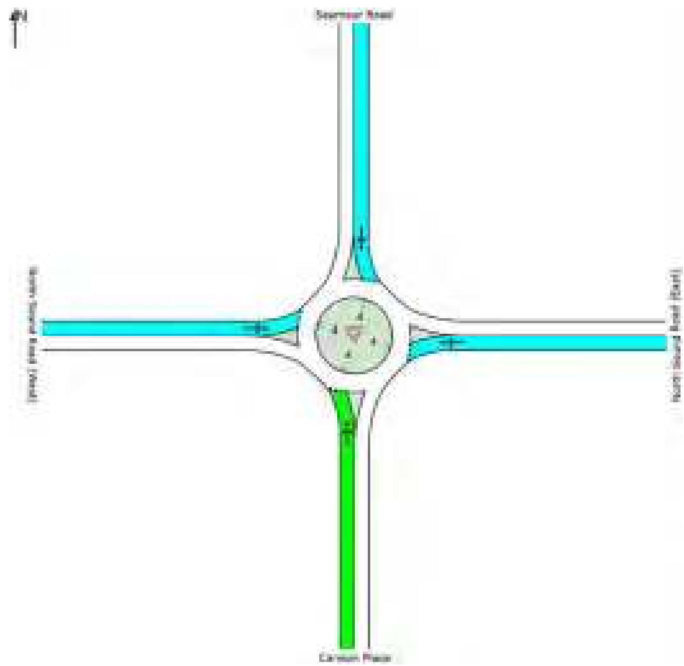

Figure 54 - Sidra Model – Seymour Road roundabout - 2036 - AM Peak - Lane LOS

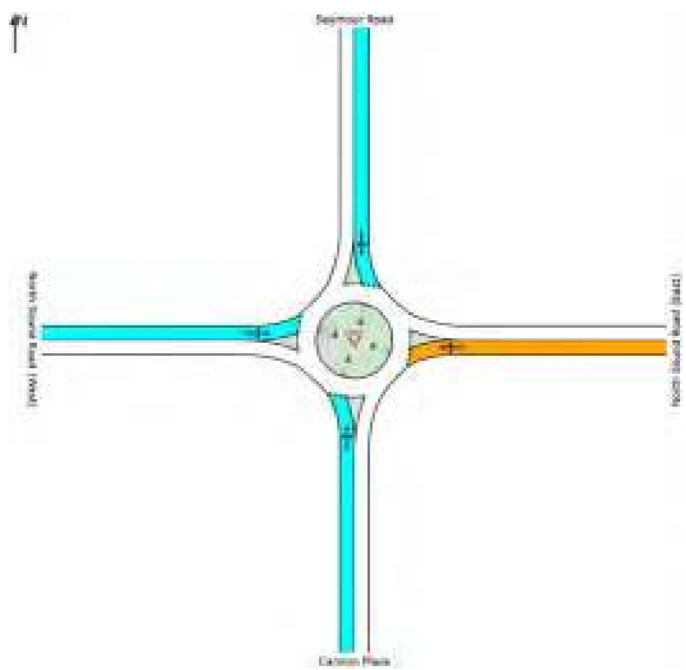

Figure 55 - Sidra Model – Seymour Road roundabout - 2036 - PM Peak - Lane LOS

The approach / lane LOS for the North Sound Road / Dorcy Drive mini-roundabout during the AM and PM peaks are shown in **Figure 56** and **Figure 57**. The results show that some approaches are predicted to degrade to LOS B during the AM and PM peak periods.

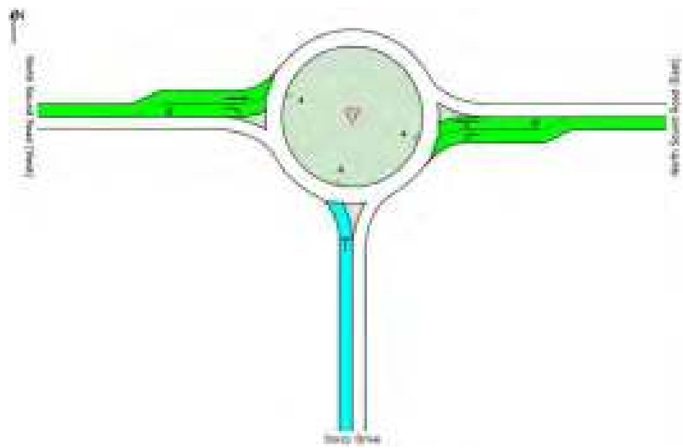

Figure 56 - Sidra Model – Dorcy Drive roundabout - 2036 - AM Peak - Lane LOS

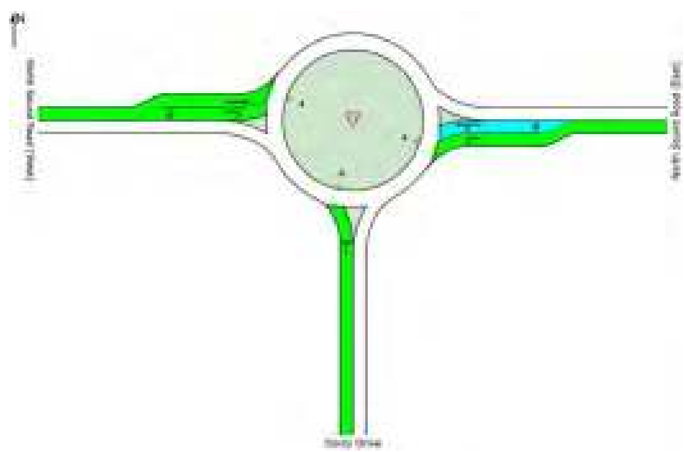

Figure 57 - Sidra Model – Dorcy Drive roundabout - 2036 - PM Peak - Lane LOS

The analysis of the North Sound Road network as a whole, which includes the three intersections, shows that the network will continue to be affected by the capacity issues at BOB roundabout. Refer to **Figure 58** for the AM peak hour analysis results and **Figure 59** for the PM peak hour results. Interrogation of the analysis results shows that the 95% percentile queue length on the North Sound Road (East) approach is predicted to increase to 416 vehicles during the AM peak hour, equating to an estimated distance of over 1.9 miles and 639 vehicles during the AM peak hour, equating to an estimated distance of nearly 2.9 miles. This will significantly impact the operation of North Sound Road through the study area.

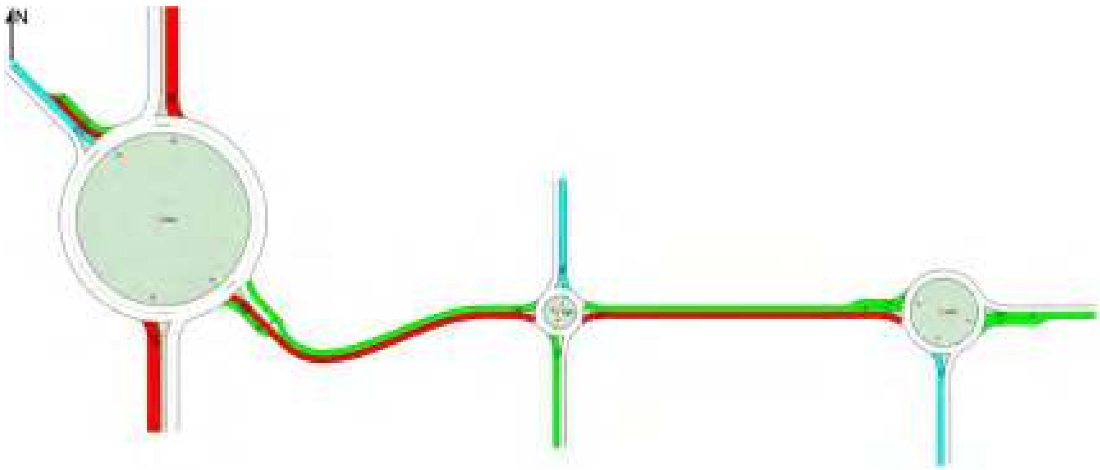

Figure 58 – Sidra Model - North Sound Road Network - 2036 - AM Peak - Lane LOS

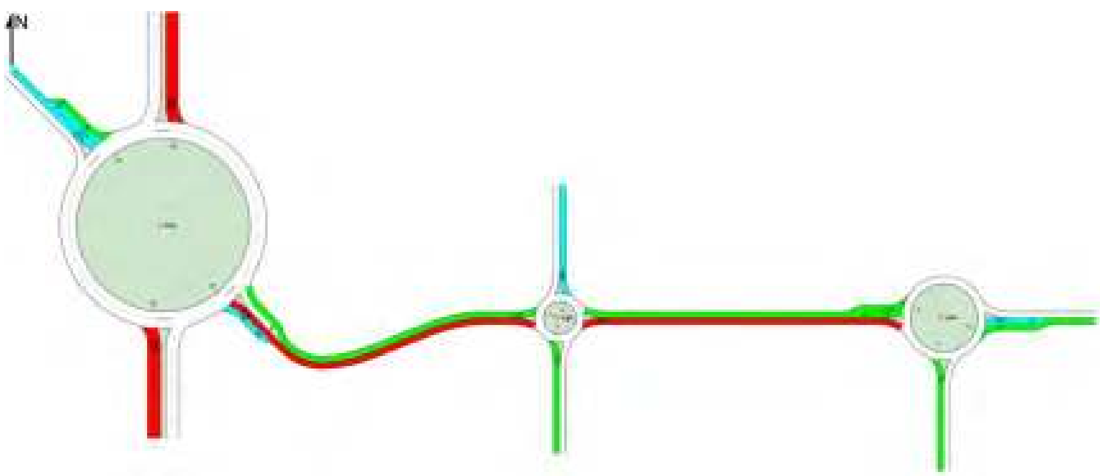

Figure 59 – Sidra Model - North Sound Road Network – 2036 - PM Peak - Lane LOS

4.7 Impact Analysis

The analysis sections above show that the existing road network will continue to experience significant degradation in future years with future predicted traffic growth due to population increase and growing car ownership. The ReGen facilities are not expected to have a direct impact on surrounding road network.

The opening of the Airport Connector Road is likely to reduce traffic flow on the North Sound Road, however an assessment of that impact is outside the scope of this report.

4.8 Mitigation

There are limited strategies available to improve traffic flow through the study area. As has been shown, the capacity issues on the surrounding road network are not as a result of the ReGen facilities and will progressively degrade over the coming years. One method of mitigating the impact of the ReGen facilities on the surrounding road network would be to encourage staff and other landfill associated traffic to access the site outside the peak periods of the network. We have determined from the traffic data available that this already occurs. The peak traffic flows associated with the GTLF occur mostly outside the peak traffic periods of the surrounding intersections / roads – any temporary fluctuations in traffic flow at the GTLF entrance will not impact peak hour operation of the rest of the road network within the study area.

4.9 Environmental Impact

Any possible environmental impacts associated with transportation will be addressed in the relevant section of the EIA.

4.10 Construction Impacts

Based on discussions with the design team, it is understood that the intention is that all ReGen facilities will come online at approximately the same time. It is anticipated that design, engineering, procurement, and construction – including site preparation and auxiliary works for the ERF will take approximately two and a half years. It is anticipated that design, engineering, procurement, and construction for the non-ERF facilities will take approximately one and a half years.

The construction works are likely to include:

- Site preparation, incorporating clearance works, site levelling, demolition, and earthworks
- Piling and foundation works
- Erection of buildings
- Internal road construction
- Underground and overhead utility works

It is expected that at its peak activity period approximately 300 construction staff would be required to construct the ReGen facilities including the associated buildings. The construction phase is a temporary condition, and the 300 personnel will only be on site during the peak construction stage. Typical construction working hours in the Cayman Islands are from 07:00 - 16:00. Based on this, the majority of the construction personnel will be travelling during the morning (AM) peak period and will partially straddle the evening (PM) peak period.

It can be expected that construction personnel will travel to site using multiple models of transport - private vehicle, shared trips (multi-occupancy vehicles), bicycle and some public transport and on foot. For the purposes of analysis, we have assumed that of the 300 staff, 150 additional vehicles would be added to the traffic along North Sound Road & Seymour Road during the peak periods. This is consistent with transportation patterns on construction sites on Grand Cayman. DECCO provided the following feedback:

"I have spoken to two of the DECCO senior project managers who are looking after two of our current construction projects (Indigo and Hospital). Both believe that 50%-60% of construction staff drive to work with the remaining majority car sharing and a smaller proportion utilizing public bus. Some existing sub-contractors do also have a company specific bus service for their staff"

It can be anticipated that the construction personnel will travel to the site in distribution similar to those already travelling on North Sound Road.

Figure 60 and **Figure 61** show the resulting LOS for Seymour Road roundabout for the base year (2022) with construction traffic during the AM & PM peak periods, respectively. In order to undertake a robust analysis of the construction impacts, all construction traffic is modelled to utilise the network during the peak periods. The addition of the construction traffic reduces the LOS on the North Sound Road (East) approach from LOS B to LOS C during the AM peak. During the PM peak, the LOS on Seymour Road is reduced from LOS B to LOS C. It can be seen that the inclusion of additional traffic related to construction of the ReGen facilities has some minor impacts on the surrounding road network.

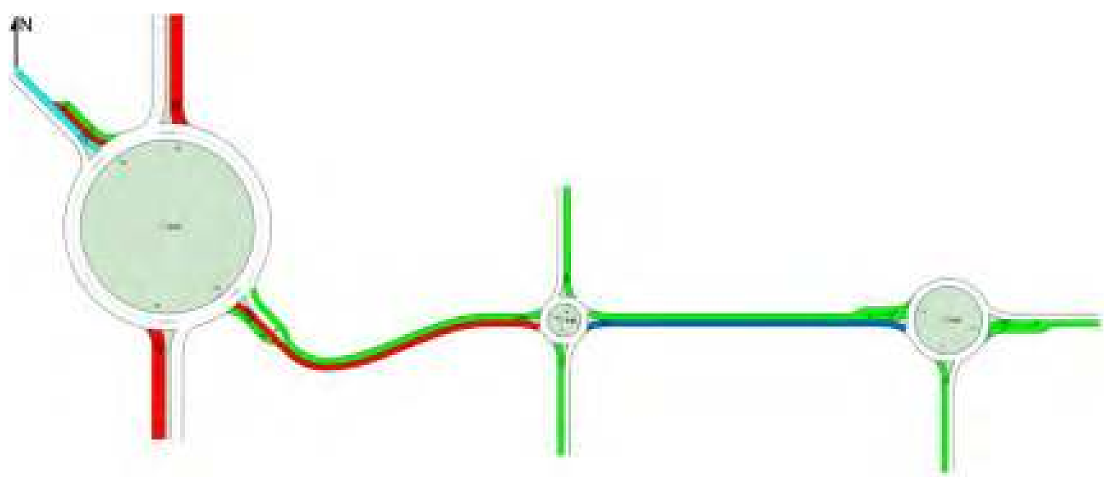

Figure 60 – Sidra Model - North Sound Road Network - Base Year with Construction Traffic AM Peak - Lane LOS

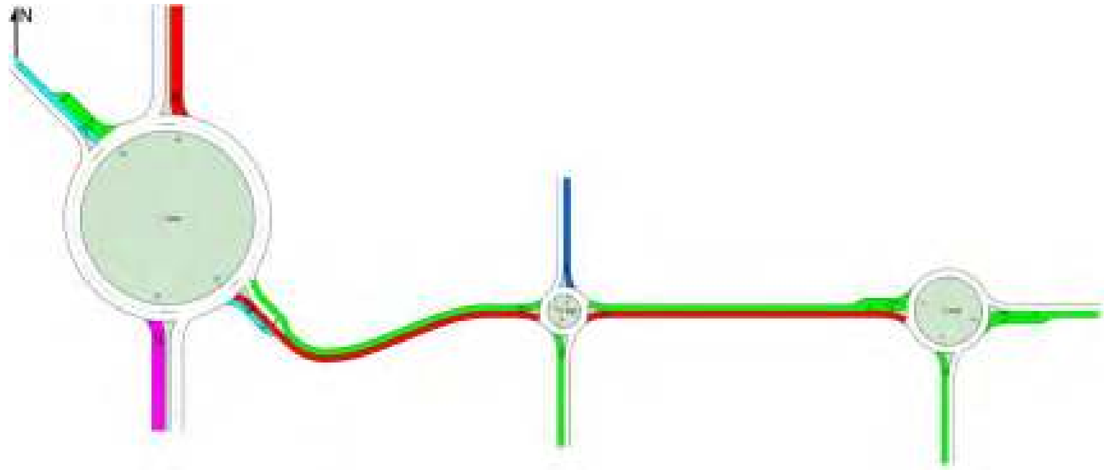

Figure 61 – Sidra Model - North Sound Road Network - Base Year with Construction Traffic PM Peak - Lane LOS

The construction process will require machinery on site as well as vehicle and truck movements on the surrounding road network. Forecasts of the construction traffic prepared by the design team currently expect that approximately 37 HGVs per day will travel to / from the ReGen site during the pile-construction stage of the project. It is expected that most construction delivery movements on the surrounding road network will occur outside the peak traffic flow periods. Based on this and the analysis above, it can be deduced that the construction delivery traffic will cause negligible impact on the surrounding road network. Movement of any large industrial equipment to the site during construction will be managed by specific plans that will consider Health & Safety and protection of any utilities along the path.

5.0 FINDINGS & CONCLUSIONS

The preceding sections provide information on the existing road network surrounding the proposed ReGen facilities and detail the current operation of the GTLF and proposed operation of the ReGen facilities. A detailed assessment of the traffic and road related aspects of the proposed development is undertaken, including a discussion on the expected trip generation of the facility. Finally, a capacity assessment is provided for the three intersections within the study area that could be impacted by the proposed development. Future traffic flows within the study area have been calculated for the Opening Year (2026), Near-Term Year (2031) and the Medium-Term Year (2036).

The following points summarise the major assumptions underpinning this Traffic Impact Assessment:

- The ReGen facilities operations (operating times, waste collection practices, etc.) are expected to be similar to the existing GTLF operations with a marginal increase in staff numbers compared to existing
- Trip generation by the ReGen facilities is expected to be in line with the trips currently generated by the GTLF. There are no plans to modify the waste collection practices
- Trip distribution to and from the ReGen facilities is expected to be similar to existing trip distribution at the GTLF

The following points summarise the major findings and conclusions of this Traffic Statement:

- The peak traffic flows associated with the GTLF occur mostly outside the peak traffic periods of the surrounding intersections / roads – any temporary fluctuations in traffic flow at the GTLF / ReGen entrance will not impact peak hour operation of the rest of the road network within the study area
- The North Sound Road network in the vicinity of the proposed ReGen facilities is currently operating beyond capacity, with much of North Sound Road and approaches to the Bank of Butterfield roundabout experiencing a Level of Service F
- The intersections within the study area will experience a further deterioration in service in the future due to projected traffic growth for Grand Cayman
- The opening of the ReGen facilities is not expected to have a direct impact on the surrounding road network, as traffic associated with the facility will be in line with existing traffic flows associated with the GTLF
- The construction of the ReGen facilities will cause some minor impacts on the surrounding road network during the peak periods

APPENDIX A

Traffic Statement Scoping Report

GRAND CAYMAN PROPOSED INTEGRATED SOLID WASTE MANAGEMENT FACILITY
ReGen

PROPOSED TRAFFIC STATEMENT

SCOPING REPORT

October 2021

Draft

GRAND CAYMAN PROPOSED INTEGRATED SOLID WASTE MANAGEMENT FACILITY PROPOSED TRAFFIC STATEMENT SCOPING REPORT

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GRAND CAYMAN PROPOSED INTEGRATED SOLID WASTE MANAGEMENT FACILITY PROPOSED TRAFFIC STATEMENT SCOPING REPORT

1.0 INTRODUCTION

This Scoping Report presents the proposed methodology that will be employed during the preparation of the Traffic Statement for the Grand Cayman proposed Integrated Solid Waste Management Facility (ISWMS), commonly referred to as the ReGen facility. APEC Consulting Engineers Ltd (APEC) will be undertaking a traffic study, analysis of existing and future traffic and an assessment o the potential impacts of the ReGen facility.

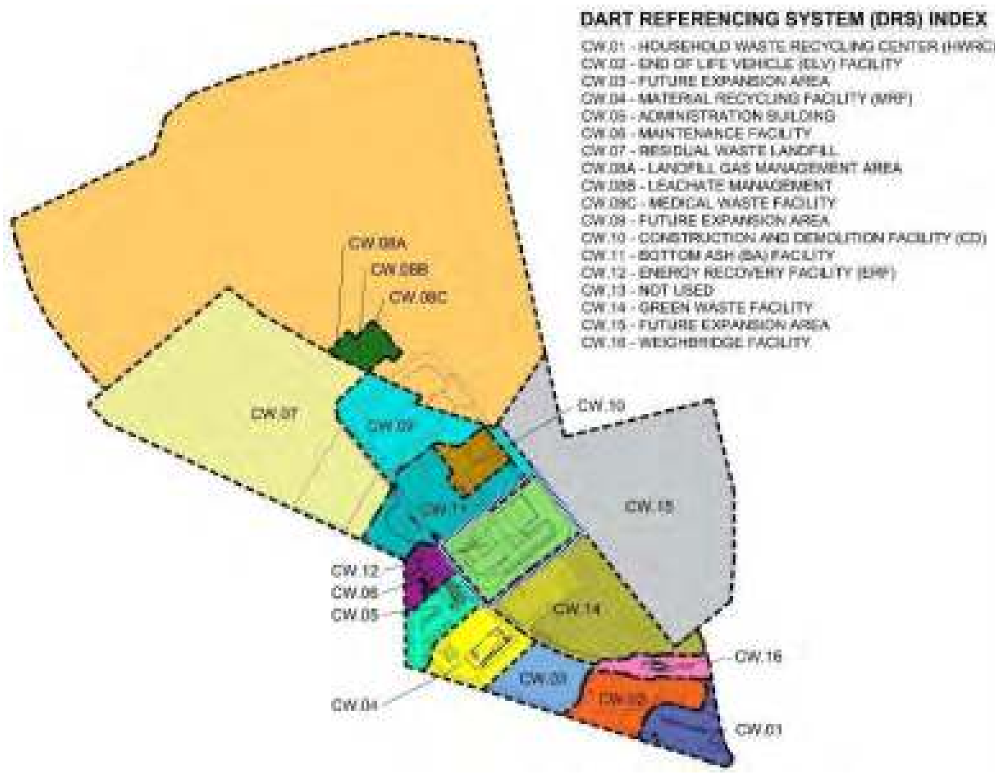


Figure 1 - Proposed Integrated Solid Waste Management Facility Layout

1.1 Proposed Scope of Assessment

As part of the Environmental Impact Assessment (EIA) process, chapter 5.8 of the Terms of Reference (ToR) document outlined the expected procedures for the Traffic Statement. This Scoping Report forms as a development of chapter 5.8 – 'Traffic' of the ToR. The Traffic Statement will follow the National Roads Authority (NRA) requirements 'Terms of Reference and Guidelines for Conduct of Traffic Impact Study in the Cayman Islands, March 2013'.

The EIA shall assess the traffic impacts associated with the ReGen facility on the surrounding road network and assess all possible mitigation measures. This assessment will be presented through a Traffic Statement

(TS). The TS will be organized in such a way as to set out the existing situation, present the proposed development and determine what impact, if any, the site-generated traffic will have on the surrounding road network.

2.0 PROPOSED METHODOLOGY

2.1 Background and Existing Conditions

The TS will provide background information on the proposed project including its location and proponent. The existing road network surrounding the proposed site will be described by way of site plan / map. This will include descriptions of traffic controls of nearby intersections. Details of existing pedestrian, cycle and public transport facilities will also be provided.

2.2 Proposed Development

A summary will be provided of the site development, including proposed energy recovery facility, material recycling & green waste / composting facilities, ancillary buildings, internal access roads, administration building, civil amenity drop-off area, etc. A detailed description of any project construction phasing will be provided.

Other information included as part of this assessment will include:

- Information on likely hours of operation of ReGen facility, number of employees, classification of vehicles on site and estimation of number of vehicles remaining on site and number of vehicles using surrounding road network
- Internal Layout (Traffic circulation, pedestrian routes, visibility and road width, speed control measures)
- Parking (Provision, disabled percentage, layout)
- Public Transport (provision, access from site)

2.3 Study Area

The study area for the TS will consist of an area stretching from the north end of Seymour Road at the entrance to the site, south along Seymour Road and encompass the intersection of Seymour Road with North Sound Road. This encompasses the only available access to the site. The study area referenced in the ToR also included the ‘Bank of Butterfield’ roundabout intersection at the western end of North Sound Road. As traffic associated with the proposed facility is very likely to be consistent with existing traffic to / from the George Town Landfill, it is not envisaged that the proposed ReGen facility will have an measurable impact on the operation of that intersection and therefore it will not be included in the proposed study area for this TS.

2.3.1 Traffic Data

Data of the traffic flows on the existing road network within the study area will be gathered by way of a combination of automatic traffic counters1 and including turning movement counts undertaken by APEC staff

[1] PicoCount 2500 counter with pneumatic road tubes

and / or associates. It is proposed that traffic data from automatic traffic counters will be collected for a period of at least 7 days at each count site. This traffic data will be analyzed to assess current traffic flow (annual average daily traffic and peak hourly flows), speed and classification through the study area and along Seymour Road.

We will request traffic count data from the 2016 / 2017 NRA island-wide traffic count project. Initial review of the traffic count shows that data should be available for Seymour Road and for the intersection of North Sound Road & Seymour Road. Traffic data is also available from 2012 for Seymour Road at the entrance to the existing George Town Landfill which may be of use in comparison with the more recent data.

Data on the current operation of the existing GTLF will be reviewed, including data from the Department of Environmental Health (DEH), traffic volumes and civic amenity drop-off (including origin information).

A summary will be presented of any committed / proposed road developments in the study area that will be undertaken in the future. In addition, any proposed significant developments that may impact the traffic flows in the study area will be assessed.

2.4 Traffic Analysis

The traffic data from 2016 / 2017 (if available), the data from 2012 along with updated data gathered as part of this study will be analyzed in order to estimate the likely traffic flows associated with the ReGen facility.

An assessment will be undertaken of the existing road capacity based on existing traffic volumes. This assessment will be presented in table format showing the existing capacities on the road network within the study area.

The Traffic Statement will undertake traffic analysis based on the following approach:

- Existing and projected traffic volumes (including turning movements),
- Description of existing road network within study area and any proposed road(s) / accesses
- Traffic controls (where applicable)
- Project trip generation
- Project generated trip distribution and assignment
- Level of service of the existing and of the future / horizon conditions, both with and without the project
- References to other traffic impact studies (as may be necessary)

2.4.1 Trip Generation / Attraction

An estimate will be made of the likely trips generated by the ReGen facility. Peak times of operation will be identified during the day and during the week.

2.4.2 Trip Distribution & Assignment

The directional split of future traffic flows along North Sound Road and Seymour Road will be estimated, based on future trip generation and existing flow distribution.

2.4.3 Assessment Year / Design Year Horizon

The assessment / design year(s) will be selected in order to undertake the traffic impact analysis. We propose to assess the impacts at 5 and 10 years following opening of the facility. Future traffic flows will be calculated based on NRA forecasts for traffic growth. It is proposed that a 3% growth rate be used, however we will review this in line with expected growth rates for waste generation that have been assumed elsewhere in the EIA.

2.5 Impact Analysis

Intersection capacity analysis will be undertaken based on traffic associated with the ReGen facility. Impacts, if any, on the current levels of service will be calculated. The impact on transportation route(s) to and from the new facility will be assessed. Roads (existing and any proposed) that may be affected by ReGen related traffic will be highlighted. If the impact of the ReGen traffic on the surrounding roads (both existing and proposed roads) is greater than a 10% increase then detailed capacity analysis may be required. The scope of this assessment will include both the near-term (Year 5) and overall long-term (Year 10) in order to determine the resulting transportation impacts of the traffic operations on the surrounding road network, particularly during the morning and evening peak hour conditions.

2.6 Mitigation

Roadway improvements or traffic management strategies will be recommended, if required, to mitigate unsafe conditions or increased traffic congestion along transportation routes. Other strategies that may be required could include requiring truck movements to be undertaken during off-peak periods.

2.7 Environmental Impact

Any possible environmental impacts associated with transportation relating to the construction and operation of the ReGen facility will be assessed and mitigations presented.

2.8 Construction Impacts

Likely truck movements required to remove construction & demolition waste from the site and to deliver fill and materials to site during construction will be calculated and presented. An assessment will be undertaken of any abnormal truck loads that may be required as part of the construction works.

APPENDIX B

Section 5.8 of the Terms of Reference of the Environmental Impact Assessment

5.8 Traffic and transport

Introduction

5.8.1 It has been previously established that The Cayman Islands National Road Authority (NRA) consider that the activity is likely to be a low traffic generator and as such a Traffic Impact Assessment will not be required. However, some elements of the transport assessment approach will be needed to inform the operational assessments of the EIA (especially noise and air quality) and this may be contained within a Transport Statement.

Applicable standards and technical guidance

5.8.2 For the traffic and transport statement the following guidance will be used:

- Cayman Island EIA Regulations: National Conservation Council Directive for Environmental Impact Assessments Section 43, National Conservation Law, Extraordinary No.50/2016, June 2016; and
- Terms of Reference and Guidelines for Conduct of TIS in Cayman Islands, Transportation & Planning Unit, National Roads Authority (March 2013).

5.8.3 In addition, it is recommended that the UK Guidance: 1993 Institute of Environmental Assessments (IEA) publication 'Guidance Notes No. 1: Guidelines for the Environmental Assessment of Road Traffic' (the IEMA guidelines) or methodology's similar to these that are based on the assessment of the environmental effects of traffic and transport. IEMA are currently in the process of looking at how this advice can be updated, and it may be supplemented with advice notes that would need to be referred to if issued before the assessment is undertaken.

Baseline conditions

5.8.4 The site is located on the north side of the George Town area of the island with access to the site from the south. The access routes to the site will define the proposed study area.

5.8.5 The study area is defined as the route between the site and Esterly Tibbetts Highway, which has been identified as a strategic route for the Island. It is assumed that traffic to and from the site would arrive at Butterfield Roundabout from the north, west and south of the island and route to the site along North Sound Road and Seymour Road.

5.8.6 The study area incorporates a series of two-lane single carriageway roads and priority junctions/roundabouts, leading to an access into the site which currently terminates with no existing gatehouses or turning head.

Data gathering methodology

5.8.7 An extensive baseline data gathering exercise would be preferable to underpin the statement and ideally this data will include the following:

- Typical baseline traffic flows, percentage HGV and traffic speed data on links in the area (existing data or new traffic surveys). At this stage, it is assumed that Automatic Traffic Counts (ATCs) will be needed on the following links:
  - Site Access Road – Seymour Road, leading onto the Dump Road;
  - Seymour Road – Between the junction with North Sound Road and the site access; and
  - North Sound Road – Between the junction with Seymour Road and Esterly Tibbetts Highway.

- Overview of parking, loading and servicing arrangements at the site;
- Local public bus routes, bus stops and service frequencies;
- Proposed site traffic generation, staff vehicles, waste loads (light and heavy vehicles) – split across daily operating schedules;
- Proposed site construction traffic, number of vehicles, routes of vehicles, types of vehicles and construction staff;
- Destination and origins of the trips to and from the site;
- Type and size of HGV operating out of the site;
- A growth rate to be agreed with the NRA;
- Local pedestrian and cycling facilities, including public rights of way (PRoW); and
- Personal injury accident records on the local highways network.

5.8.8 However, in the absence of this data approximations and extrapolation could be used from data gathered:

- During the NRA 2016 Island Wide Traffic Collection Study at:
  - Intersection ID #8 - ETH / North Sound Rd and Godfrey Nixon Way (Butterfield Roundabout);
  - Intersection ID #28 - North Sound Rd and Dorcy Dr/Kentsville Dr;
  - Various ATRs.
- During a site visit such as:
  - Information on local public bus routes, bus stops and service frequencies, pedestrian and cycling facilities, including public rights of way (PRoW);
  - Information on the standard of highways to gauge levels of road safety in lieu of personal injury accident records on the local highways network.
- From the scheme plans, such as:
  - An overview of parking, loading and servicing arrangements at the site;
- From the current waste operator (and the intended operator if different), such as:
  - Proposed site traffic generation, staff vehicles, waste loads (light and heavy vehicles) per day with operating hours;
  - Type and size of HGV operating out of the site.
- From the intended construction contractor, such as the number of construction vehicles, routes, types of vehicles and the number of construction staff; and
- From any other historical counts undertaken in the vicinity of the site, possibly as part of another planning application.

5.8.9 As a minimum, the following information will be needed:

- Tonnages of waste to be processed and the site operating hours;
- A site visit; and

- Scheme plans.

Current baseline

Local Highways Network

The Dump Road

5.8.10 The Dump Road is a small, single carriageway unmade / informal road, running in a north-westerly direction off Seymour Road. This will be the point at which access is gained to the proposed ISWMS site.

Seymour Road

5.8.11 Seymour Road is a single carriageway road without road markings which links the North Sound Road with the informal Dump Road (and beyond that, the Cayman waste water treatment works). The road runs through a predominantly commercial/industrial area.

North Sound Road

5.8.12 North Sound Road is a two-lane single carriageway road with central white lines which runs between a roundabout with Esterly Tibbetts Highway and the entrance into George Town Yacht Club. The road runs through an area of industrial, commercial and residential land uses and has numerous junctions with minor roads. The road also currently provides access to the airport and numerous other key facilities on the coast as well as access into the commercial/industrial area where the proposed development is located.

Pedestrian and cycle facilities

5.8.13 There are 108 official PRoW on Grand Cayman most of which are relate to beach access. Details of these PRoW will be needed as part of the baseline data collection.

5.8.14 The local roads in the industrial estate do not have paved footways on the side of the carriageway but online photograph would indicate that users do walk in the carriageway on the Island. There are more formal footways provided on both sides of North Sound Road.

5.8.15 There are no designated cycle routes on the Island of Grand Cayman. There are some tourist routes which are advertised such as the Western Loop but none of these overlap the study area.

Bus, rail and air

5.8.16 A public mini-bus transport system connects all districts of Grand Cayman. The buses can be identified by numbers in a coloured circle and the nearest route to the proposed site is the Fuchsia Route (5A and 5B) which provides a loop that includes the Farmers Market, the International Airport and the Cayman Water Authority. These services run every 30 minutes.

5.8.17 The purple route (WB3) runs north south along North Shore Way and Easterly Tibbetts Highway and runs every 15 minutes.

5.8.18 In general bus services runs Monday to Thursday 06:00 to 23:00 and Friday and Saturday between 06:00-01:00. There are some limited services on a Sunday.

5.8.19 There are no railway lines on Grand Cayman, and the International Airport is located approximately 2.5 km as the crow flies south of the proposed development site.

Future baseline

5.8.20 The local road network is being improved and construction is underway to construct the $34 million, two-mile Airport Connector Road. This road is proposed to link the Camana Bay South Roundabout (Esterly Tibbetts Highway) and the Airport via a route passing to the north of the site before heading south to North Sound Road and then on to the Airport. The provision of this road will relieve the Esterly Tibbetts Highway and North Sound Road (west of Butterfield Roundabout) which are key routes proposed to be used by the operational traffic of the proposed development.

5.8.21 It is also noted that there will be a degree of background traffic growth because of population growth and car ownership growth on the Island. The NRA will be contacted to discuss:

- an agreed growth rate for the assessment; and
- details of any significant local developments that need to be considered; and
- any other highway schemes relevant to the study area.

Consultation

5.8.22 A discussion with the Cayman Islands NRA and EAB will be required to discuss a range of issues set out in the baseline and future baseline assessment sections above. One area for clarification will be the inclusion or exclusion of the Planned Development Area for Camana Bay and the proposed Cruise Berthing Facility within the baseline conditions, which at this stage should not be considered in the cumulative impact baseline for assessment.

Scope of the assessment

Potential receptors

5.8.23 As set out within the baseline section above the scope of assessment has been identified as the routes from the strategic Esterly Tibbetts Highway to the site access via local roads which are described within the current baseline section - see **Figure 5.7: Study area for transport assessment.**

5.8.24 The receptors on these roads will be the land uses adjacent to the carriageway and users of the roads.

5.8.25 It should be noted however that during the consultation with the NRA the scope of assessment will be discussed, and it may be widened depending on site specific details that the NRA may set out.

5.8.26 Table 5.41 sets out the initial locations of receptors. Should further receptors be identified their sensitivity to traffic flow will be determined according to the following examples:

- receptors of high sensitivity to traffic flow include schools, accident clusters and roads without footways/sidewalks that are used by pedestrians;
- receptors with medium sensitivity to traffic flow include congested junctions, shopping areas and roads with narrow footways/sidewalks; and
- receptors with low sensitivity include industrial adjacent land uses and places with adequate footway/sidewalk provision.

Table 5.41 Proposed initial receptors and estimated sensitivity

Receptor	Sensitivity	Justification
Seymour Road (from North Sound Road to the Dump Road)	Low	Industrial adjacent land uses
North Sound Road – Between Seymour Road and Esterly Tibbetts Highway	Medium/High	Urban / town centre adjacent land uses

Likely significant effects

5.8.27 The likely significant transport effects that have been taken forward for assessment are summarised in Table 5.42.

Table 5.42 Likely significant transport effects

Activity	Effect	Receptor
Operation and construction traffic increases on local road network	Visual effects	Local road users Adjacent land uses to the carriageway Pedestrian and cyclists
Operation and construction traffic increases on local road network	Driver severance and delay	Other vehicles using the local road network
Operation and construction traffic increases on local road network	Pedestrian severance and delay	Pedestrian using the local roads
Operation and construction traffic increases on local road network	Pedestrian amenity and intimidation	Pedestrian using the local roads
Operation and construction traffic increases on local road network	Accidents and safety	Local road users Adjacent land uses to the carriageway Pedestrian and cyclists
Operation and construction traffic increases on local road network	Hazardous and dangerous loads	Local road users Adjacent land uses to the carriageway Pedestrian and cyclists

5.8.28 The effects scoped out from further assessment are as follows:

- Decommissioning of the facility;
- Capacity of local highways junctions; and
- Ability to convey abnormal loads to site if required.

Assessment methodology

5.8.29 The generic project-wide approach to the assessment methodology is set out in Chapter 4, and specifically in sections 4.2. However, whilst this approach has informed the approach that has been used in this Transport environmental assessment, it is necessary to set out how this methodology has been applied, and adapted as appropriate, to address the specific needs of the Transport assessment.

5.8.30 The traffic and pedestrian inputs (for both the construction and operational phases of the development) used in the EIA will be informed by the baseline data capture exercise and future traffic flows estimated using a first principals' approach. The magnitude and significance of any environmental traffic and pedestrian effects will be determined and any suitable mitigation identified.

5.8.31 The EIA assessment process will adopt the established methodology as outlined in Guidelines for the Environmental Assessment of Road Traffic (Institute of Environmental Assessment, 1993). The assessment will also be undertaken in consultation with the Proponent and agreement on the following aspects will be sought:

- Identification of sensitive areas / affected parties;
- Forecast traffic levels and characteristics;
- Time(s) suitable for assessment (e.g. AM peak);
- Year of Assessment (year of construction and year of opening); and
- Geographical boundaries of the assessment.

5.8.32 The screening process to define the geographical scope of the EIA study will be based upon the established guidance which recommends that detailed environmental impact studies will only be triggered where road links experience a change in traffic greater than 30% for all vehicles (or HGV) or more than 10% where the links pass sensitive areas. However, as part of this ToR an initial review of the likely receptors to be affected have been made subject to agreement with NRA.

5.8.33 Traffic and pedestrian construction and operational impacts to be assessed will include:

- Driver severance and delay – at junctions or links subject to traffic flow increases which are either approaching capacity, or are over capacity (or delays resulting from traffic diversions);
- Pedestrian severance and delay – at locations where physical obstructions or increases in traffic flows more than 30% are forecast to result in an increase in severance;
- Pedestrian amenity / intimidation – at junctions or links subject to substantial increases in traffic flow in conjunction with any changes in footway widths or crossing facilities. The presence of sensitive user groups will also be considered;
- Accidents and safety – links and junctions (for which data is available) with existing accident rates more than national averages which may be subject to an increase in traffic flows; and
- Hazardous and dangerous loads – consideration of estimated number and composition of loads and assessment of accident risk if considered significant.

5.8.34 The criteria for evaluation will be based on Table 5.41 for the sensitivity of receptors and Table 5.43 for the magnitude of change.

Table 5.43 Guidelines for the Assessment of Impact Magnitude

	Magnitude of Impact			
Magnitude of Change	**Very Low**	**Low Medium**	**Medium**	**High**
Severance	Change in total traffic or HGV flows of less than 30%	Change in the total traffic or HGV flows of 30%-60%	Change in total traffic or HGV flows of 60%-90%	Change in total traffic or HGV flows of over 90%
Pedestrian and Cycle Delay	A professional judgement based on the routes in the context of the individual characteristics			
Pedestrian Amenity	Change in total traffic or HGV flow of <100%	A professional judgement based on the routes with >100% change in context of the individual characteristics		
Cyclist Amenity	Change in total traffic or HGV flow of <100%	A professional judgement based on the routes with >100% change in context of the individual characteristics		
Accidents and Safety	A professional judgement based on the level of baseline collision numbers and severity of collisions as well as the predicted change in collisions.			

5.8.35 Identified adverse effects will be categorised as 'slight', 'moderate' or 'substantial' as appropriate using the matrix presented in Table 5.44; with substantial, moderate/substantial and moderate classed as significant.

Table 5.44 Establishing the Level of Effect

	Sensitivity of receptors		
Magnitude of Change	**High**	**Medium**	**Low**
High	Substantial	Moderate/Substantial	Moderate
Medium	Moderate/Substantial	Moderate	Slight/Moderate
Low Medium	Moderate	Slight/Moderate	Slight
Very Low	Slight	Slight/Negligible	Negligible

5.8.36 Any departures from the guidelines will be agreed with the Proponent and will be clearly stated within the Environmental Statement. Mitigation will also be developed in consultation with the Proponent and will adopt the hierarchical principles of prevention, reduction and offsetting if required at all.

Inputs to other EIA Topics

5.8.37 The traffic team will supply existing and forecast data and analysis, relating to peak and average flows, Annual Average Daily Traffic (AADT) flows and traffic speeds, to inform other assessments within the EIA such as noise and air quality as required.

Key

Site boundary

Transport study area

0 100 200 300 400 m

Scale at A3: 1:8,000

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan,

George Town
Integrated Waste Management Solution

Figure 5.7
Study area for transport assessment

February 2021

wood.

H:\Projects\36082 NOR Cayman\GIS\36082-Shr81a.mxd Originator: jacqui.parkin

APPENDIX C

Automatic Traffic Count Data

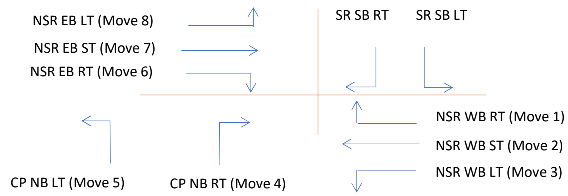
The traffic count data is available to view at the following link:
https://apec.box.com/s/bgmcdl0heoutkym9b0ctopuco90ej15f

APPENDIX D

Manual Traffic Count Data

REGEN TIA TRAFFIC COUNT

DATE: WEDNESDAY 15-DEC-22



MOVEMENT		MOVEMENT 1 NORTH SOUND ROAD WESTBOUND RIGHT TURN					MOVEMENT 2 NORTH SOUND ROAD WESTBOUND STRAIGHT					MOVEMENT 3 NORTH SOUND ROAD WESTBOUND LEFT TURN					
NORTH SOUND ROAD - SEYMOUR ROAD JUNCTION MORNING PEAK	TIME	BICYCLE MOTORCYCLE	CAR PICKUP SUV	BUSES (PUBLIC & PRIVATE)	TRUCKS		BICYCLE MOTORCYCLE	CAR PICKUP SUV	BUSES (PUBLIC & PRIVATE)	TRUCKS		BICYCLE MOTORCYCLE	CAR PICKUP SUV	BUSES (PUBLIC & PRIVATE)	TRUCKS		
	0730-0745	0	22	0	2	24	0	73	2	5	80	0	6	0	0	6	110
	0745-0800	0	26	0	4	30	0	72	4	7	83	0	2	0	0	2	115
	0800-0815	0	24	0	3	27	0	95	2	6	103	0	1	0	0	1	131
	0815-0830	0	9	0	6	15	0	91	5	6	102	0	2	0	0	2	119

0	81	0	15	0	331	13	24	0	11	0	0	475
96				368				11				
0%	84%	0%	16%	0%	90%	4%	7%	0%	100%	0%	0%	

MOVEMENT		MOVEMENT 4 CANNON PLACE (MIRCO CENTRE) NORTHBOUND RIGHT TURN					MOVEMENT 5 CANNON PLACE (MIRCO CENTRE) NORTHBOUND LEFT TURN					
NORTH SOUND ROAD - SEYMOUR ROAD JUNCTION MORNING PEAK	0730-0745	0	3	0	0	3	0	3	0	0	3	6
	0745-0800	0	0	0	0	0	0	3	2	1	6	6
	0800-0815	0	5	0	0	5	0	9	0	0	9	14
	0815-0830	0	1	0	0	1	0	11	0	0	11	12

0	9	0	0	0	26	2	1	38
9				29				
0%	100%	0%	0%	0%	90%	7%	3%	

MOVEMENT		MOVEMENT 6 NORTH SOUND ROAD EASTBOUND RIGHT TURN					MOVEMENT 7 NORTH SOUND ROAD EASTBOUND STRAIGHT					MOVEMENT 8 NORTH SOUND ROAD EASTBOUND LEFT TURN					
NORTH SOUND ROAD - SEYMOUR ROAD JUNCTION MORNING PEAK	TIME	BICYCLE MOTORCYCLE	CAR PICKUP SUV	BUSES (PUBLIC & PRIVATE)	TRUCKS		BICYCLE MOTORCYCLE	CAR PICKUP SUV	BUSES (PUBLIC & PRIVATE)	TRUCKS		BICYCLE MOTORCYCLE	CAR PICKUP SUV	BUSES (PUBLIC & PRIVATE)	TRUCKS		
	0730-0745	0	17	0	0	17	4	122	1	0	127	1	33	0	0	34	178
	0745-0800	0	10	0	0	10	2	101	1	2	106	1	38	0	1	40	156
	0800-0815	0	16	0	0	16	2	110	10	2	114	0	31	0	6	37	167
	0815-0830	0	14	0	0	14	1	96	1	0	98	0	30	0	3	33	145

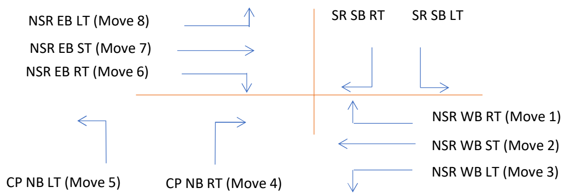
0	57	0	0	9	429	3	4	2	132	0	10	646
57				445				144				
0%	100%	0%	0%	2%	96%	1%	1%	1%	92%	0%	7%	

MOVEMENT		MOVEMENT 9 SEYMOUR ROAD SOUTHBOUND RIGHT TURN					MOVEMENT 10 SEYMOUR ROAD SOUTHBOUND LEFT TURN					
NORTH SOUND ROAD - SEYMOUR ROAD JUNCTION MORNING PEAK	TIME	BICYCLE MOTORCYCLE	CAR PICKUP SUV	BUSES (PUBLIC & PRIVATE)	TRUCKS		BICYCLE MOTORCYCLE	CAR PICKUP SUV	BUSES (PUBLIC & PRIVATE)	TRUCKS		
	0730-0745	0	22	0	0	22	0	11	0	2	13	35
	0745-0800	0	23	0	2	25	0	19	0	4	23	48
	0800-0815	2	27	0	5	34	0	11	0	2	13	47
	0815-0830	0	23	0	4	27	0	15	0	3	18	45

2	95	0	11	0	56	0	11	175
108				67				
2%	88%	0%	10%	0%	84%	0%	16%	

REGEN TIA TRAFFIC COUNT

DATE: WEDNESDAY 26-JAN-23



MOVEMENT		MOVEMENT 1 NORTH SOUND ROAD WESTBOUND RIGHT TURN					MOVEMENT 2 NORTH SOUND ROAD WESTBOUND STRAIGHT					MOVEMENT 3 NORTH SOUND ROAD WESTBOUND LEFT TURN					
	TIME	BICYCLE MOTORCYCLE	CAR PICKUP SUV	BUSES (PUBLIC & PRIVATE)	TRUCKS		BICYCLE MOTORCYCLE	CAR PICKUP SUV	BUSES (PUBLIC & PRIVATE)	TRUCKS		BICYCLE MOTORCYCLE	CAR PICKUP SUV	BUSES (PUBLIC & PRIVATE)	TRUCKS		
NORTH SOUND ROAD - SEYMOUR ROAD JUNCTION MORNING PEAK	1630-1645	0	22	0	0	22	1	65	2	0	68	0	8	0	1	9	99
	1645-1700	1	23	0	6	30	0	90	2	2	94	0	8	0	1	9	133
	1700-1715	**0**	**22**	**0**	**2**	**24**	**12**	**110**	**3**	**1**	**126**	**0**	**5**	**0**	**0**	**5**	155
	1715-1730	**0**	**10**	**0**	**3**	**13**	**3**	**108**	**2**	**3**	**116**	**0**	**0**	**0**	**0**	**0**	129
	1730-1745	**1**	**22**	**0**	**6**	**29**	**3**	**100**	**2**	**5**	**110**	**0**	**2**	**0**	**0**	**2**	141
	1745-1800	**0**	**27**	**0**	**3**	**30**	**2**	**127**	**3**	**3**	**135**	**0**	**0**	**0**	**0**	**0**	165
	1800-1815	0	25	0	1	26	2	110	5	2	119	1	3	0	0	4	149
	1815-1830	0	23	0	2	25	5	127	2	3	137	0	2	0	0	2	164

1	81	0	14	20	445	10	12	0	7	0	0		1135
96				487				7					
1%	84%	0%	15%	4%	91%	2%	2%	0%	100%	0%	0%		

MOVEMENT		MOVEMENT 4 CANNON PLACE (MIRCO CENTRE) NORTHBOUND RIGHT TURN					MOVEMENT 5 CANNON PLACE (MIRCO CENTRE) NORTHBOUND LEFT TURN					
	TIME	BICYCLE MOTORCYCLE	CAR PICKUP SUV	BUSES (PUBLIC & PRIVATE)	TRUCKS		BICYCLE MOTORCYCLE	CAR PICKUP SUV	BUSES (PUBLIC & PRIVATE)	TRUCKS		
NORTH SOUND ROAD - SEYMOUR ROAD JUNCTION MORNING PEAK	1630-1645	0	21	0	0	21	0	10	0	0	10	31
	1645-1700	0	12	0	0	12	0	7	0	0	7	19
	1700-1715	**1**	**10**	**0**	**0**	**11**	**2**	**19**	**0**	**0**	**21**	32
	1715-1730	**0**	**10**	**0**	**0**	**10**	**0**	**20**	**0**	**0**	**20**	30
	1730-1745	**0**	**13**	**0**	**0**	**13**	**0**	**25**	**0**	**0**	**25**	38
	1745-1800	**1**	**10**	**0**	**0**	**11**	**2**	**20**	**0**	**1**	**23**	34
	1800-1815	0	3	0	0	3	0	31	0	0	31	34
	1815-1830	0	7	0	0	7	1	21	0	0	22	29

2	43	0	0	4	84	0	1		247
45				89					
4%	96%	0%	0%	4%	94%	0%	1%		

MOVEMENT		MOVEMENT 6 NORTH SOUND ROAD EASTBOUND RIGHT TURN					MOVEMENT 7 NORTH SOUND ROAD EASTBOUND STRAIGHT					MOVEMENT 8 NORTH SOUND ROAD EASTBOUND LEFT TURN					
	TIME	BICYCLE MOTORCYCLE	CAR PICKUP SUV	BUSES (PUBLIC & PRIVATE)	TRUCKS		BICYCLE MOTORCYCLE	CAR PICKUP SUV	BUSES (PUBLIC & PRIVATE)	TRUCKS		BICYCLE MOTORCYCLE	CAR PICKUP SUV	BUSES (PUBLIC & PRIVATE)	TRUCKS		
NORTH SOUND ROAD - SEYMOUR ROAD JUNCTION MORNING PEAK	1630-1645	1	14	0	3	18	2	52	0	7	61	0	10	0	0	10	89
	1645-1700	2	20	0	7	29	2	63	1	6	72	0	5	0	0	5	106
	1700-1715	**0**	**33**	**0**	**0**	**33**	**0**	**81**	**1**	**4**	**86**	**0**	**6**	**1**	**0**	**7**	126
	1715-1730	**0**	**30**	**0**	**3**	**33**	**1**	**88**	**1**	**3**	**93**	**0**	**17**	**0**	**0**	**17**	143
	1730-1745	**1**	**21**	**0**	**3**	**25**	**2**	**96**	**0**	**3**	**101**	**0**	**9**	**0**	**0**	**9**	135
	1745-1800	**1**	**10**	**0**	**3**	**14**	**1**	**81**	**1**	**5**	**88**	**0**	**13**	**0**	**0**	**13**	115
	1800-1815	0	25	0	1	26	2	75	0	3	80	0	12	0	0	12	118
	1815-1830	0	12	0	2	14	1	86	1	1	89	1	10	0	0	11	114

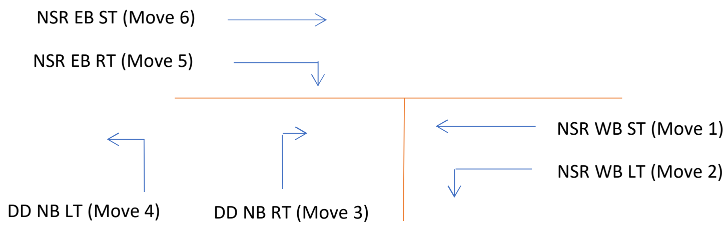
2	94	0	9	4	346	3	15	0	45	1	0		946
105				368				46					
2%	90%	0%	9%	1%	94%	1%	4%	0%	98%	2%	0%		

MOVEMENT		MOVEMENT 9 SEYMOUR ROAD SOUTHBOUND RIGHT TURN					MOVEMENT 10 SEYMOUR ROAD SOUTHBOUND LEFT TURN					
	TIME	BICYCLE MOTORCYCLE	CAR PICKUP SUV	BUSES (PUBLIC & PRIVATE)	TRUCKS		BICYCLE MOTORCYCLE	CAR PICKUP SUV	BUSES (PUBLIC & PRIVATE)	TRUCKS		
NORTH SOUND ROAD - SEYMOUR ROAD JUNCTION MORNING PEAK	1630-1645	0	15	0	1	16	0	5	0	2	7	23
	1645-1700	0	16	1	1	18	0	9	0	2	11	29
	1700-1715	**3**	**24**	**0**	**1**	**28**	**0**	**15**	**0**	**2**	**17**	45
	1715-1730	**3**	**34**	**0**	**0**	**37**	**0**	**33**	**0**	**0**	**33**	70
	1730-1745	**1**	**39**	**0**	**0**	**40**	**0**	**21**	**0**	**2**	**23**	63
	1745-1800	**0**	**18**	**0**	**2**	**20**	**1**	**18**	**0**	**0**	**19**	39
	1800-1815	0	20	0	0	20	0	14	0	1	15	35
	1815-1830	2	28	0	0	30	0	18	1	0	19	49

7	115	0	3	1	87	0	4		353
125				92					
6%	92%	0%	2%	1%	95%	0%	4%		

REGEN TIA TRAFFIC COUNT

DATE: WEDNESDAY 15-MAR-23



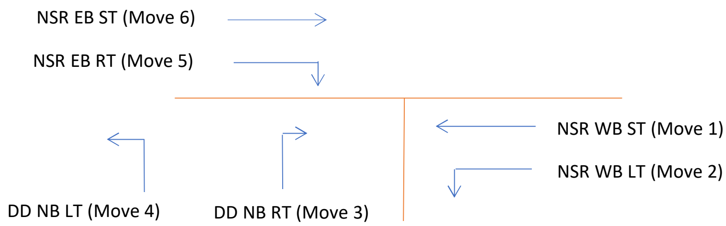
MOVEMENT		MOVEMENT 1 NORTH SOUND ROAD WESTBOUND STRAIGHT					MOVEMENT 2 NORTH SOUND ROAD WESTBOUND LEFT TURN					
	TIME	BICYCLE MOTORCYCLE	CAR PICKUP SUV	BUSES (PUBLIC & PRIVATE)	TRUCKS		BICYCLE MOTORCYCLE	CAR PICKUP SUV	BUSES (PUBLIC & PRIVATE)	TRUCKS		
NORTH SOUND ROAD - DORCY DRIVE JUNCTION MORNING PEAK	0700-0715	0	40	1	3	44	0	14	0	3	17	61
	0715-0730	0	45	0	7	52	0	27	0	6	33	85
	0730-0745	0	60	0	1	61	0	31	0	9	40	101
	0745-0800	0	61	1	0	62	1	24	0	5	30	92
	0800-0815	3	73	3	3	82	1	29	2	5	37	119
	0815-0830	0	75	1	7	83	0	43	1	5	49	132
		3	239	4	11		2	111	2	25		590
		257					140					
		1%	93%	2%	4%		1%	79%	1%	18%		

MOVEMENT		MOVEMENT 3 DORCY DRIVE NORTHBOUND RIGHT TURN					MOVEMENT 4 DORCY DRIVE NORTHBOUND LEFT TURN					
	TIME	BICYCLE MOTORCYCLE	CAR PICKUP SUV	BUSES (PUBLIC & PRIVATE)	TRUCKS		BICYCLE MOTORCYCLE	CAR PICKUP SUV	BUSES (PUBLIC & PRIVATE)	TRUCKS		
NORTH SOUND ROAD - DORCY DRIVE JUNCTION MORNING PEAK	0700-0715	0	37	0	0	37	0	40	0	2	42	79
	0715-0730	0	47	0	0	47	0	54	0	6	60	107
	0730-0745	0	30	0	0	30	0	35	1	2	38	68
	0745-0800	1	30	0	2	33	1	35	0	3	39	72
	0800-0815	0	19	0	0	19	0	41	0	5	46	65
	0815-0830	0	22	0	0	22	0	34	0	1	35	57
		1	126	0	2		1	165	1	16		448
		129					183					
		1%	98%	0%	2%		1%	90%	1%	9%		

MOVEMENT		MOVEMENT 5 NORTH SOUND ROAD EASTBOUND RIGHT TURN					MOVEMENT 6 NORTH SOUND ROAD EASTBOUND STRAIGHT					
	TIME	BICYCLE MOTORCYCLE	CAR PICKUP SUV	BUSES (PUBLIC & PRIVATE)	TRUCKS		BICYCLE MOTORCYCLE	CAR PICKUP SUV	BUSES (PUBLIC & PRIVATE)	TRUCKS		
NORTH SOUND ROAD - DORCY DRIVE JUNCTION MORNING PEAK	0700-0715	0	25	1	1	27	1	83	2	4	90	117
	0715-0730	0	39	1	4	44	5	93	0	3	101	145
	0730-0745	0	37	0	5	42	1	75	0	3	79	121
	0745-0800	1	34	0	5	40	0	76	0	0	76	116
	0800-0815	0	32	0	5	37	0	73	1	2	76	113
	0815-0830	2	37	0	2	41	0	61	2	6	69	110
		1	142	1	19		6	317	1	8		722
		163					332					
		1%	87%	1%	12%		2%	95%	0%	2%		

REGEN TIA TRAFFIC COUNT

DATE: WEDNESDAY 14-DEC-22



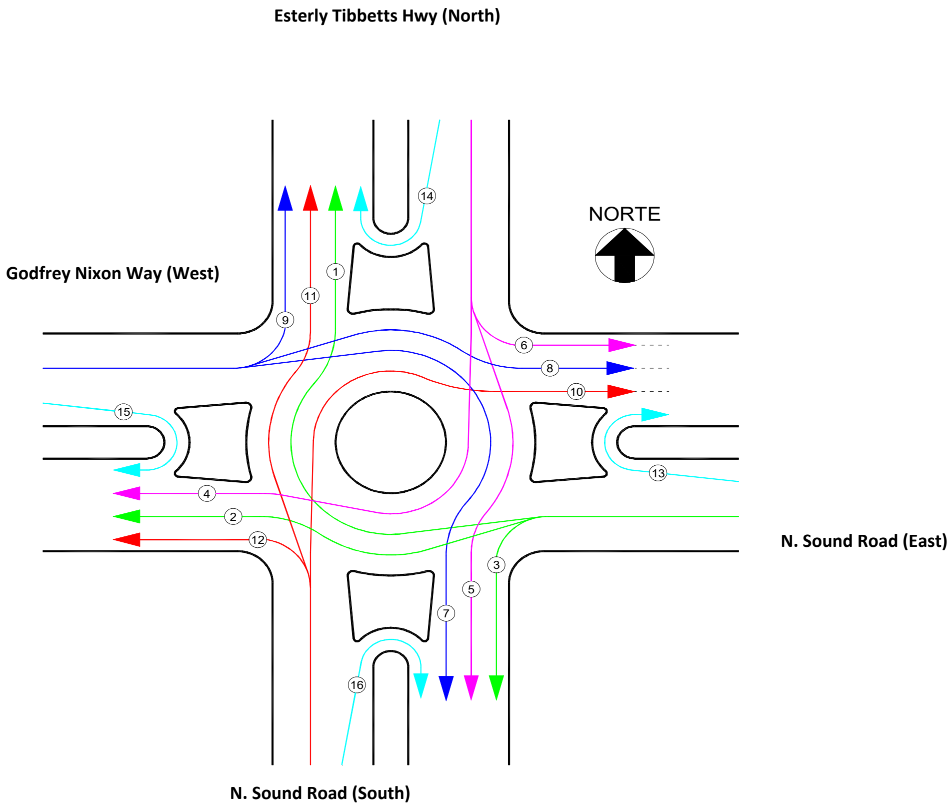
MOVEMENT		MOVEMENT 1 NORTH SOUND ROAD WESTBOUND STRAIGHT					MOVEMENT 2 NORTH SOUND ROAD WESTBOUND LEFT TURN					
NORTH SOUND ROAD - DORCY DRIVE JUNCTION EVENING PEAK	TIME	BICYCLE MOTORCYCLE	CAR PICKUP SUV	BUSES (PUBLIC & PRIVATE)	TRUCKS		BICYCLE MOTORCYCLE	CAR PICKUP SUV	BUSES (PUBLIC & PRIVATE)	TRUCKS		
	1630-1645	0	61	4	3	68	0	22	0	1	23	91
	1645-1700	5	70	1	1	77	0	35	0	0	35	112
	1700-1715	5	46	0	3	54	0	28	0	0	28	82
	1715-1730	1	41	4	1	47	1	18	0	0	19	66
		11	218	9	8		1	103	0	1		351
		246					105					
		4%	89%	4%	3%		1%	98%	0%	1%		

MOVEMENT		MOVEMENT 3 DORCY DRIVE NORTHBOUND RIGHT TURN					MOVEMENT 4 DORCY DRIVE NORTHBOUND LEFT TURN					
NORTH SOUND ROAD - DORCY DRIVE JUNCTION EVENING PEAK	TIME	BICYCLE MOTORCYCLE	CAR PICKUP SUV	BUSES (PUBLIC & PRIVATE)	TRUCKS		BICYCLE MOTORCYCLE	CAR PICKUP SUV	BUSES (PUBLIC & PRIVATE)	TRUCKS		
	1630-1645	0	3	0	1	4	1	48	2	4	55	59
	1645-1700	0	1	0	0	1	0	47	0	3	50	51
	1700-1715	0	1	0	0	1	2	33	0	0	35	36
	1715-1730	0	2	0	0	2	0	26	2	0	28	30
		0	7	0	1		3	154	4	7		176
		8					168					
		0%	3%	0%	0%		3%	147%	4%	7%		

MOVEMENT		MOVEMENT 5 NORTH SOUND ROAD EASTBOUND RIGHT TURN					MOVEMENT 6 NORTH SOUND ROAD EASTBOUND STRAIGHT					
NORTH SOUND ROAD - DORCY DRIVE JUNCTION EVENING PEAK	TIME	BICYCLE MOTORCYCLE	CAR PICKUP SUV	BUSES (PUBLIC & PRIVATE)	TRUCKS		BICYCLE MOTORCYCLE	CAR PICKUP SUV	BUSES (PUBLIC & PRIVATE)	TRUCKS		
	1630-1645	1	81	1	2	85	2	38	0	3	43	128
	1645-1700	2	86	3	3	94	1	40	3	7	51	145
	1700-1715	1	91	1	1	94	4	31	1	8	44	138
	1715-1730	1	85	1	4	91	4	36	1	1	42	133
		5	343	6	10		11	145	5	19		544
		364					180					
		2%	139%	2%	4%		10%	138%	5%	18%		

APPENDIX E

NRA Turning Movement Count Data for Bank of Butterfield roundabout



8

Intersection Street Names ETH / North Sound Rd and Godfrey Nixon Way
Date 03/09/2016

Movement	From	To
1	N. Sound Road (East)	Esterly Tibbetts Hwy (North)
2	N. Sound Road (East)	Godfrey Nixon Way (West)
3	N. Sound Road (East)	N. Sound Road (South)
4	Esterly Tibbetts Hwy (North)	Godfrey Nixon Way (West)
5	Esterly Tibbetts Hwy (North)	N. Sound Road (South)
6	Esterly Tibbetts Hwy (North)	N. Sound Road (East)
7	Godfrey Nixon Way (West)	N. Sound Road (South)
8	Godfrey Nixon Way (West)	N. Sound Road (East)
9	Godfrey Nixon Way (West)	Esterly Tibbetts Hwy (North)
10	N. Sound Road (South)	N. Sound Road (East)
11	N. Sound Road (South)	Esterly Tibbetts Hwy (North)
12	N. Sound Road (South)	Godfrey Nixon Way (West)
13	N. Sound Road (East)	N. Sound Road (East)
14	Esterly Tibbetts Hwy (North)	Esterly Tibbetts Hwy (North)
15	Godfrey Nixon Way (West)	Godfrey Nixon Way (West)
16	N. Sound Road (South)	N. Sound Road (South)

Summary

Station ID# **8**
Date **03/09/2016**

Intersection Street Names **ETH / North Sound Rd and Godfrey Nixon Way**

Hour	Mov. 1	Mov. 2	Mov. 3	Mov. 4	Mov. 5	Mov. 6	Mov. 7	Mov. 8	Mov. 9	Mov. 10	Mov. 11	Mov. 12	Mov. 13	Mov. 14	Mov. 15	Mov. 16	Total	Period Of Hour		Total
7:00	38	84	18	29	156	41	26	110	19	40	124	60	0	0	0	3	748			
7:15	72	60	20	18	171	28	15	109	19	73	157	45	0	0	1	0	788			
7:30	64	97	14	12	187	37	15	117	21	72	142	48	0	0	0	1	827			
7:45	87	68	18	30	246	29	10	122	15	76	170	71	0	1	0	4	947	7:00	8:00	3,310
8:00	66	100	10	20	242	28	24	87	15	87	168	68	0	0	0	1	916	7:15	8:15	3,478
8:15	75	100	6	31	243	31	31	114	14	117	132	65	0	1	0	3	963	7:30	8:30	3,653
8:30	92	68	27	33	210	39	35	104	12	141	120	65	1	0	0	2	949	7:45	8:45	3,775
8:45	89	71	25	23	210	30	28	120	6	160	123	64	1	0	0	2	952	8:00	9:00	3,780
11:00	110	28	36	26	138	39	28	73	15	42	87	83	4	0	1	1	711			
11:15	67	51	45	16	146	39	20	57	16	39	112	94	0	1	1	4	708			
11:30	74	67	44	41	147	46	26	24	11	54	128	103	0	0	1	2	768			
11:45	70	76	47	24	149	45	73	37	16	83	113	85	2	0	2	2	824	11:00	12:00	3,011
12:00	83	77	35	27	152	52	51	76	17	99	119	88	2	0	1	3	882	11:15	12:15	3,182
12:15	87	69	35	21	119	44	99	41	17	118	122	77	0	1	1	2	853	11:30	12:30	3,327
12:30	77	76	34	22	172	53	87	56	18	128	116	100	2	0	0	4	945	11:45	12:45	3,504
12:45	82	70	29	33	178	35	92	75	17	143	132	93	0	0	0	0	979	12:00	13:00	3,659
15:00	81	106	32	36	213	48	27	61	18	59	130	73	1	0	2	2	889			
15:15	124	63	28	33	226	38	15	63	17	84	131	77	1	0	1	3	904			
15:30	97	47	61	24	188	40	18	42	18	77	102	84	0	3	0	1	802			
15:45	107	54	34	12	179	39	52	40	15	63	118	87	1	1	1	2	805	15:00	16:00	3,400
16:00	67	78	33	15	222	30	25	71	22	34	131	96	1	0	1	2	828	15:15	16:15	3,339
16:15	77	76	35	20	195	49	57	37	19	65	116	98	1	1	0	1	847	15:30	16:30	3,282
16:30	103	69	29	11	227	35	60	38	20	65	97	78	0	0	0	2	834	15:45	16:45	3,314
16:45	123	48	33	7	201	41	73	42	24	50	120	76	1	2	2	3	846	16:00	17:00	3,355
17:00	115	52	32	18	218	19	52	44	23	55	137	93	1	0	2	2	863	16:15	17:15	3,390
17:15	98	42	41	26	180	34	63	37	28	48	109	79	1	1	1	0	788	16:30	17:30	3,331
17:30	78	53	40	14	179	26	42	26	23	46	114	78	0	0	0	1	720	16:45	17:45	3,217
17:45	101	35	35	10	144	24	58	38	27	53	116	75	0	1	0	2	719	17:00	18:00	3,090

Peak Hour	8:00	9:00	3,780
Max 15 min	963		
PHF	0.98		

AM Peak Hour	8:00	9:00	3,780
Max 15 min	963		
PHF	0.98		

PM Peak Hour	12:00	13:00	3,659
Max 15 min	979		
PHF	0.93		

Appendix 14.A

Socio-Economic Impact Assessment

ISWMS for the Cayman Islands

Socio-Economic Impact Assessment

ReGen and Cayman Islands Government

4 August 2023

The Power of Commitment

Contents

Table index

Figure index

1. Introduction

1.1 Purpose of this report

GHD Limited was retained by ReGen and the Cayman Islands Government (CIG) as approved by the Environmental Assessment Board (EAB) to undertake a socio-economic impact assessment (SEIA) as part of the Environmental Impact Assessment (EIA) for the proposed Integrated Solid Waste Management System (ISWMS, Project). The SEIA has been prepared to address the socio-economic requirements of the ISWMS for the Cayman Islands: Environmental Impact Assessment Terms of Reference (ToR) prepared by the proponent.

In line with ToR for project, the objectives for the SEIA are to 'consider the way in which the proposed development will affect people's way of life, their community, economic activity and culture'. Specifically, the SEIA:

– Describes the existing socio-economic conditions of the study area.
– Identifies potential socio-economic benefits and adverse impacts of the development, during construction and operation, and assesses their significance.
– Outlines measures that will be undertaken by the proponent to enhance socio-economic benefits and mitigate and/or manage negative socio-economic impacts of the project.

The SEIA has been informed by the outcomes of stakeholder consultation conducted for the SEIA. It also includes consideration of the results of other technical studies prepared for the EIA, including Landscape and Visual (Chapter 10), Air Quality (Chapter 11), Noise and Vibration (Chapter 12), and Traffic and Transport (Chapter 13).

The SEIA has further been guided by the International Association for Impact Assessment's Guidance for Social Impact Assessment (Vanclay et al., 2015).

1.2 Overview of the proposed development

Each year, approximately 115,000 tons of solid waste is produced in the Cayman Islands, with the overwhelming majority of the material presently being managed by the George Town landfill (GTLF). This landfill capacity is, however, finite and in accordance with the provisions of both the National Solid Waste Management Strategy for the Cayman Islands (2016) and the National Planning Framework (draft for public consultation) (2018), the ToR has been prepared in relation to the proposed development of a replacement ISWMS for the Cayman Islands.

The proposed ISWMS site is located to the north of central George Town towards the western coast of Grand Cayman, immediately south-west of the existing GTLF. The proposed ISWMS is a multi-facility development, including an energy recovery facility (ERF) and supporting non-ERF waste processing, treatment, and disposal facilities. Construction and operation of the ISWMS would allow the existing landfills in George Town, Cayman Brac and Little Cayman to be closed and remediated.

1.2.1 Key features

The proposed ISWMS consists of various new waste management facilities, the majority of which are subject to the EIA process. The development also includes some smaller elements that would not on their own attract the need for an EIA but are still considered as part of the overall development in order to assess their 'in combination' effects with the major components of the ISWMS. In this regard, the EIA considers the cumulative effects of all aspects of the ISWMS.

The various components of ISWMS are as follows:

– Energy Recovery Facility (ERF) (subject to EIA)
– Non-Energy Recovery Facilities:
    - Site weighbridges (excluded from the EIA)

- Green Waste Processing Facility (subject to EIA)
- Construction and Demolition Waste Processing Facility (subject to EIA)
- Bottom Ash Processing Facility (subject to EIA)
- Abandoned and End of Life / Scrap Metal Processing Facility (subject to EIA)
- Medical Waste Facility (subject to EIA)
- Materials Recycling Facility (excluded from the EIA)
- Household Waste Recycling Centre (excluded from the EIA)
- Landfill Gas Facility (subject to EIA)
- Residual Waste Landfill (RWL) (subject to EIA)

– Ancillary Facilities:
  - Admin Building (excluded from the EIA)
  - Maintenance Building (excluded from the EIA)
  - CUC Substation (excluded from the EIA)

An overview of the location of the ISWMS and its components is shown on Figure 1.1.

A complete description of each of the project elements described above is provided in Chapter 4 (Proposed Project and Overview of Concerns and Constraints) of the EIA.

1.2.2 Workforce

A construction workforce of approximately 300 persons will be required to complete the ISWMS development, over the three-year construction period.

The project is anticipated to result in the creation of approximately 70 full-time positions during operation.

1.2.3 Timeframes

Construction for the proposed ISWMS development would commence in 2024, with completion planned in 2027.

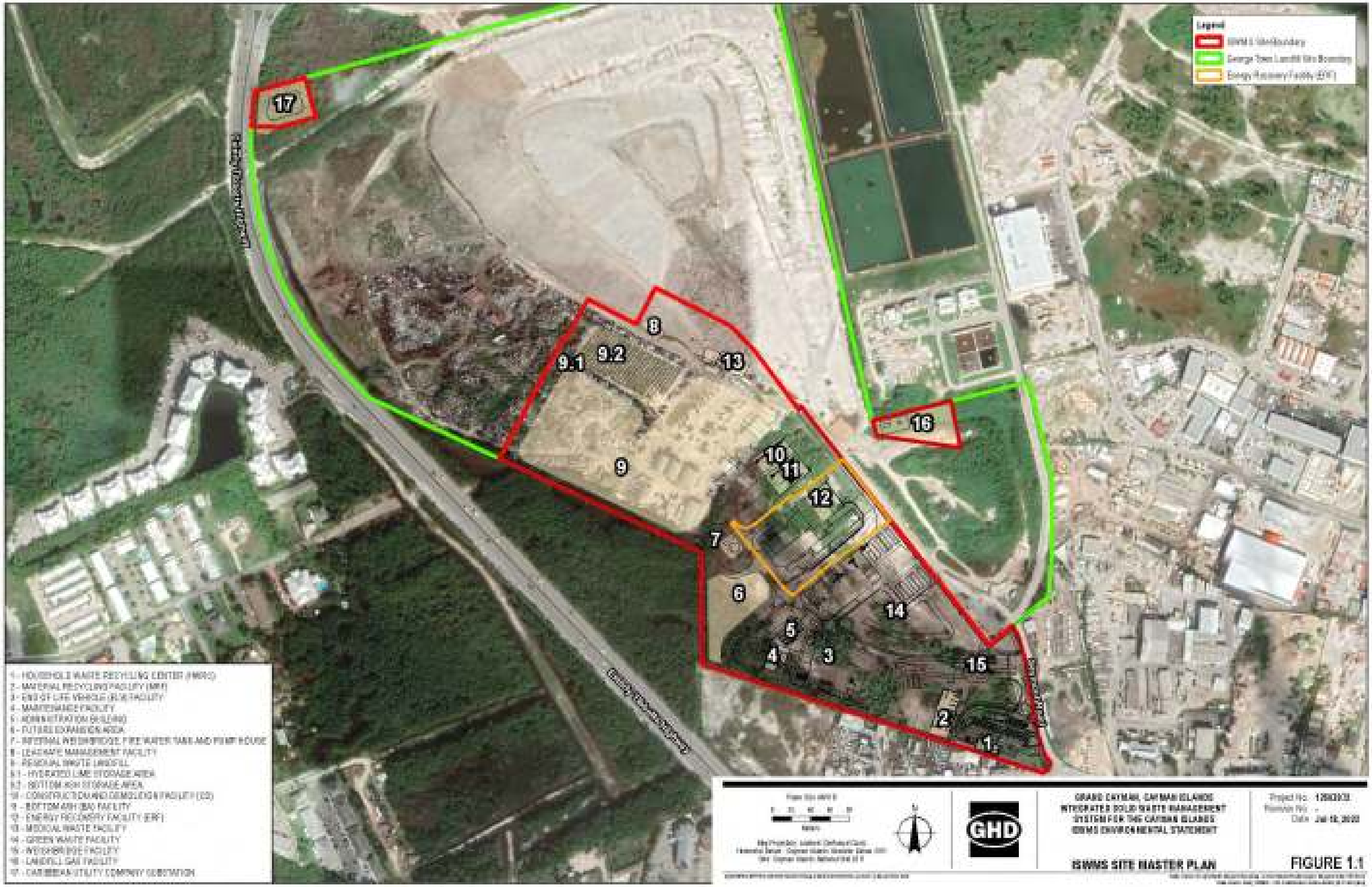


Figure 1.1 ISWMS project site plan

1.3 Structure of report

The structure of this SIA is outlined below.

– Section 1 – introduces the report and includes a brief description of the project.
– Section 2 – outlines the relevant legislation and policy applicable to this assessment.
– Section 3 – describes the methodology for the assessment.
– Section 4 – describes the SIA-specific consultation (including outcomes) undertaken for the project.
– Section 5 – describes the existing socio-economic environment for the project.
– Section 6 – identifies the potential social impacts arising from the construction of the project.
– Section 7 – identifies the potential social impacts arising from the operation of the project.
– Section 8 – provides recommended impact management and mitigation measures.
– Section 0 – provides a conclusion for the report.
– Section 10 – provides a list of references used in the report.

1.4 Scope and limitations

This report: has been prepared by GHD for ReGen and Cayman Islands Government and may only be used and relied on by ReGen and Cayman Islands Government for the purpose agreed between GHD and ReGen and Cayman Islands Government as set out in section 1.1 of this report.

GHD otherwise disclaims responsibility to any person other than ReGen and Cayman Islands Government arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section(s) 1.5 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

1.5 Limitations

The methodology includes the following limitations:

– there is no national guidance on the assessment of socio-economic impacts for the Cayman Islands, however, international best practice guidelines have been adopted as outlined in Section 3.
– the assessment is based on the information provided to GHD at the time of undertaking the SEIA.
– economic data required to undertake the economic impact assessment was not available at the time of preparing this SEIA and therefore, economic impacts have been assessed qualitatively based on desktop information, the project description and through findings from consultation.

2. Applicable legislation, policies and guidelines

Table 2.1 summarises legislation, policies and guidelines relevant to this assessment.

Table 2.1 Applicable legislation, policies and guidelines

Policy name	Relevance to project
Labour Law (2011 Revision)	The Labour Law (2011 Revision) applies to any employee and/or employer in the Cayman Islands. The Labour Law provides a system of regulations including employment contract, types of leave, minimum wage, severance pay and termination. The project is required to meet the obligations under the Labour Law (2011 Revision), through the employment of the construction and operational workforce.
Workmen's Compensation Law (1996 Revision)	The Workmen's Compensation Law (1996 Revision) provides workers' compensation which is payable to a worker who suffers an injury, disease or death arising from, or during, employment. The project is required to meet the obligations under the Workmen's Compensation Law (1996 Revision), through the employment of the construction and operational workforce.
Tourism Law (1995 Revision)	The Tourism Law (1995 Revision) applies to the Department of Tourism and tourism-related boards and councils, operators licensing and more. This SEIA considers impacts of the project, both beneficial and adverse to the tourism industry of the Cayman Islands.
Cayman Islands Climate Change Policy 2011	The Cayman Islands' Climate Change Policy outlines consensus-based interventions to be implemented. Additionally, the Policy contains measures required to curb greenhouse gas emissions from activities that contribute to the problem of continued climate change. The Policy identifies policy goals and objectives. Under Critical Infrastructure one of the legislative actions to be implemented is to "Climate proof" existing and future waste management sites and designate temporary waste collection sites for storage of hurricane debris/waste. Another key policy goals is to Reduce Greenhouse Gas Emissions, in line with agreed national targets, through promoting energy conservation, reducing energy use and encouraging greater use of renewable energy. This project is proposing to remediate and replace the existing landfill site with an integrated waste management facility as well as provide recycling opportunities for domestic and other waste. This is in line with the aforementioned goals and objectives.
National Tourism Plan 2019-2023	The National Tourism Plan (NTP) provides a road map for enhancing the competitiveness of the Cayman Islands tourism industry and ensuring the sustainability of the islands' cultural and natural assets. The intent of the plan is to maximise and spread the benefits of tourism development throughout the country. The Plan identifies priority issues and challenges to be addressed. Solid Waste Disposal/Recycling was raised as an important and growing issue, revolving around landfills. Several studies have been conducted and alternative approaches proposed, including relocation of the existing landfill on Grand Cayman, development of a waste-to-energy facility, and recycling programmes. There appears to be a strong desire within the industry to improve and increase recycling programmes, but these issues have yet to be resolved. This project is proposing to close the existing landfill in George Town, remediate and replace it with an integrated waste management facility. Therefore, is in line with the aforementioned aspirations.
National Energy Policy 2017-2037	The NEP seeks to establish a framework with which all stakeholders can identify, sets the stage for the achievement of the territory's energy goals and takes into account the imperative to reduce greenhouse gas emissions, thereby lowering the carbon footprint

Policy name	Relevance to project
	of the Cayman Islands. The Policy focuses on exploiting renewable energy, promotes energy efficiency and conservation measures and supports energy security by reducing the reliance on imported fossil-based fuels. Goal 1 aims to educate people on the impacts of energy demand on the environment. Strategy 3.1.2 - fuel products sector strategy: support jurisdiction-wide and industry developed public education programmes on handling, storage and disposal of waste, aims to support Goal 1. Goal 3 aims to ensure energy security for the Cayman Islands. Under this goal strategy 3.3.11.3 aims to support national waste management policies by facilitating interconnection of waste to energy generation to the grid. The ISWMS facility is proposed to include an ERF which is in line with the aforementioned goals and strategies.

3. Methodology

This section presents the methodology adopted for this SEIA. The approach was developed based on the Terms of Reference (Wood, 2021), and best practice methodologies established by relevant standards, polices and guidelines and leading research, including:

– International Principles for Social Impact Assessment 2003 (Vanclay 2003)
– Social Impact Assessment: Guidance for Assessing and Managing the Social Impacts of Projects (Vanclay et al. 2015).

SEIA is broadly defined as the process for 'identifying and managing the socio-economic issues of project development' (Vanclay et al., 2015). The goal of SEIA is ultimately to bring about better project outcomes that benefit both communities and proponent alike, not just the identification or amelioration of negative outcomes (Vanclay, 2003).

In line with this understanding, the assessment process comprised of three phases as shown on Figure 3.1. These steps are explained in further detail below.

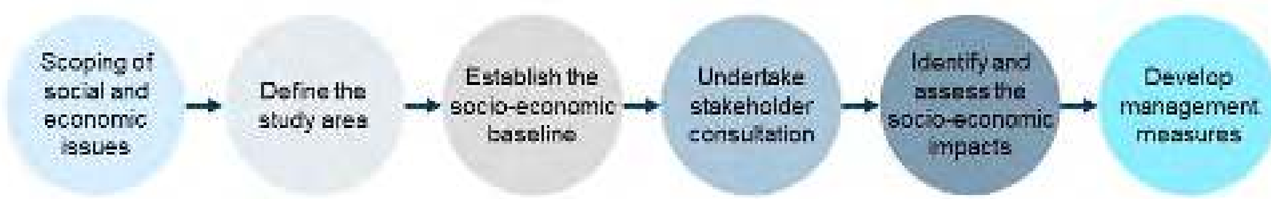


Figure 3.1 Overview of SEIA methodology

3.1 Scoping

The scoping phase involved preliminary planning of the SEIA. This included initial desktop research and consultation with the internal EIA project team to understand the local context, discuss and agree on the SEIA scope, and identify project affected stakeholders.

A key outcome of this phase included agreement on the elements of the socio-economic environment for investigation that may be directly or indirectly changed by the project. These indicators are outlined and defined in Table 3.1 below. These indicators have been adapted from a review of social changes commonly associated with major infrastructure development, in particular waste facilities (Franks, 2012). The structure of the SEIA (i.e., the baseline and impact assessment) reflect these aspects in the sections which follow.

Table 3.1 Elements of SEIA investigation

Element	Definition and scope
Population	The characteristics, mobility and rate of change of populations, including diversity, community composition and rates of influx.
Employment and economy	The availability and accessibility of employment and business development opportunities, and the existence and role of particular industries.
Health and community wellbeing	The ability of people to maintain their health and a lifestyle that is not detrimental to their wellbeing. Also includes the overall wellbeing of a community, including its cohesion and safety, how it functions and people's sense of place.

Element	Definition and scope
Services and infrastructure	The quality, availability and accessibility of social services and infrastructure. This may include (but not limited to) health and emergency services, aged and childcare, utilities, roads network and infrastructure, public transport, housing and accommodation, recreational facilities.
Access and connectivity	The ability of people to maintain access to public spaces or private property and/or their ability to conveniently get from one place to another.

3.2 Study area

The study area is the geographical area of social influence of the project. For the purpose of this study, the study area includes the people and communities who are likely to experience changes to existing socio-economic conditions resulting from the Project.

Table 3.2 presents the study area for the SEIA.

Table 3.2 Description of the study area

Study area	Statistical area	Relevance to Project
Project footprint	N/A	This what is at the site and landholdings in the Project's immediate surroundings.
Local study area	District of George Town	This includes the community of George Town, which is the municipal area containing the Project infrastructure and is likely to be the main source of workers, goods or services for the Project. People in the broader city of George Town are also expected to have a variety of interests and concerns with the Projects.
Regional study area	Cayman Islands	This includes the Cayman Islands as a whole, which is likely to be the focus where economic changes will be most noticeable.

3.3 Establishing the socio-economic baseline

A baseline of the existing social and economic conditions was established for the local study area and regional study area.

This context was used as the basis for considering potential impacts of the project. Existing conditions were determined via a review of:

- Local population census data
- Government planning documents
- International financial institutions' statistics
- Non-governmental organisations (NGOs) and industry reports
- Other assessment reports prepared for projects in proximity to the study area
- GIS mapping
- Information gathered through consultation with stakeholders (Section 4)

All data in Section 5 has been drawn from the Cayman Islands' 2021 Census of Population and Housing Report published in July 2022 and prepared by the Economic and Statistics Office (ESO), unless otherwise stated.

Where required information is not available in the 2021 Census, the baseline assessment has been supplemented by other available reports, including The Cayman Islands' Compendium of Statistics 2020 (ESO, 2021) and The Cayman Islands' Labour Force Survey Report Fall 2022 prepared by the ESO.

The existing conditions describe the social values, economic characteristics and social infrastructure and services that are likely to be affected by the project.

3.4 Consultation

3.4.1 SEIA consultation

Stakeholder consultation is a critical component of the SEIA process. Internal and external stakeholder consultation was undertaken to inform the SEIA. Prior to consultation being undertaken, a Stakeholder Consultation Plan for approval by ReGen and the Environmental Assessment Board (EAB) was prepared to identify key stakeholders, detail the approach to consultation and identify themes to be discussed during consultation.

SEIA consultation was undertaken between May and June 2023 by the SEIA team via videoconference facilities. Section 4 presents a summary of the consultation activities and outcomes relevant to this assessment.

The overall purpose of the SEIA consultation was to validate and gather additional information to inform the development of the socio-economic baseline, the identification of potential social and economic benefits and impacts, and development of recommended mitigation and management measures. The stakeholders consulted for the SEIA (Table 3.3) were identified because they would have the potential to experience positive or negative social and economic impacts as a result of the project, or because they represent communities and stakeholders who would potentially experience impacts.

Table 3.3 Stakeholders

Stakeholder group	Stakeholders consulted
Government	– Department of Environment (DOE) – Ministry of Sustainability and Climate Resiliency – Ministry of Tourism and Ports – Ministry of health and Wellness
Business / industry organisations	– Cayman Islands Tourism Association (CITA) – Cayman Islands Chamber of Commerce – Island Waste Carriers
Community service providers	– George Town Police Station – Cayman Islands Fire Service
Non-government organisations	– Sustainable Cayman

3.5 Description and assessment of impacts

Following the scoping of socio-economic issues described in Section 3.1, impacts were confirmed using a data triangulation method, whereby multiple sources of information were used to confirm socio-economic impacts. These data sources are summarised below:

- The project description for the EIA to understand the proposed activities that would influence social aspects.
- Baseline conditions against which the social changes/impacts were measured.
- Outcomes of the stakeholder consultation undertaken for the SEIA and the project as a whole to understand the existing environment and stakeholder views on potential social changes brought about by the project.
- Relevant draft and final technical studies prepared for the EIS to gather technically sound evidence to identify and assess the social changes resulting from the project:
  - Air Quality Assessment (Chapter 11)
  - Noise and Vibration Assessment (Chapter 12)
  - The Seascape and Landscape Visual Considerations Report (Chapter 10)
  - Traffic Statement (Chapter 13)

The evaluation of the identified social impacts was undertaken using a sensitivity and magnitude significance rating, based on the significance criteria provided in the Terms of Reference and shown in Section 3.5.2.

3.5.1 Characterise the socio-economic impact

In order to place potential socio-economic impacts in context, the nature (beneficial or adverse), the temporal extent (short or long term) and their spatial context (local or national) were considered in accordance with Section 5.9.19 of the Terms of Reference.

The criteria used in considering the nature and type of impact are defined below:

3.5.1.1 Nature

– Beneficial: an impact is considered beneficial if a change represents an improvement from the socio-economic baseline, or if a new and desirable factor is introduced to the socio-economic environment.
– Adverse: an impact is considered adverse if there is a negative change to the socio-economic baseline, or if a new undesirable factor is introduced to the socio-economic environment.

3.5.1.2 Temporal extent

The temporal extent of an impact refers to the time in which the change will take place, and includes:

– Short term: an impact is considered short term if it involves a temporary socio-economic change (e.g., during construction or up to 3 years).
– Long term: an impact is considered long term if it involves a socio-economic change which is permanent or will be experienced over an extended period (e.g., over 5 years).

3.5.1.3 Spatial context

The spatial extent of an impact refers to the geographical rage in which something extent over which a change extends, and includes:

– Local: an impact is considered to have local spatial context if it involves a socio-economic change which will have an adverse or beneficial impact on the immediate surrounds and George Town.
– National: an impact is considered to have national spatial context if it involves a socio-economic change which will have an adverse or beneficial impact on the Cayman Islands.

3.5.2 Assess the significance

Potential social impacts were organised according to the socio-economic elements described in Section 3.5. An assessment of the identified socio-economic impacts was then undertaken to determine their likely level of 'significance' in accordance with Section 4 of the Terms of Reference. Significance was determined by considering the sensitivity of socio-economic receptors (individuals or social or economic groups), (Table 3.4), and the anticipated (most likely) magnitude of the impact if it were to occur (Table 3.5). The overall level of significance was determined by combining the sensitivity and magnitude criteria as shown in Table 3.6.

Table 3.4 Description of sensitivity

Sensitivity level	Description
Very low	Where the social area of influence is economically diverse and socio-economic indicators demonstrate an ability for the area to recover easily from the impact and natural, cultural and social functions are minimally affected.
Low	The socio-economic environment has minimal areas and levels of vulnerability and a high ability to absorb or adapt to change.

Sensitivity level	Description
Medium	The socio-economic environment has some vulnerabilities but retains some ability to absorb or adapt to change.
High	The socio-economic environment exhibits a number of vulnerabilities and/or little capacity to absorb or adapt to change.
Very high	The socio-economic environment exhibits multiple vulnerabilities, will be irreversibly changed, and it will have a significant impact on natural, cultural and social functions of the community, leading to a compromise to the way of life.

Table 3.5 Description of magnitude level

Magnitude level	Description
Very low	No discernible positive or negative changes caused by the impact. Change from the baseline remains within the range commonly experienced by receptors.
Low	Minor changes to the social environment, which are easily reversible over time; localised impact among a small group of impacted stakeholders.
Medium	Noticeable deterioration/improvement to something that people value highly, either lasting for an extensive time, or affecting a group of people.
High	Substantial deterioration/improvement to something that people value highly, either lasting for an indefinite time, or affecting many people in a widespread area.
Very high	There is irreplaceable impact to a highly valued community, social, infrastructure area or item of international significance and would lead to loss of license to operate.

Table 3.6 Significance rating

		Magnitude of Change				
		Very High	**High**	**Medium**	**Low**	**Very Low**
Sensitivity	**Very High**	Major (Significant)	Major (Significant)	Major (Significant)	Major (Significant)	Moderate (Possibly significant)
	High	Major (Significant)	Major (Significant)	Major (Significant)	Moderate (Possibly significant)	Minor (Not significant)
	Medium	Major (Significant)	Major (Significant)	Moderate (Possibly significant)	Minor (Not significant)	Negligible (Not significant)
	Low	Major (Significant)	Moderate (Possibly significant)	Minor (Not significant)	Negligible (Not significant)	Negligible (Not significant)
	Very Low	Moderate (Possibly significant)	Minor (Not significant)	Negligible (Not significant)	Negligible (Not significant)	Negligible (Not significant)

Source: ISWMS Terms of Reference (2021)

The risk rating then determines if mitigation or management actions are required to address the socio-economic impact, or enhance the socio-economic benefit.

This SEIA has assessed the potential socio-economic impacts and benefits that may occur as a result of construction of the project (Section 6) and operation of the project (Section 7).

3.6 Development of management measures

Following the identification of impacts, measures were developed to enhance the positive impacts of the Project and to avoid, mitigate or manage negative impacts (collectively referred to as 'management measures'). Management measures were developed based on the findings of:

– Stakeholder consultation
– The assessment of potential social impacts
– The knowledge of the SIA study team in developing and implementing management frameworks

Impact management measures are identified in Section 8 of this SIA.

4. Stakeholder consultation

This section presents a summary of key themes and issues relevant to this SEIA raised by stakeholders and community members during SEIA consultation. Chapter 5 of the EIA details the broader EIA engagement activities undertaken for the project.

4.1 SEIA consultation

Table 4.1 provides a summary of key themes and issues raised by stakeholders during SEIA consultation.

Table 4.1 Summary of key themes and issues

Topic	Description
Amenity impacts	– There are concerns about the potential amenity impacts including air quality and pollution, noise, and traffic and access from the new facility. – Some stakeholders raised concerns around the frequency of fires at the existing landfill and the associated decreased air quality particularly for those who live and work around the existing site. – Most stakeholders were supportive of the potential overall visual improvements of the project at the existing landfill site especially with regards to improved visual amenity for tourism. – General comments about the poor road infrastructure near the existing landfill site and impacts construction activities will have on the road quality. – Some stakeholders reported that odour is a current problem at the existing landfill site.
Environmental impacts	– There was overall support for better environmental outcomes from the closure of the existing facility and the capacity of the new facility. – There was interest among stakeholders in the new facility potentially providing power to the existing grid and consequently overall lower energy costs for local Caymanians. – Some stakeholders raised concerns around potential run-off pollutants ending up in the nearby bay and ocean which could impact marine wildlife and overall health of the marine ecosystem. – Additional waste generated after hurricanes and other bad weather is a key issue facing the islands. Some stakeholders questioned if the new facility will have the ability to accommodation this additional waste.
Hazards and safety	– There was interest from stakeholders around the new facility's ability to deal with chemical, hazardous, and biological waste. – Some stakeholders raised safety concerns of the existing landfill and were interested in the safety measures, management and mitigation methods for the new facility. – Existing health and safety legislation is currently lacking and is not enforced on the Islands.
Health and wellbeing	– Most stakeholders were interested in the health and wellbeing benefits and overall improvements to local residents from reduced air pollution and visual impacts.
Economic and businesses	– The nature-based tourism industry is an important part of the Cayman Islands which has increased in popularity over the last decade. – Some stakeholders raised queries as to who will operate the facilities once up and running.
Workforce and labour force	– There was keen interest in procurement and other business opportunities for local people, businesses and industries. – Rising cost of living expenses was a key barrier effecting the attraction and retention of new workers from overseas. – 'Green jobs' was raised as a potential employment opportunity to future proof the workforce and skills availability in the Cayman Islands. – Across the Cayman Islands there is a strong dependency on the financial and insurance service industry and tourism industry which both contribute significantly to the economy.

Topic	Description
	– Some stakeholders raised concerns about the lack of local labour force availability and increases in the foreign labour force which makes up a large portion of the tourism, financial services and construction industries. – There was interest among stakeholders about the potential long term employment opportunities during the operation of the new facility.
Skills and education development	– Some stakeholders indicated that there is a lack of local skills available particularly in the highly specialist/ technical fields or niche skills. – There was interest from stakeholders in potential skills development and local education and training opportunities for local Caymanians to either upskill or train in a new field to support the delivery of the new facility. – Some stakeholders mentioned opportunities to increase education and knowledge around litter and waste management practices across the Cayman Islands.
Housing and accommodation	– Housing availability and affordability is a key challenge across the Cayman Islands. Some stakeholders raised concerns around potential housing challenges and shortages from the arrival of overseas skilled migration.
Community	– There are a number of vulnerable people and people of lower socio-economic status who live around the existing landfill site. – Rapid population increase and overcrowding has put a strain on the existing infrastructure on the Islands including the existing landfill services and capacity and overall waste management. – Some stakeholders mentioned there exists scepticism from local community members around the existing recycling options available and where that recycled material gets used/ sent to after recycling. – The local community value, and take pride in, the natural environment.
Other	– There is a current shortfall in other waste management services available including haulage services, curb side pick up and recycling. – Some stakeholders raised questions about resource recovery store available at the landfill for items that can be reused or resold. Also noting that it would be good to have more of these available in each community to support the reuse of items. – There is current work being undertaken by the Government to ban single use plastics on the Islands.

5. Baseline conditions

The section establishes the socio-economic context for the SEIA study areas, against which potential impacts of the proposed ISWMS development can be identified and measured.

5.1 Project footprint and immediate surrounds

The existing George Town Land Fill (GTFL) site, also known locally as 'Mount Trashmore', is currently one of the most pressing environmental issues for the Island. The GTLF can be seen by local and visitors from across the island as well as offshore. Part of the existing landfill is currently undergoing capping and remediation.

As described in Chapter 3, the proposed ISWMS development encompasses 11.9 acres (4.8 hectares (ha)) of the existing GTLF site for the development of a new Residual Waste Landfill and Landfill Gas Facility, together with a 16.8 acres (6.8 ha) parcel of undeveloped land immediately south-west of this for the remainder of the ISWMS facilities.

The undeveloped parcel of the ISWMS Site is zoned Heavy Industrial (HI). This designation includes all of the activities proposed at the ISWMS Site: power generation, solid waste disposal and recycling. The proposed ISWMS activities are consistent with existing zoning designations and activities on the lands surrounding the proposed ISWMS development. The site is accessed via Seymour Drive.

The land usage surrounding the ISWMS site is summarised in Table 5.1 below.

Table 5.1 Description of land uses surrounding the ISWMS site

Direction	Land use description
North	The existing GTLF lies immediately north and east of the proposed ISWMS Site. North of the GTLF is a tidal drainage channel managed by Mosquito Research & Control Unit (MRCU) for mosquito control that connects with North Sound about 0.7 miles (1.23 kilometres (km)) to the east. The area immediately north of the drainage channel is the alignment of the under-construction Airport Connector Road (ACR) and further north lies a swathe of disturbed mangrove area. The under-construction Health City Hospital, Cayman International School and Camana Bay development are located within 0.5 mile (0.8 km) to the north of GTLF. The Cayman International School (CIS) is a private, college preparatory, co-educational school for students from two years old through to Grade 12. It provides American/International educational services for the dependents of the multi-national professionals living in Cayman. In 2021, there were 955 students enrolled at CIS[1]. The Camana Bay development is a mixed-use master-planned community consisting of a town centre with retail and commercial office space, a marina village and a collection of residential neighbourhoods.
East	The land east of the GTLF is owned by Cayman Water Authority and comprises four large former wastewater treatment lagoons that are used for sludge storage. South of the lagoons is the current wastewater treatment plant including some buildings and four smaller basins. Approximately 524 ft to 1049 ft (160 m to 320 m) east of the landfill site is land zoned for industrial use. This is mainly undeveloped or used for open storage. The Department of Environmental Health (DEH) collections depot (comprising several trailers for staff facilities and parking for staff and collection vehicles) is located on approximately one acre of land to the east of the wastewater treatment lagoons.
South	The southern boundary of the proposed ISWMS site is currently an area covered by mangroves, beyond which is industrial and commercial development. This land is occupied by a variety of businesses, including a concrete batching plant and a concrete block and paver stone manufacturer.
West	The Esterly Tibbetts Highway (the main arterial road to West Bay) lies immediately adjacent to the fence line forming the western boundary of the proposed ISWMS site.

1 Teacher Horizons, Cayman International School, 2023

Direction	Land use description
	The Lakeside residential development is located west of this Highway. This development comprises 12 three-storey residential apartments with car parking and leisure/landscape areas (including a small lake). The North Mound of the GTLF is visible from the easternmost lakeside buildings

5.2 Local and regional study area

5.2.1 Overview of the study area

The Cayman Islands are a British Overseas Territory located in the Caribbean Sea, approximately 257 kilometres (km) south of Cuba and 269 km north-west of Jamaica. The Cayman Islands is comprised of three islands: Grand Cayman, Cayman Brac and Little Cayman. In total, they encompass 263 square kilometres (km^2).

The project site is situated in the nation's capital of George Town, located on the western shore of Grand Cayman. The city covers approximately 29 km^2 and is one of six districts of the Cayman Islands.

Caymans natural resource base, including beaches, coral reefs and other marine resources is a main draw for the tourism industry, a second vital pillar of the nation's economy (CIG, 2019).

George Town is the economic, commercial, and governmental centre of the islands. It is the site of several of Grand Cayman's main tourism attractions, including Seven Mile Beach Popular and Stingray City, and hosts the majority of the Islands' hotels, resorts, and restaurants.

5.2.2 Demographic profile

5.2.2.1 Population

In 2021, George Town had a population of 34,921 persons, representing 49.1 percent of the Cayman Islands total population (Table 5.2). Between 2010 and 2020, the population of George Town increased by 24.3 percent at an average annual growth rate of 2.2 percent. This was slower than the annual growth rate recorded between the period between 1999 and 2010 (3.3 percent).

The overall population of the Cayman Islands was estimated at 71,105 persons in 2021. The population of the country increased by 29.2 percent between 2010 and 2021, however, decreasing from the 41.0 percent that was recorded between 1999 and 2010.

The population of the Cayman Islands was comprised of residents from 162 countries. The top countries of birth outside of the Cayman Islands were Jamacia (24.8 percent), Philippines (5.5 percent), UK (5.3 percent) and the USA (5.2 percent).

Table 5.2 Estimated population of local and regional study areas (1999, 2010, 2021)

Study area	1999	2010	2021	Percentage (percent) change		Annual percent change	
				’99 – ‘10	’10 – ‘21	’99 – ‘10	’10 – ‘20
George Town	20,626	28,089	34,921	36.2 percent	24.3 percent	3.3 percent	2.2 percent
Cayman Islands	39,020	55,036	71,105	41.0 percent	29.2 percent	3.7 percent	2.7 percent

Source: ESO, 2022

5.2.2.2 Age and sex profile

Previous census data indicated the median age of the Cayman Islands' population increased from 32.8 years in 1999 to 35 years in 2010 (ESO, 2011; p.19). The populations median age at the time of the 2021 census was 38 years for both males and females (ESO, 2022; p. 11).

Data from for the 2021 census (Table 5.3) shows there are proportionally more men than women in George Town at 51.7 percent and 48.2 percent, respectively. This ratio is similar at the national level with men comprising 50.6 percent and women comprising 49.3 percent of the total population.

Table 5.3 Sex profile of local and regional study areas (2021)

Area	Male	Female
Cayman Islands	50.6 percent	49.3 percent
George Town	51.7 percent	48.2 percent

Source: ESO, 2022

The Cayman Islands is characterised by an ageing population with an estimated 7.9 percent of the population aged 65 years and over at the 2021 census, compared to only 5.1 percent in 2010 (Table 5.4). This is consistent with the increasing age dependency ratio in the Cayman Islands, which was reported at 33.8 percent in 2020 compared to 30.8 percent in 2010 (ESO, 2021).

In contrast, the proportion of youth (0 to 14 years) decreased slightly from 18.1 percent in 2010 to 15.9 percent in 2021. The majority of the Cayman Islands population are persons in working age groups (75.5 percent), between the ages of 15 and 64 years.

Table 5.4 Population by age group, Cayman Islands (2010 and 2020)

Age group	2010		2021	
	Total	percent	Total	percent
0 -14 years	9,968	18.1 percent	11,315	15.9 percent
15 - 29 years	10,747	19.5 percent	12,251	17.2 percent
30 - 49 years	23,167	42.1 percent	27,291	38.4 percent
50 - 64 years	8,168	14.8 percent	14,130	19.9 percent
65 + years	2,832	5.1 percent	5,602	7.9 percent
Not stated	153	0.3 percent	515	0.7 percent

Source: ESO, 2022

5.2.2.3 Households

In 2021, there were a total of 29,699 households in the Cayman Islands. The 2021 census data shows that 6,939 households were added between 2010 and 2021, representing a 30.5 percent increase over that time (ESO, 2022; p. 50).

The average household size declined marginally to 2.39 persons per household in 2021. Except for George Town, which remained constant over the census period, all districts recorded marginal reductions. George Town accounts for 51.6 percent of households in the Cayman Islands (15,331 households). The average household size in George Town is 2.3, which is slightly lower than the national average of 2.4 persons per household.

5.2.2.4 Cultural diversity

In 2021, 88.8 percent of the total population (Caymanians and non-Caymanians) spoke English as the main language at home (or 95.5 percent for Caymanian and 81.0 percent for non-Caymanian). For non-Caymanians, Filipino was the next most spoken language at home (8.0 percent) while for Caymanians, Spanish was the next most spoken language at home (3.2 percent) (ESO, 2022).

5.2.3 Employment and economy

5.2.3.1 Labour force and employment

In 2022, the Cayman Islands had a working age population of 69,383 people, with 57,582 of these within the labour force resulting in a labour force participation rate of 83.0 percent. Males (53.6 percent or 30,841 people) made up slightly more of the labour force compared to females (46.4 percent or 26,741 people). Of those employed, non-Caymanians made up 53.4 percent of the employed persons (ESO, 2023; p. 10).

There is also a strong foreign labour force within the Cayman Islands. Foreign workers have sought to take advantage of the relatively easy access to Caymanian employment market afforded by temporary work permits (Amit, 2001). As of January 2023, and estimated 34,067 people were recoded as having a work permit. Of these the top six nationalities on work permits included Jamaica (14,586 people or 42.8 percent), Philippines (5,284 people or 15.5 percent), UK (1,983 people or 5.8 percent), India (1,899 people or 5.5 percent), Honduras (1,234 people or 3.6 percent), and Canada (1,218 people or 3.6 percent) (Department of Workforce Opportunities & Residency Cayman, 2023).

The *Review of Employment Policy and Strategy in the Cayman Islands* (Cayman Islands Government, 2015) highlighted that the Caymanian population is unable to meet the existing labour demand, and it is not expected to meet this demand in the foreseeable future due to anticipated growth of the local population in relation to the anticipated growth of the local economy. During consultation, stakeholders confirmed this trend, noting that there is often not enough local labour to meet the demand of certain industries, with foreign labour comprising a large proportion of the of the tourism, financial services and construction industries.

5.2.3.2 Unemployment and underemployment

Of the labour force, there were 1,227 people unemployed within the Cayman Islands in 2022, resulting in an unemployment rate of 2.1 percent. The unemployed labour force mainly consisted of persons aged 25 to 34 years (421 persons), accounting for 34.3 percent of the total unemployed.

'Underemployment' is defined as 'Involuntary part-time' work, where workers who could (and would like to) be working for a full work week can find only part-time work. The underemployed accounted for 5.1 percent (4.9 percent male and 5.3 percent female) of the employed in 2022. Caymanians and Permanent Residents had above-average underemployment rates of 6.4 percent and 6.6 percent respectively, while non-Caymanians had a lower rate of 4.0 percent.

The *Review of Employment Policy and Strategy in the Cayman Islands* (Cayman Islands Government, 2015), highlights a number of barriers to employment amongst the local Caymanian population, including a lack of training and development, a lack of internet and transportation and poor housing.

5.2.3.3 Key sectors of employment

Within the Cayman Islands the top six industries accounted for 59.4 percent of the employed labour force. The largest employing industries in 2022 were construction (15.7 percent); wholesale and retail trade (12.8 percent); professional, scientific, and technical activities (9.2 percent); administrative and support service activities (7.3 percent); activities of households as employers (7.3 percent) and financial and insurance activities (7.1 percent) (ESO, 2023; p. 20).

Financial services

The financial services industry within the Cayman Islands employed 3,654 people during 2021, accounting for 8.2 percent of total employment within the country. In 2021, this industry was the fourth largest employer in the Cayman Islands. The financial services industry contributed $1,486 million worth of GDP to the Cayman Islands economy in 2019 (or 30.4 percent of GDP). The Cayman Islands had a total of 111,568 registered companies in 2020, with 92,550 of these being identified as exempt companies (whose proposed activities are to be carried out mainly outside the islands (offshore)), with an additional 11,731 new companies being registered between 2019 and 2020 (ESO, 2021; p. 134-135).

Tourism

The Cayman Islands recorded 659,900 visitors in 2020, down significantly compared to the 2,333,700 visitors in 2019 as a result of the global pandemic. Pre-2020, the Cayman Islands recorded in excess of 2.1 million visitors annually since 2015, with the majority of visitors (78.5 percent of visitors) arriving to the island on cruise ships in 2019. For visitors arriving to the Cayman Islands by air, 83.3 percent of these were from the USA, with Canada accounting for 6.0 percent of air arrivals and Europe accounting for 4.8 percent. Air arrival visitors to the Cayman Islands spent an average of 6.09 days within the country during 2019, travelling in a party of 2.39 people and spending on average CI$201.70 per night. In contrast, cruise ship visitors were estimated to spend on average CI$94.90 per day within the country (ESO, 2021; p. 150 – 155). Consultation indicated that tourism numbers were beginning to return to pre-2020 levels.

The tourism industry has grown rapidly within the Cayman Islands. While the tourism industry is one of the largest industries on the islands it is dependent on a foreign workforce with Caymanians reluctant to seek employment in the industry (Amit, 2001).

5.2.3.4 Occupation of employment

The top five occupations, which collectively accounted for 79.1 percent of total employment, were professionals (18.8 percent); service and sales workers (17.0 percent); craft and related trades workers (16.5 percent); elementary occupations (14.2 percent), and technicians and associate professionals (12.6 percent) (ESO, 2023; p. 19).

5.2.3.5 Income

In 2021, 4,213 employed persons recorded annual earnings of between $14,400 - $19,199, which makes up 9.5 percent of employed persons. Within this income bracket women made up 59.5 percent and men made up 40.5 percent. The next highest annual earnings recorded was within the income bracket of $100,800 and over, which made up 8.8 percent of the total employed persons. Within this income bracket men made up 63.0 percent and women made up 37.1 percent.

Employed persons with annual earnings of between $19,200 - $23,999 were in the third highest bracket at 8.6 percent. Those with annual earnings between $24,000 - $28,799 were in the fourth highest income bracket at 8.1 percent of the total of employed persons. 1.0 percent of employed persons recorded annual earnings of $0 - $4,799. This income bracket represented the lowest percentage of employed persons.

5.2.3.6 Cost of living

The cost of living in the Cayman Islands is among the highest in the world. Recent estimates, estimate that the average monthly costs for a family of four is CI$,6,821 and CI$3,959 for a single person (Expatistan, 2023).

Increases in the Consumer Price Index (CPI) also indicate rising costs in consumer goods and services. Between 2020-21 CPI rose 3.3 percent (ESO, 2022).

Consultation indicated that increases in the cost of living across the Cayman Islands is a key barrier to people moving and staying on the Islands as well as finding affordable housing.

5.2.3.7 Regional output

As shown on Figure 5.1, the GDP of the Cayman Islands was CI$4.72 billion in 2021 (current prices). The financial and insurance services sector was the largest contributor in 2021 contributing $1.5 billion or 30.7 percent to GDP followed by the professional, scientific and technical activities industry which contributed $0.7 billion or 15.2 percent to GDP (ESO, 2022).

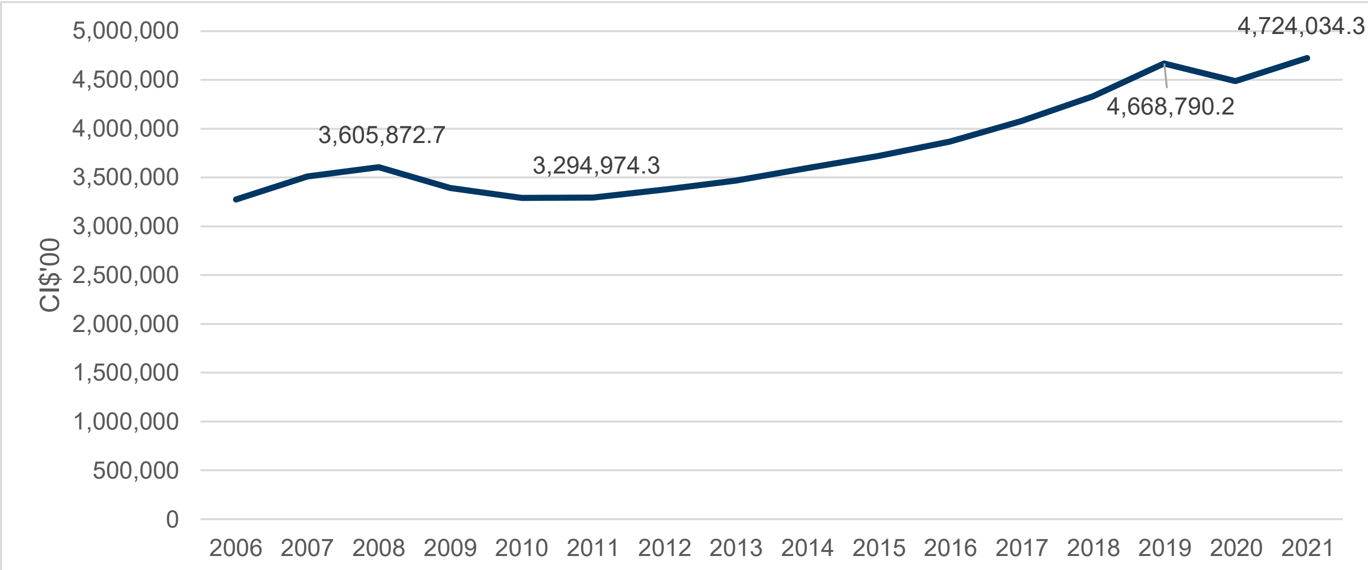


Figure 5.1 Cayman Islands GDP at Current Basic Prices 2006-2021

Source: ESO, 2022

5.2.4 Education

There are six universities and technical colleges located within the Cayman Islands. The University College of the Cayman Islands offers a number of programs and course and is the only public university on the Islands.

In 2021, 13.3 percent of those 15 years and older (both Caymanians and non-Caymanians) had attained technical/ vocational training. 8.8 percent of those 15 years and older (both Caymanians and non-Caymanians) had attained associate or equivalent level education and 30.3 percent had attained a bachelor's degree of higher.

When this is split into Caymanian and non-Caymanian subset, non-Caymanians have a higher rate of attainment of technical/ vocational training at 15.7 percent, compared to 11.0 percent of Caymanians. Attainment of a Bachelor's degree, Master's degree, Doctoral or equivalent education was higher for non-Caymanian's (36.2 percent) than Caymanian (24.3 percent). Attainment of associate level or equivalent education is higher for Caymanians at 10.5 percent than in non-Caymanians (7.0 percent).

Of the total school attendees in the Cayman Islands, the majority attend school in George Town.

5.2.5 Housing and accommodation

5.2.5.1 Tenure

Renting (furnished) is the most common type of tenure for dwellings among households in George Town (58.3 percent), followed by ownership with a mortgage (18.9 percent) (Table 5.5). These trends are similar for the national level. The high percentage of rentals points to the presence of a large immigrant population on contracts of employment, and who need to rent accommodation during their stay in the Cayman Islands (Kairi Consultants Ltd, 2008).

Table 5.5 Housing tenure

Housing tenure type	George Town		Cayman Islands	
	Number	percent	Number	percent
Owned with a mortgage	2,903	18.9 percent	6,787	22.9 percent
Owned without a mortgage	2,413	15.7 percent	6,052	20.4 percent
Rented - Furnished	8,943	58.3 percent	14,668	49.4 percent
Rented - Unfurnished	348	2.3 percent	568	1.9 percent
Subsidised Rent	48	0.3 percent	128	0.4 percent
Rent Free	278	1.8 percent	673	2.3 percent
Other	40	0.3 percent	113	0.4 percent
Not stated	356	2.3 percent	711	2.4 percent
Total	15,331	-	29,699	-

Source: ESO, 2022; p. 279

5.2.5.2 Median weekly rent

The rental market in the Cayman Islands has seen consistent growth over the last decade from 2010 to 2020. While COVID-19 has impacted rental rates in response to decrease in tourism and associated industry workers relocating, rental prices have returned to the decade long trend (IRG International, 2021). During consultation, stakeholders noted that the cost of living, and in particular, high housing costs is an issue in Cayman.

The average rental prices in Georgetown and across Grand Cayman are summarised in Table 5.6:

Table 5.6 Average rental price by location and accommodation type 2023

Area	1 Bedroom	2 Bedroom	3 Bedroom
West Bay	$900-1,500	$1,500-4,000	$2,500-3,200
Seven Mile Beach	$2,000-2,500	$3,500-5,500	$5,000+
Seven Mile Corridor	$2,000-2,500	$3,000-5,500	$5,000+
George Town	$1,100-2,100	$2,000-2,500	$4,000+
South Sound	$1,800-2,750	$2,000-3,000	$3,200+
Prospect/Savannah	$1,200-2,000	$1,750-2,500	$3,000+
Bodden Town	$950-1,500	$1,200-2,500	$2,500+

Source: https://caymanresident.com/housing/rentals/renting-a-property (reported 2023)

5.2.5.3 Median house price

There is a large disparity of house prices in the Cayman Islands and relatively small number of properties in the market. As such, reporting on house prices is often categorised by housing type, to attempt like-for-like market trend analysis. Sales data reported for villas in George Town shows that this area of the Cayman Islands has seen the some of the greatest surges in property prices. The average price per unit for a villa in George Town in 2010 was CI$383,000, increasing to CI$655,464 in 2018 and CI$918,952 in 2020 (Whittaker, 2021).

This trend is reflected at the national level, where an independent review of government data, found that open market property values steadily increased over the 2013 and 2019 period (Charterland Ltd, 2019). While COVID-19 related constraints brought challenges to this trend in early 2020, data from 2021 show property prices and transfer rates returning to pre-COVID-19 trends (Lands and Survey Department, 2021). The average house price in 2020 was CI$700,000 (Whittaker, 2021).

As mentioned in Section 5.2.3.6 the cost of living in the Cayman Islands is one of the highest in the world and increasing. Consultation supported this and indicated that an increase in cost of living across the Cayman Islands as a barrier to attracting and retaining skilled workforce.

5.2.5.4 Short term accommodation

Short-term rental accommodation has become increasingly popular on the Islands as it has become highly desirable for tourist visiting the Islands. In May 2023, there were approximately 226 short-term rental accommodation listings available on Airbnb on Grand Cayman Island. The short-term rental accommodation available on the Islands plays an important role in supporting the tourism industry and wider economy. Under the Tourism Law (1995), short-term rental accommodation must be operated by a licenced provider in the Cayman Islands. During consultation, stakeholders noted that there can be issues with the availability and affordability of available housing, particularly during peak tourism seasons.

5.2.6 Natural environment

The natural environment of the Cayman Islands is rich in biodiversity which attracts visitors from overseas and boost environmental and nature-based tourism businesses as well as the overall economy on the Islands.

Currently, the National Trust protects approximately 6 percent of terrestrial areas. These protected reserves are designed to conserve wilderness representing areas of high biological diversity and significance. These areas of high importance include Salina Reserve, Collier’s Wilderness Reserve, Governor Michael Gore’s Bird Sanctuary, Mastic Reserve, and Malportas Pond Bird Sanctuary (National Trust, 2022). Aquatic and coastal areas around the Islands are also of importance with several important coral reefs, sea grasses and mangrove forests providing essential nutrients and habitat to fish colonies and other sea life (DOE, 2023).

There are also several terrestrial areas protected under the National Conservation Law in Grand Cayman, including the Western Mangrove Cays which is located approximately 2km north-east from the project site (National Conservation Council of the Cayman Islands, 2022).

Consultation undertaken for this SEIA indicated residents and tourist value the natural environment of the Cayman Islands. As mentioned earlier nature-based tourism is a significant draw for tourism on the islands.

5.2.7 Community health and wellbeing

5.2.7.1 Community identity and values

The local community have a strong sense of community and pride in local heritage. They also value and have a deep respect for the environment. The Cayman Islands have a rich and unique cultural heritage blending Caribbean and European style and influence (Destination Cayman Islands, 2021).

Consultation with stakeholders noted that the local residents of the Cayman Islands highly value the natural environment including the terrestrial and marine environments where there are key unique flora and fauna. The local community also value the protection of these natural environments.

5.2.7.2 Health

The Cayman Islands enjoys a relatively high standard of living, as reflected in an annual per capita gross national income of US$61,880 in 2021 (12th in the world) (World Bank, 2023). The high standard of living, together with the high level of general and specialised medical care universally available in the Cayman Islands have contributed to the relatively good health of the population (Kairi Consultants Ltd, 2008).

The ESO's 2020 Annual Compendium of Statistics recorded several improvements in health status and outcomes for the Cayman Islands population over recent years, including:

- Between 2005 and 2020 the general mortality rate fell from 3.8 deaths per 1,000 population to 3.3.
- Between 2002 and 2020 the infant mortality rate decreased from 13.7 deaths per 1,000 live births to 3.6.

Alongside these improvements, the Cayman Islands Government has recognised an important concern regarding the health status of the Cayman population relates to the gradual shift in disease patterns over the years, with chronic/lifestyle non-communicable diseases becoming more prevalent than communicable disease (Ministry of Health, 2012). Mortality data for 2008 indicates that the leading causes of death in the Cayman Islanders were cardiovascular disease, heart disease, cancer, and respiratory diseases (Ministry of Health, 2012).

5.2.7.3 Crime and security

Data from the Royal *Cayman Islands Police Service* (RCIPS), which showed in 2021 (RCIPS, 2021):

- There were 3,696 total recorded crimes, accounting for 11 percent of all incidents or calls for service. There have been 140 more crimes recorded in 2021 compared to 2020 equating to an increase of 3.9 percent.
- There were 56 crimes per 1,000 population in 2021, compared to 51 crimes in 2020.
- There was a total of 131 burglaries in 2021, a reduction of 26 compared to 2020, equating to a 16.6 percent year on year reduction.
- There was a slight decrease in the number of recorded offences involving domestic abuse, from 469 in 2020 to 406 in 2021. However, this reportedly decrease goes against the trend of year-on-year increases seen in previous years.

Consultation supported the finding that the Cayman Islands is a relatively safe place to live and visit. Car accidents and speeding were the most common type of incidents reported on the islands leading to the Cayman Islands having one of the highest road incidents in the world per capita. Other crimes include those involving drugs and alcohol.

5.2.8 Access and connectivity

The Islands can be accessed via plane or ship. Owen Roberts International Airport which is the main access point for international visitors is located in George Town on Grand Cayman Island. There are direct flights to 18 cities across the USA including New York City, Los Angles, Miami, and Denver. There are also direct flights from Panama, Jamaica, Cuba, and Honduras. There are four cruise ship offshore anchor points located off Grand Cayman Island. Access to the Island from cruise ships is via two major port entries located at Grand Cayman and Cayman Brac.

When on the Islands, car travel is the most common and best way to get around. An existing bus service exists within the study area. According to the Public Transport Unit within the Cayman Islands Government, bus 5A travels along North South Road passing the south end of Seymour Road. Seymour Road is the main access road to the existing landfill site. Seymour Road connects with North Sound Road and to the main access roads of Esterly Tibbetts Highway and Godfrey Nixon Way, which connects various parts of the Island (APEC, 2023). Other transport options include taxi's, walking, bicycle and rideshare options.

5.2.9 Access to services and infrastructure

5.2.9.1 Health infrastructure

Cayman Islands is serviced by a number of hospitals and health care services with three fully equipped hospitals in Grand Cayman, including, Cayman Islands Hospital, Doctors Hospital, and Health City Cayman Islands.

The local study area is serviced by a mix of public and private health care services, notably:

– The 127-beds Cayman Islands Hospital is the principal health care facility of the country, providing 24-hour full service medical services (HSA, 2023). It is located on Smith Road, George Town approximately 4km from the project site and is operated by the Health Services Authority (HSA) of the Cayman Islands.
– The George Town District Health Centre, also operated by the HSA, also provides health services including physicians, including general physicians and mental health support services (HSA, 2021b). The Clinic is located at the Cayman Islands Hospital.
– Doctors Express is located in George Town and offers urgent care, family medicine, a pharmacy and other wellness services (Cayman Islands Urgent Care, 2021).
– Health City Cayman Islands is a tertiary care medical centre and hospital in Grand Cayman which opened in 2021 and offers a number of medical, surgical and diagnostic services (Health City Cayman Islands, 2023).
– The independently owned and operated Doctor's Hospital is located on Walkers Road in George Town, approximately 4.5km from the project site. It is an eighteen-bed, medical/surgical hospital (Cayman Health, 2021).

George Town is also serviced by a number of smaller, private health care clinics, general practitioners and pharmacies.

With respect to the capacity of these facilities, there are 4.7 doctors per 1,000 population in the country, representing a decrease from 5.5 in 2015 (ESO, 2021).

5.2.9.2 Police service

The Cayman Islands is serviced by the RCIPS. RCIPS has seven police stations and approximately 400 officers and support staff and 50 coast guards (RCIPS, 2021). The George Town Police Station, the main headquarters, is located on Elgin Street approximately 4km from the project site.

Consultation identified that the Police service do support the fire department in incident response and management as needed.

5.2.9.3 Fire service

The Cayman Islands Fire Service (CIFS) provides firefighting and rescue services nation-wide and is operational 24 hours a day 7 days a week. CIFS has approximately 153 staff members who work rotating shifts. The George Town fire station is located on Owen Roberts Drive, approximately 4km from the project site.

Consultation indicated that the Fire service currently attend to all fire related matters including aviation, education, residential, commercial, hazardous, and search and rescue. The Fire service also attend to fires at the existing landfill site on a regular basis. They also conduct annual inspections of the existing landfill including fire breaks around the landfill site.

5.3 Key findings

The key findings of the socio-economic baseline are summarised below:

– The population of George Town and the Cayman Islands has grown considerably over the last decade.
– There is a high migrant population in the Cayman Islands with a high proportion of people arriving from Jamacia, the Philippines, the UK, and USA. This is also reflected in the high foreign labour market and temporary workers permits.
– Along with the high foreign labour force there was high labour force participation. Males made up slightly more of the labour force compared to females.
– Unemployment across the Cayman Island was low at an estimate 2.2 percent in 2022. The majority of the unemployed labour force consisted of persons aged 25-34 years.

- The construction industry was the largest employing industry in the Cayman Islands by total labour force making up over 15 percent of the total labour force.
- The financial services industry was the fourth largest industry by people employment and the largest industry by economic value contributing $1.5 billion to the GDP of the country.
- Tourism is a key industry on the Islands with over 2.1 million people visiting the Islands each year. The tourism industry also employs a significant proportion of the foreign labour market.
- Renting is the most common type of tenure across the Cayman Islands. Over the last decade the rental market has seen consistent growth with the average rental price for a 2-bedroom apartment between CI$2,000 and CI$2,500 per month. High rental prices and overall cost of living is seen as a barrier to housing affordability and attracting and retaining people.
- The natural environment of the Cayman Islands is highly valued and protected by the local community. The natural environment is also a key tourist attraction to the islands with a number of businesses in the nature-based tourism industry.

6. Impact assessment – construction

This section assesses the socio-economic impacts associated with the construction of the project. The sensitivity and magnitude have been determined in accordance with the methodology outlined in Section 3.5. The significance rating shown in Section 3.5.2 has been applied to each social impact based on the outcome of this assessment.

Table 6.1 Socio-economic impact assessment – construction

Impact summary	Description	Nature/ extent/ context	Magnitude	Sensitivity	Significance rating
Population					
Population and demographic change from construction workforce	During construction, the workforce is estimated to be 300 employees over the duration of the three-year construction timeframe. As detailed within the *Works Delivery Plan* (Regen, 2023), there is aspiration for up to 100 personnel to be local Caymanian residents as employees or subcontractors. The project will prioritise the sourcing of construction personnel from the Cayman Islands, however, for the remaining workforce, and where workers are unable to be sourced from within the country, personnel may be engaged from elsewhere, including from other surrounding Caribbean islands and overseas. On this basis, project construction would contribute to a temporary population increase in Cayman. Given that the existing high tourism and non-resident worker populations is part of community composition in Cayman, a temporary increase in the non-resident population may not be highly noticed. Given the typical nature of construction workforce, it is also anticipated that the additional temporary population would be a predominantly single male population.	**Beneficial / Adverse** **Short term** **National**	**Low**	**Medium**	**Minor (neutral)**
Employment and economy					
Increase in direct local employment during construction.	The project's construction phase will create direct employment for approximately 300 FTE workers over the three-year construction period (on average 100 FTE per year), and for 15 months the number will exceed 250 people. This would provide employment opportunities for residents in Cayman, in particular those skilled in construction, engineering, project management and administration, potentially increasing the level of employment in the region. Stakeholders consultation indicated the potential of the project to have positive impact on the regional economy through direct employment opportunities was a key benefit.	**Beneficial** **Short term** **National**	**Low**	**Medium**	**Minor (beneficial)**

Impact summary	Description	Nature/ extent/ context	Magnitude	Sensitivity	Significance rating
	As detailed within the *Works Delivery Plan* (Regen, 2023), up to 100 individuals are proposed be local Caymanian residents engaged as employees or subcontractors (and for 16 months the percentage of local Caymanians will exceed 30 percent) during the construction period. Based on the number of people employed within the construction industry, this would amount to 1.5 percent of the total construction workforce currently within the Cayman Islands. Notwithstanding this, during consultation, stakeholders noted that there is often not enough local labour to meet the demand of certain industries, with foreign labour comprising a large portion of the construction industry.				
Increased training opportunities	The project's construction phase will provide opportunities to enhance skills and capacity of employees in the local and regional study areas through the proposed apprenticeships, traineeships and work experience opportunities throughout the works period, as identified in the *Works Delivery Plan* (Regen, 2023). Through the SEIA consultation it was understood that there is a strong interest in the potential for the project to create employment and skills development opportunities for the local population, however understanding these training requirements ahead of time is critical in allowing time for trade colleges and vocational education providers to upskill the existing workforce. Project training and development opportunities would provide particular benefit for young people and new entrants to the workforce who experience high levels of disadvantage and employment inequity in the regional study area.	**Beneficial** **Long term** **National**	**Medium**	**Medium**	**Moderate (beneficial)**
Increased competition for workers in local and regional labour market	During consultation, stakeholders noted that there are often labour challenges amongst local workforces for specialist roles, with many industries being supplemented by a foreign workforce. Consequently, there is potential for the project to draw local workers from existing jobs, potentially creating competition for labour for particular skills, particularly in the construction industry. This may result in increased skilled labour shortages for periods of the construction phase. The attraction of a construction workforce from existing businesses and industries in the region may contribute to competition for labour in the regional study area. This may lead to temporary labour shortfalls and increased cost of labour for other construction work, particularly if other projects are constructed during the same period.	**Adverse** **Short term** **National**	**Medium**	**Medium**	**Moderate (adverse)**

Impact summary	Description	Nature/ extent/ context	Magnitude	Sensitivity	Significance rating
Procurement opportunities for local businesses and the purchase of goods and services during construction	As noted in the *Works Delivery Plan* (Regen, 2023) the project will provide procurement opportunities for eligible regional businesses to provide construction materials and services (including civil works, construction and transportation), which would lead to increased revenue and business growth for those engaged and contribute to the regional economy. Consultation for the SEIA noted that there is capacity amongst local businesses to support the construction of the project.	**Beneficial** **Short term** **National**	**Low**	**Medium**	**Minor (beneficial)**
	During the construction period, the project will provide local spend at Cayman businesses through the provision of goods and services to support construction activities, including, but not limited to construction materials, uniforms, catering and accommodation. An increase in local spend opportunities would lead to increased revenue and business growth for those businesses.	**Beneficial** **Short term** **National**	**Low**	**Medium**	**Minor (beneficial)**
Indirect employment through procurement opportunities	The procurement of local and regional goods and services to support construction and operation of the project would indirectly generate employment opportunities for residents of the region.	**Beneficial** **Short term** **National**	**Low**	**Low**	**Negligible (beneficial)**
Increased in local trade associated with expenditure of wages	Local food and retail businesses in George Town would benefit economically from increased food and beverage trade as a result of patronage by the construction personnel working on the project site. Local businesses, including accommodation providers, and food and beverage providers may also benefit from short term foreign workers during the construction phase, as they would need to be accommodated nearby.	**Beneficial** **Short term** **National**	**Low**	**Medium**	**Minor (beneficial)**
Services and infrastructure					
Increased demand for housing and accommodation access	During construction, an influx non-resident workers may result in an increased demand on short term housing and accommodation in Cayman. During consultation, stakeholders noted that there existing pressures relating to the availability and affordability of housing and accommodation in Cayman, particularly during peak tourism seasons. Housing requirements during construction may result in reduced availability of rentals and short-term accommodation facilities.	**Adverse** **Short term** **National**	**Low**	**Low**	**Negligible (adverse)**
	Tourism is a major industry contributing to the Cayman Island economy. Increased pressure on short term accommodation, over the construction period, may have some impact on short-term accommodation availability for the tourism industry.	**Adverse** **Short term** **National**	**Very low**	**Low**	**Negligible (adverse)**

Impact summary	Description	Nature/ extent/ context	Magnitude	Sensitivity	Significance rating
Increased demand for community facilities and services.	The non-resident construction workforce may increase demand on local and regional community facilities and services, such health services. As identified in Section 5.2.9.1, there are a number of health services in Cayman, including the Cayman Islands Hospital and George Town District Health Centre. On this basis, it is anticipated that available services can absorb an increase in demand and therefore unlikely to impede of local community' s access to health services.	**Adverse** **Short term** **National**	**Very low**	**Low**	**Negligible (adverse)**
Increased demand on emergency services	There may also be demand for assistance from fire services in relation to fire planning / prevention to protect project infrastructure. During consultation, it was noted that emergency services are frequently required at the existing landfill site to respond to fires occur at the site. Increased construction activity in addition to an increase in population associated with the construction activity may result in increased demand for emergency services, particularly for the Cayman Island Fire Service.	**Adverse** **Short term** **National**	**Medium**	**Low**	**Minor (adverse)**
Perceived impacts to community safety and community cohesion	Research indicates a common concern raised by communities during the planning for major infrastructure projects relates to the 'influx' of non-local workers ('outsiders') and the perceived potential for an increase in anti-social behaviour, crime and overall reduction in community cohesion, particularly in small communities with limited exposure to development (Scott et al., 2011). The construction workforce (approximately 300 FTE workers over the three-year construction period) would include a proportion of non-resident workers. In the event that the majority of construction workers are from outside of the regional study area, there is potential that the occurrence of or any perceived anti-social behaviour could be attributed to the presence of construction workers and result in feelings of anxiety and distrust towards project workers by members of the local community.	**Adverse** **Short term** **National**	**Medium**	**Low**	**Minor (adverse)**
Changes in perception of personal safety	Presence of male dominated workforce during construction in George Town may contribute to concerns about community safety within Cayman particularly as the workforce would be non-local to Cayman. The presence of a non-local construction workforce may also concern some residents regarding reduction in feelings of community cohesion. However, given the high proportion of foreign workers currently in Cayman (Section 5.2.3.1), it is anticipated that residents are likely to adapt to an increase to the existing non-residential workforce.	**Adverse** **Short term** **National**	**Medium**	**Low**	**Minor (adverse)**

Impact summary	Description	Nature/ extent/ context	Magnitude	Sensitivity	Significance rating
Mental health of non-resident workers	Non-resident construction workforce may be at greater risk of mental health and wellbeing impacts. Isolation and loneliness has been found to contribute to feelings of decreased mental health for non-resident construction workforce.	**Adverse** **Short term** **National**	**Very low**	**Low**	**Negligible (adverse)**
Environmental quality and natural resources					
Increased noise, vibration and dust levels due to construction activities	Construction activities would generate noise, vibration and dust during standard work hours. This would involve the use of noise generating equipment, operation and movement of heavy machinery (such as dozers, graders, front end loaders, excavators, trucks and scrapers) and construction traffic. Most noise would be intermittent or sporadic throughout the construction period. Increased construction noise during the daytime may disturb day-to-day activities for affected residents, and impact their quality of life. This could include the need to close windows whilst indoors, or spending less time outdoors engaging in recreational activities or relaxation. Increased noise could disturb activities such as conversations, watching television, or listening to music or the radio. The *Noise and Vibration Assessment* (GHD, 2023) found that the project has the potential to produce noise emissions in the vicinity of the project above the documented baseline limits. These changes would be experienced for nearby sensitive receptors including nearby residential areas, residents along haulage routes, the nearby school and nearby hospital. The *Noise and Vibration Assessment* (GHD, 2023) has deemed that construction vibration impacts are 'insignificant' for all receptors with magnitude of change of "very low".	**Adverse** **Short term** **Local**	**Medium**	**Low**	**Minor (adverse)**
	The *Air Quality Impact Assessment* (GHD, 2023) found that some construction activities would have the potential to generate dust which would be experienced by residences and businesses close to the construction area, and at some residences along haulage routes. Increases in dust may lead some residents and businesses to alter their way of life, such as closing windows whilst indoors, spending less time outside, or spending additional time cleaning indoor and outdoor surfaces. The *Air Quality Impact Assessment* (GHD, 2023) has deemed that there are negligible dust effects likely to occur due to the construction activities and will be managed through the implementation of appropriate mitigation plans.	**Adverse** **Short term** **Local**	**Low**	**Low**	**Low (adverse)**

Impact summary	Description	Nature/ extent/ context	Magnitude	Sensitivity	Significance rating
Changes to visual amenity and sense of place	During consultation, stakeholders noted that the visual amenity and the natural environment is highly valued by residents and tourists of the Cayman Islands (Section 5.2.6). Additionally, stakeholders noted that the current landfill operations considerably reduce the visual amenity, particularly for surrounding residents, residents in high-rise apartment buildings, tourists using main roads, incoming cruise ships off Seven Mile Beach. The *Seascape and Landscape Visual Considerations Report* (GHD, 2023) found that there may be direct and indirect landscape effects upon the surrounding landscape/townscape/seascape character of areas during construction of the project (for those visual receivers/viewpoints with views to the project site). This would include the presence of construction machinery and infrastructure, construction workers, and views of construction vehicles along haulage routes. Changes to visual surroundings may impact residents' sense of pride in their local area, and reduce enjoyment of outdoor areas, or views from some windows and yards. Views of construction activities would have the potential to impact properties close to the project site in surrounding residential settlements and properties in high-rise residential properties on Seven Mile Beach. These residents are likely to be sensitive to these changes due to the value that is placed on the character of the area (Section 5.2.6), and the existing visual amenity impacts of the current landfill operation (Section 0). Visual impacts would be limited to the duration of the construction period, and most residents are expected to adapt to these changes.	**Adverse** **Short term** **National**	**Medium**	**Low**	**Minor (adverse)**
	The *Seascape and Landscape Visual Considerations Report* (GHD, 2023) identified that construction activities may be visual from high-rise residential properties on Seven Mile Beach, the National Gallery of the Caymans Island and Cruise Liners anchored off Seven Mile Beach, which are key areas for tourists. This would include the presence of construction machinery and infrastructure, construction workers, and views of construction vehicles along haulage routes. Tourists may be to be sensitive to these changes due to the value that is placed on the character of the area (Section 5.2.6). Visual impacts would be limited to the duration of the construction period, and most tourists are expected to adapt to these changes, as construction sites are a commonly occurring urban views.	**Adverse** **Short term** **National**	**Medium**	**Low**	**Minor (adverse)**

Impact summary	Description	Nature/ extent/ context	Magnitude	Sensitivity	Significance rating
Combined amenity impacts	Residents and businesses located adjacent to the project site and along construction haulage routes would have the potential to experience combined impacts during construction due to noise, dust and visual changes. Residents in the area would be sensitive to these changes, however as the site is located on the site of the existing landfill, it is not expected that residents will be able to adapt to these changes. Some residents may be more vulnerable, and there is potential for impacts to overall wellbeing for some.	**Adverse** **Short term** **National**	**Medium**	**Low**	**Minor (adverse)**
Access and connectivity					
Reduced traffic safety / increased risk of traffic accidents due to construction traffic	During construction, the *Traffic Statement* (APEC, 2023) anticipates that of the 300 staff, 150 additional vehicles would be added to the traffic along North Sound Road & Seymour Road during the peak periods, across the 3- year construction period. In addition to this, it is expected that there will be approximately 37 heavy vehicles will travel to and from the ISWMS site during the construction stage of the project. During consultation, stakeholders noted that along these roads there are existing traffic issues associated with long travel time during peak hours as well as a high number of traffic accidents. An increase in light and heavy vehicles on major roads may result in actual or perceived reductions in road safety for road users.	**Adverse** **Short term** **Local**	**Medium**	**Low**	**Minor (adverse)**
Increased travel times and inconvenience for local road users	Increased time spent travelling may cause delays in getting home, to work, or other commitments. This may be inconvenient for some road users and cause frustration.	**Adverse** **Short term** **Local**	**Low**	**Low**	**Low (adverse)**
Damage to roads as a result of construction traffic	The presence of construction traffic on local roads in Cayman, and in particular, in George Town, may result in damage to roads and potentially lead to increased travel time for commuters, increase the chances of damages to commuter vehicles and reduced road safety.	**Adverse** **Short term** **Local**	**Low**	**Low**	**Low (adverse)**

7. Impact assessment – operation

This section assesses the socio-economic impacts associated with the operation phase of the project. The sensitivity and magnitude have been determined in accordance with the methodology outlined in Section 3.5. The significance rating shown in Section 3.5.2 has been applied to each social impact based on the outcome of this assessment.

Table 7.1 Socio-economic impacts – operation

Impact category	Description	Nature/ extent/ context	Magnitude	Sensitivity	Significance rating
Population					
Population and demographic change from operational workforce	As detailed within the *Works Delivery Plan* (Regen, 2023), the project is expected to require an operational workforce of 70 FTE workers per year. The project will prioritise the sourcing of operational personnel from the Cayman Islands, however, where workers are unable to be sourced from within the country, personnel may be engaged from elsewhere, including from other surrounding Caribbean islands and overseas. There is currently low levels of unemployment (Section 5.2.3.2) and a high proportion of foreign workers in Cayman, with stakeholders (during SEIA consultation) noting a number of industries are supplemented by non-resident workers, particularly specialist roles (Section 5.2.3.1). On this basis, it is likely that a proportion of the operational workforce may be sourced from overseas, requiring relocation to Cayman Islands, which is likely to result in a direct increase in the permanent resident population of Cayman.	**Beneficial / Adverse** **Long term** **National**	**Low**	**Medium**	**Minor (neutral)**
Employment and economy					
Increase in local employment during operation.	As detailed within the *Works Delivery Plan* (Regen, 2023), the project is expected to require an operational workforce of 70 FTE workers per year. These would be new roles and be predominantly skilled positions associated with the operation of the ERF and resource recovery facilities. This would provide employment opportunities for residents in the local and regional area, potentially increasing the level of employment in the region. However, there is low unemployment rates in Cayman (Section 5.2.3.2) with stakeholders (during SEIA consultation) noting that there is often not enough local labour to meet the demand of certain industries, with foreign labour supplementing a number of industries, and in particular, skilled roles (Section 5.2.3.1).	**Beneficial** **Long term** **National**	**Low**	**Low**	**Negligible (beneficial)**

Impact category	Description	Nature/ extent/ context	Magnitude	Sensitivity	Significance rating
	On this basis, operational-related local employment opportunities are likely to be limited to a small number of people, however, would be long-term in nature and sustain local employment opportunities.				
Contribution to the regional economy through procurement of goods and services, employment, and supporting growth of the renewable energy industry.	During operation, there would be opportunities for businesses in Cayman to supply goods and services to the ERF. This includes opportunities to service operations such as transport and logistics (e.g., waste haulage companies). The project also has the potential to generate new businesses to support its operations in Cayman as ERF technology is a new industry for the region.	**Beneficial** **Long term** **National**	**Medium**	**Medium**	**Moderate (beneficial)**
	During operation, the project will contribute to the regional economy through: – The sale of electricity from the ERF to the Caribbean Utility Company (CUC) – The Green Waste Processing Facility which will receive and process yard waste and will store the resulting compost and mulch products for onward resale into the Cayman marketplace – The Construction and Demolition Waste Processing Facility which will allow for the recycling, recovery and diversion of construction and demolition wastes which can be repurposed will be re-sold into the market These components of the project will contribute to the growth of the region's renewable energy and waste management industries.	**Beneficial** **Long term** **National**	**Medium**	**Medium**	**Moderate (beneficial)**
Opportunity to support local businesses through improvements in waste management	During operation, the waste management facilities, including the Construction and Demolition Waste Processing Facility and Green Waste Processing Facility will receive materials which includes yard materials, construction waste and demolition waste. Businesses such as construction and landscaping companies may benefit from appropriate facilities to manage their waste, assisting in their waste management process. This may improve processes and efficiency of waste management, which is likely to be positively received by local businesses.	**Beneficial** **Long term** **National**	**Low**	**Low**	**Negligible (beneficial)**
Opportunity for economic diversification	Operation of the project would contribute to economic diversification of the Cayman Island economy through the production of green electricity, the operation of new waste management technology and through the recovery and repurposing of resources. Diversification of the economy was noted as a key benefit of the project by stakeholders.	**Beneficial** **Long term** **National**	**Medium**	**Medium**	**Moderate (beneficial)**

Impact category	Description	Nature/ extent/ context	Magnitude	Sensitivity	Significance rating
Opportunity for the project to support the growth of the tourism industry	Stakeholders consulted for the SEIA noted that within the tourism industry, there is an aspiration for more sustainable waste management practices.. Improvements in waste management practices, including the transition from the existing landfill site, may improve Cayman's tourism offering by allowing expansion the nature-based tourism market and to promote sustainable tourism practices. The tourism industry, including operators and business owners, are likely to be welcoming of improvements to waste management.	**Beneficial** **Long term** **National**	**Low**	**Low**	**Negligible (beneficial)**
Increased competition for workers in local and regional labour market	As discussed in Section 5.2.3.2, there is low unemployment rates in Cayman. Consequently, due to operational workforce requirements there may be potential for the project to draw workers from existing jobs, potentially creating competition for labour for particular skillsets. However, during consultation, stakeholders noted that there is often not enough local labour to meet the demand of certain industries and operational roles are likely to require specialist skills which may not be available in the local workforce. This may require outsourcing employment to non-resident workers which would reduce pressure on the local labour market.	**Adverse** **Long term** **National**	**Low**	**Low**	**Negligible (adverse)**
Increased capacity of the local workforce	During consultation, stakeholders identified that education and training associated with upskilling the workforce is a potential key benefit that could arise during operation of the project. Training opportunities would benefit residents of Cayman by building capacity and skills of the workforce, with stakeholders citing potential opportunities as including apprenticeships, traineeships, upskilling and linkages with existing training providers in the region.	**Positive** **Long term** **National**	**Medium**	**Medium**	**Moderate (beneficial)**
Services and infrastructure					
Increased demand for housing and accommodation	During operation, there may be non-residential workers being employed and subsequently permanently relocating to Cayman. An increase in non-resident operational workers may result in an increased demand on housing in Cayman. During consultation, stakeholders noted that there is existing demand on affordability and availability of housing and accommodation in Cayman, particularly during peak tourism seasons. Housing requirements during operation may result in reduced availability of long-term rentals.	**Adverse** **Long term** **National**	**Low**	**Low**	**Negligible (adverse)**

Impact category	Description	Nature/ extent/ context	Magnitude	Sensitivity	Significance rating
Increased demand for community facilities and services.	An increase in the permanent population of Cayman during operation may increase demand on local services and facilities, such as health services. As identified in Section 5.2.9.1, there are a number of health services in Cayman, including the Cayman Islands Hospital and George Town District Health Centre. The number of non-resident workers required for operation of the project is likely to be small, generating limited additional demand for community infrastructure. Community infrastructure is likely to cope with this additional demand.	**Adverse** **Long term** **National**	**Low**	**Low**	**Negligible (adverse)**
Increased demand on emergency services	There may also be demand for assistance from fire services in relation to fire planning / prevention to protect project infrastructure. During consultation, it was noted that emergency services are frequently required at the existing landfill site to respond to fires occur at the site. Operational activities in addition to an increase in population associated with the operation activity may result in increase demand for emergency services to respond to incidents. Consultation with emergency services suggested that with current operations requiring frequent incident response, there would be capacity for the service to respond to demand created by the new facility if appropriate emergency management planning is undertaken.	**Adverse** **Long term** **National**	**Low**	**Low**	**Negligible (adverse)**
Health and community wellbeing					
Community pride associated with the contribution to the circular economy.	During operation of the project, the recycling center will be used to receive end of life goods together with unwanted but serviceable or repairable products that can be re-used or repurposed. These will then be made available free of charge to other members of the public or third sector organisations for beneficial re-use. Additionally, the Green Waste Processing Facility and Construction and Demolition Waste Processing Facility will receive and process reusable materials for onward resale into the Cayman marketplace. The establishment of the household waste recycling centre, Green Waste Processing Facility and Construction and Demolition Waste Processing Facility may create a sense of civic pride and satisfaction through participation in recycling and contribution to a circular economy.	**Beneficial** **Long term** **National**	**Medium**	**Medium**	**Moderate (beneficial)**
	During operation, the process of diverting solid waste from a conventional landfill to an energy recovery process, would emit considerably less GHG and will offset emissions with every ton of avoided waste to a landfill. Residents of Cayman place a high value on the natural environment and environmental preservation. This is also a key driver of tourism on the Island. A reduction in GHG emissions from the operation of the project may	**Beneficial** **Long term** **National**	**Medium**	**Medium**	**Moderate (beneficial)**

Impact category	Description	Nature/ extent/ context	Magnitude	Sensitivity	Significance rating
	create a sense of civic pride and satisfaction through the participation in environmental sustainability efforts.				
Perception of health risk associated with the operation of the project	Residents in the local study area may be concerned that the project may increase the potential for the ingestion of contaminated produce or water or inhaling air-borne pollutants. The perception of potential impacts to health may lead to stress and worry for some community members, which could impact health and wellbeing for some individuals, and may have broader community wellbeing effects.	**Adverse** **Long term** **National**	**Medium**	**Medium**	**Moderate (adverse)**
Changes (actual and perceived) to personal safety and hazard exposure	Energy from waste is an emerging technology in Cayman, although it is a common method of processing waste in a range of countries around the world. Stakeholders indicates that the potential impacts and benefits of energy from waste technology and these types of facilities are not well understood by the community. The perception of negative health impacts from the operation of the project, and uncertainty about the processing technology, may lead to stress and worry for some residents in the area. This could affect overall mental health and wellbeing	**Adverse** **Long term** **National**	**Medium**	**Medium**	**Moderate (adverse)**
Perceived impacts to community safety and community cohesion	The operational workforce (averaging 70 FTE per year) would include a proportion of non-resident workers. In the event that the majority of operational workers are from outside of the regional study area, there is potential that the occurrence of or any perceived anti-social behaviour could be attributed to the presence of operational workers and result in feelings of anxiety and distrust towards project workers by members of the local community. However, given the high proportion of foreign workers currently in Cayman (Section 5.2.3.1), it is anticipated that residents are likely to adapt to an increase to the existing non-residential workforce.	**Adverse** **Long term** **National**	**Low**	**Low**	**Negligible (adverse)**
Changes in perception of personal safety during operation	During operation of the medical waste facility, there may be actual or perceived impacts to community safety as a result of possible theft of contraband drugs destined for incineration. This may concern some residents regarding reduction in safety.	**Adverse** **Long term** **National**	**Low**	**Low**	**Negligible (adverse)**
	The project operation will involve the processing and storing of some combustible materials, particularly in the Construction and Demolition of existing waste facility. This may elevate the fire risk at the project site. Given the current issues associated with fire occurrences at the existing landfill site, residents may be sensitive to safety concerns associated potential fire risk during operation of the project.	**Adverse** **Long term** **National**	**Low**	**Low**	**Negligible (adverse)**

Impact category	Description	Nature/ extent/ context	Magnitude	Sensitivity	Significance rating
Environmental quality and natural resources					
Improvements to safety and amenity during operation of the ISWMS	During consultation, the majority of stakeholders noted considerable issues with the existing landfill operations. These concerns include safety impacts associated with persistent fire risk, the unpleasant visual amenity as the existing site is visible from major roads and from tourist destinations, and the odour associated with an open landfill site. The project aims to alleviate the current waste management issues associated with the landfill site by providing an ERF and household waste recycling centre which aims to reduce the amount of physical waste present on the site. The operation of the project will subsequently minimise current amenity and safety impacts being experienced, with stakeholders noting that the project will be beneficial to improve current conditions. Residents in Cayman are likely to be receptive to improvements in current waste management operations which may result in improved amenity.	**Positive** **Long term** **National**	**Medium**	**Medium**	**Moderate (beneficial)**
Noise impacts associated with the operation of the project	During operation of the project, there will be a number of noise and vibration generating activities associated with waste processing and storage. These activities will involve exhaust systems, shredders, grinders, generators and combustion stacks which have the potential to cause an adverse noise impacts at receptors. Sensitive receptors associated with noise impacts are surrounding residential properties, schools, and commercial sites. Some of the activities with highest noise and vibration potential, such as combustion and power generation would occur 24 hours a day, 7 days a week. However, a number of design features have been built into the concept design for the facility to reduce potential noise impacts and ensure compliance with noise criteria at residences. During operation of the ERF, steam purging is a critical hot commissioning activity that occurs once in the lifetime of the plant, and is a high noise generating activity. This process involves a silencer designed to reduce noise from this event and will only occur one time prior to the commencement of operation of the facility. The *Noise Impact Assessment* (GHD, 2023) indicates that the overall noise impact is considered to be low during the daytime and medium moderate during the quiet parts of the evening and night-time. The *Noise Impact Assessment* (GHD, 2023) recommends measures to manage and minimise the potential impacts identified. With appropriate design responses, it is expected that operation of the facility is unlikely to generate significant noise impacts.	**Adverse** **Long term** **National**	**Low**	**Low**	**Negligible (adverse)**
	During operation, the *Noise Impact Assessment* (GHD, 2023) indicated that additional heavy vehicles associated with the transport of waste materials will result in a negligible to minor short-term increase and a	**Adverse** **Long term**	**Low**	**Low**	**Negligible (adverse)**

Impact category	Description	Nature/ extent/ context	Magnitude	Sensitivity	Significance rating
	negligible long-term increase to road traffic noise levels at existing sensitive receptors. Residents along haulage routes are likely to be sensitive to operational traffic	**National**			
Changes to air quality due to operation of the project	During operation of the project, there would be increased contaminant concentrations and odour due to the additional emissions. Emissions and odour would be associated with the ERF, incinerators, waste storage and from the transportation of waste. Operation associated with the Green Waste Operations and Construction and Demolition processing may produce dust during processing of materials. Increases in odour and air-borne pollutants may be noticeable in areas around the project site and along haulage routes and could lead some residents and business owners changing their behaviour. This could include spending more time indoors, and closing windows and doors of houses or vehicles. This may impact residents' overall enjoyment of outdoor spaces, and reduce feelings of pride in their local area. However, the *Air Quality Assessment* (GHD, 2023) states that all cumulative impacts are shown to be 'not significant', when mitigation measures are applied.	**Adverse** **Long term** **National**	**Low**	**Low**	**Negligible (adverse)**
Changes to visual amenity and sense of place	During consultation, stakeholders noted that the visual amenity is highly valued by residents and tourists of the Cayman Islands. Additionally, stakeholders noted that the current landfill operations considerably reduce the visual amenity, particularly for surrounding residents, residents in high-rise apartment buildings, tourists using main roads, incoming cruise ships off Seven Mile Beach. The *Seascape and Landscape Visual Considerations Report* (GHD, 2023) found that there may be direct and indirect landscape effects upon the surrounding landscape/townscape/seascape character of areas during operation of the project due to the presence of the ERF and associated resource recovery facilities (for those visual receivers/viewpoints with views to the project site). The operation would be visible from properties close to the project site in surrounding residential settlements and properties in high-rise residential properties on Seven Mile Beach. These properties would currently have views of the existing landfill site. Due to existing amenity impacts associated with the current landfill operation, it is anticipated that residents would be able to adapt to these changes, with stakeholders noting that the project is welcome to provide improvements overall visual amenity.	**Adverse / beneficial** **Long term** **National**	**Low**	**Low**	**Negligible (neutral)**

Impact category	Description	Nature/ extent/ context	Magnitude	Sensitivity	Significance rating
Combined amenity impacts	Residents and businesses located adjacent to the project site and along waste haulage routes would potentially experience combined impacts during operation due to noise, dust and visual changes. Residents in the area would be sensitive to these changes, however as the site is located on the existing landfill, it is expected that residents will be able to adapt to these changes. Some residents may be more vulnerable, and there is potential for impacts to overall wellbeing for some.	**Adverse** **Long term** **National**	**Low**	**Low**	**Negligible (adverse)**
Access and connectivity					
Increased traffic during the operation of the project	An increase in light and heavy vehicles on major roads during operation may result in actual or perceived reductions in road safety for road users. However, as noted in the *Traffic Statement* (APEC, 2023), the operation of the project (operating times, waste collection practices, etc.) are expected to be similar to the existing GTLF operations with a marginal increase in staff numbers compared to existing. Trip generation by the ReGen facilities is expected to be in line with the trips currently generated by the GTLF. There are no plans to modify the waste collection practices. During consultation, stakeholders noted that along these roads there are existing traffic issues associated with long travel time during peak hours as well as a high number of traffic accidents. While the operation of the project does not involve any changes to the existing waste collection processes, there may be an increase in private vehicles transporting waste to the resource recovery facilities at the ISWMS, however this is not expected to increase the existing safety issues on the road network.	**Adverse** **Long term** **National**	**Low**	**Low**	**Negligible (adverse)**

8. Mitigation measures

The socio-economic opportunities and impacts identified and assessed in this report would be managed and mitigated and opportunities enhanced through a range of measures recommended in this report, and by other relevant mitigation measures recommended in other EIS specialist studies (such as the noise and vibration assessment, landscape and visual assessment, and traffic and transport assessment) and the *Works Delivery Plan* (ReGen, 2023). Measures for the mitigation and management socio-economic impacts are detailed in Table 8.1.

Table 8.1 Overview of mitigation and enhancement measures

Plan	Description
Employment and skills plan	As detailed in the *Works Delivery Plan* (ReGen,2023), the construction contractor will develop an Employment and skills plan which will be submitted to the Government two months prior to the Works Commencement Date for comment and review. The employment and skills plan would aim to: – Promote the availability of both skilled and unskilled employment opportunities within the project – Encourage the workless and new entrants into the workforce – Ensure compliance with the relevant labour Legislation in the Cayman Islands by setting out the particular requirements – Improve the skills of the local workforce, both new and existing by encouraging transition from expats to local employment over the course of time – Provide apprenticeships, traineeships and work experience opportunities throughout the Works Period The Employment and Skills Plan will include, at a minimum: – Staffing capacity – Staff training and performance assessment procedures – Details of induction training for staff and visitors – Working hours and shift patterns for each Facility – Number of supervisors and use of sub-contractors – Details of experience and qualifications required of key Project personnel – Staff welfare policy – Job descriptions – Backup arrangements in case of shortages, seasonal and exceptional staffing requirements The Contractor will undertake annual reviews of the Employment and Skills Plan to ensure relevance and appropriateness and to monitor performance. As part of the Employment and Skills Plan, the Contractor will develop an “Employees Handbook” that sets out the rights and responsibilities of all members of staff during the Services period.
Consultation framework	As detailed in Chapter 5 of the EIA, a formal consultation framework for the ISWMS has been developed in collaboration with ReGen and the Cayman Islands Government (CIG) to satisfy the public consultation requirements of the EIA as well as engage and educate the public and key stakeholders about the ISWMS Project. The main goals of the consultation framework include: – Satisfy public consultation requirements per the EIA Directive – Improve efficiency of communication with the public and stakeholders – Maintain and improve relationships with stakeholders, including neighbors, and the broader community – Demonstrate willingness to listen and consider input from stakeholders

Plan	Description
	– Enhance the reputation of ReGen as a responsible entity for managing waste The consultation framework is expected to assist in managing potential concerns about the project once the EIA is on public exhibition, as well as strengthen relationships with key stakeholders (e.g. emergency services, government agencies and residents).
Community Liaison Plan	ReGen has been undertaking engagement with the local community and key stakeholders for the ISWMS prior to this project. There is therefore an established relationship between ReGen, and some local communities and stakeholders. SEIA consultation indicated that ongoing, regular and transparent communication with key stakeholders and residents in Cayman would be important to managing community perceptions of the project in the community. In line with Good Industry Practice, the Contractor will develop and agree with the Government a Community Liaison Plan (CLP), which will cover both the construction and operational phases of the Contract. The CLP will include: – The scope, purpose and timetable for all consultations with relevant stakeholders – Full details of all promotional activities to promote each of the Facilities (including but not limited to the provision of a web site containing community and facility performance information). For the construction period this will be provided through a link to the Contractor's Project website – Measures to proactively encourage community attendance at organised liaison meetings – Details of the general procedures for handling questions, complaints and protests A Community and Stakeholder Engagement Strategy is expected to assist with managing potential concerns about the project, as well as strengthen relationships with key stakeholders (e.g. emergency services, government agencies and residents).
Enquires and complaints plan	A project specific enquiries and complaints plan for the project will be developed to establish the protocol by which standards for dealing with enquiries, complaints, compliments and suggestions from members of the public and other interested parties. The Contractor will allow for enquiries, complaints, compliments and suggestions to be made directly to a member of staff either by telephone, e-mail, via the designated Project website or social media interface or in writing. This will involve a dedicated e-mail address to enable the receipt of complaints, which will facilitate an acknowledgement by return via an automated response. Details of the dedicated web address for enquiries and complaints will be published in newsletters, on site entrance signs, on informational or promotional literature associated with the Project, and on the Contractor's website with an appropriate link. This would be developed and implemented to ensure that residents and stakeholders are notified in a timely manner about construction activities and potential for impacts, accurate information is accessible, and enquiries and complaints are managed in a timely manner.
Procurement plan	As detailed in the *Works Delivery Plan* (ReGen, 2023), the proponent ReGen is committed to supporting the Cayman Islands through the procurement with local businesses. ReGen will develop a procurement plan, to support procurement activities required for the construction and operation of the project, and to leverage local contractors, where feasible. Procurement for the project will, at a minimum, involve: – Bid packages: which will be developed to make best use of local contractors and their capabilities – A procurement plan will be developed to include target dates for scope development Procurement planning will be developed to assist local contractors and businesses in understanding the opportunity and scope of the project procurement requirements and allow for involvement in the tendering process for bid packages.

Table 8.2 summarises the mitigation and enhancement measures applicable to the socio-economic impact identified in Sections 6 and 7 of this report, and from other EIA specialist studies.

Table 8.2 Summary of mitigation and enhancement measures for socio-economic impacts

Impact category	Mitigation or enhancement	Relevant EIA specialist study
Population and demographic change from construction workforce	Employment and skills plan	SEIA
Increase in direct local employment during construction.	Employment and skills plan	SEIA
Increased training opportunities	Employment and skills plan	SEIA
Increased competition for workers in local and regional labour market	Employment and skills plan	SEIA
Procurement opportunities for local businesses and the purchase of goods and services during construction	Procurement plan	SEIA
Indirect employment through procurement opportunities	Procurement plan	SEIA
Increased in local trade associated with expenditure of wages	Procurement plan	SEIA
Increased demand for housing and accommodation access	Employment and skills plan Consultation framework Community Liaison Plan	SEIA
Increased demand for community facilities and services.	Consultation framework Community Liaison Plan	SEIA
Increased demand on emergency services	Consultation framework Community Liaison Plan	SEIA
Perceived impacts to community safety and community cohesion	Consultation framework Community Liaison Plan Enquires and complaints plan	SEIA
Changes in perception of personal safety	Consultation framework Community Liaison Plan Enquires and complaints plan	SEIA
Mental health of non-resident workers	Employment and skills plan	SEIA
Increased noise, vibration and dust levels due to construction activities	Environmental Management Plan Mitigation measures will be incorporated into the site design to reduce noise emissions where feasible and Best Available Technology (BAT) will be adopted, which will further reduce noise from the ISWMS at receptors Consultation framework Community Liaison Plan Enquires and complaints plan	Noise and Vibration Impact Assessment Air Quality Impact Assessment
Changes to visual amenity and sense of place	Consultation framework Community Liaison Plan Enquires and complaints plan	Landscape and Visual Assessment

Impact category	Mitigation or enhancement	Relevant EIA specialist study
Reduced traffic safety / increased risk of traffic accidents due to construction traffic	Environmental Management Plan	Traffic and Transport Assessment
Increased travel times and inconvenience for local road users	Environmental Management Plan	Traffic and Transport Assessment
Damage to roads as a result of construction traffic	Environmental Management Plan	Traffic and Transport Assessment
Increase in local employment during operation.	Employment and skills plan	SEIA
Contribution to the regional economy through procurement of goods and services, employment, and supporting growth of the renewable energy industry.	Procurement plan	SEIA
Opportunity to support local businesses through improvements in waste management	Procurement plan	SEIA
Opportunity for economic diversification	Procurement plan	SEIA
Opportunity for the project to support the growth of the tourism industry	Consultation framework Community Liaison Plan	SEIA
Increased competition for workers in local and regional labour market	Employment and skills plan	SEIA
Increased capacity of the local workforce	Employment and skills plan	SEIA
Increased demand for housing and accommodation	Consultation framework Community Liaison Plan	SEIA
Increased demand for community facilities and services.	Consultation framework Community Liaison Plan	SEIA
Increased demand on emergency services	Consultation framework Community Liaison Plan	SEIA
Community pride associated with the contribution to the circular economy.	Consultation framework Community Liaison Plan	SEIA
Perception of health risk associated with the operation of the project	Consultation framework Community Liaison Plan Enquires and complaints plan	SEIA
Changes (actual and perceived) to personal safety and hazard exposure	Consultation framework Community Liaison Plan Enquires and complaints plan	SEIA
Perceived impacts to community safety and community cohesion	Consultation framework Community Liaison Plan Enquires and complaints plan	SEIA
Changes in perception of personal safety during operation	Consultation framework Community Liaison Plan Enquires and complaints plan	SEIA
Improvements to safety and amenity during operation of the ISWMS	Consultation framework Community Liaison Plan	Landscape and Visual Assessment
Noise impacts associated with the operation of the project	Environmental Management Plan	Noise and Vibration Impact Assessment

Impact category	Mitigation or enhancement	Relevant EIA specialist study
	Mitigation measures will be incorporated into the site design to reduce noise emissions where feasible and BAT will be adopted, which will further reduce noise from the ISWMS at receptors Consultation framework Community Liaison Plan Enquires and complaints plan	Air Quality Impact Assessment
Changes to air quality due to operation of the project	Environmental Management Plan Enquires and complaints plan	Air Quality Impact Assessment
Changes to visual amenity and sense of place	Consultation framework Community Liaison Plan Enquires and complaints plan	Landscape and Visual Assessment
Increased traffic during the operation of the project	Environmental Management Plan	Traffic and Transport Assessment

9. Conclusion

This SEIA has identified and addressed the key socio-economic impacts associated with the project and provides a set of recommended mitigation measures.

The key positive socio-economic impacts with the potential to occur during construction are primarily related to an increase in employment opportunities for Cayman residents, procurement opportunities for businesses to supply goods and services, and minor increase in revenue for local businesses due to construction workers purchasing meals and other services.

The potential negative socio-economic impacts that may occur during construction are summarised below:

– Reduced amenity for some residents, businesses and community facilities in close proximity to construction activities.
– Disruptions to traffic conditions, resulting in delays and potential for increased travel times for people travelling in the local and regional area, including local community members and regional road users.

The key socio-economic benefits of the project are primarily related to the regional economic benefits associated with the development of a new, technologically advanced, industry and the diversification of the economy. In particular, the project has the potential for capacity building and upskilling of the existing workforce, and provide opportunities for new business generation to support its operations in Cayman as ERF technology is a new industry for the region.

Additionally, due to the nature of the facility, involving the production of green energy, the recovery and reusing of materials and the overall improvements to current waste management practices in Cayman, residents may experience a sense of community pride associated with the contribution to the circular economy. This may in turn support the tourism industry to achieve its aspirations for sustainable and nature-based tourism practices as a large waste contributor on the island.

The key negative socio-economic impacts during operation are related to the perception health and safety risk associated with the operation of the project and potential changes to local amenity for some residents and businesses in close proximity to the project site due to changes in air quality, noise and visual amenity.

The positive and negative social impacts identified and assessed in this report would be managed and mitigated through a range of measures, including those recommended in other EIS technical papers.

The SEIA has identified the following recommended mitigation measures from the *Works Delivery Plan* (ReGen, 2023) to minimise potential social impacts, and to enhance social benefits:

– Employment and skills plan
– Consultation framework
– Community Liaison Plan
– Enquires and complaints plan
– Procurement plan

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