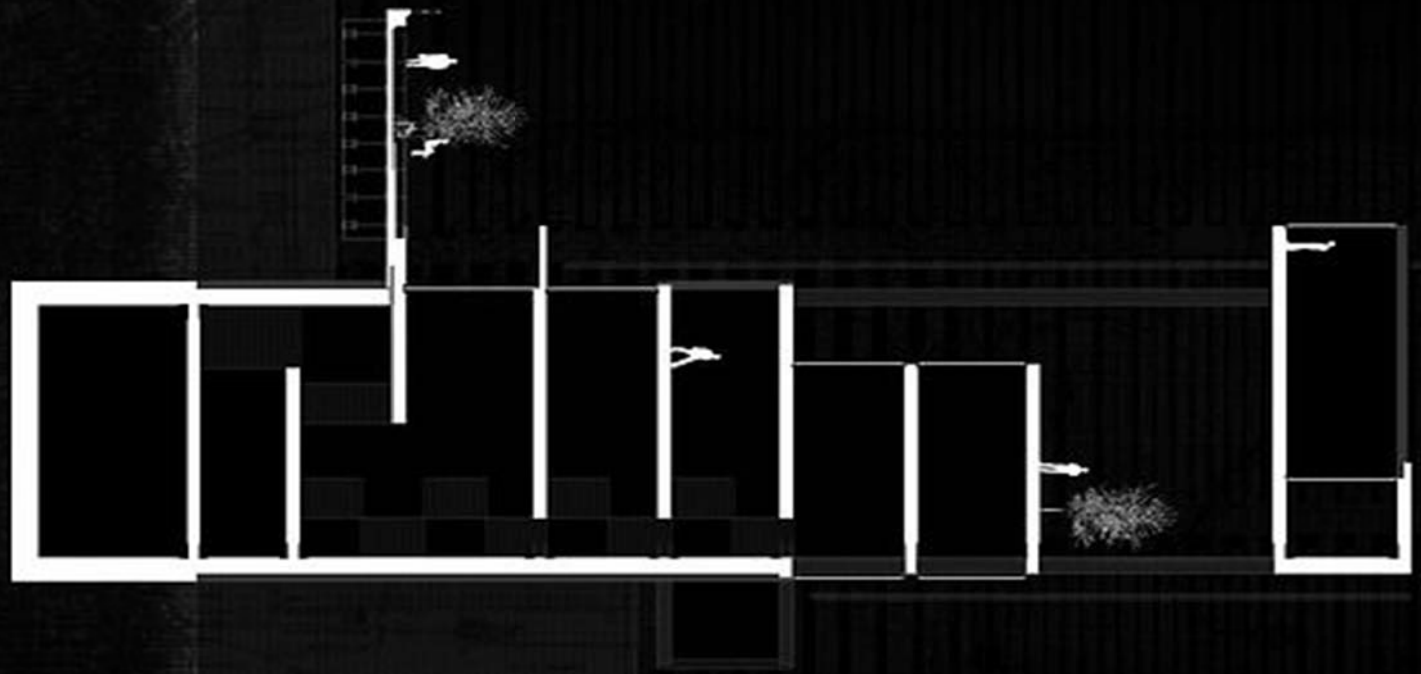
+ Associates Inc.

Environmental Impact Statement (E.I.S.)

Environmental Study for St. John's Redevelopment Global Ports Holding Antigua Cruise Ports Project 2023



REDEVELOPMENT AND REFURBISHMENT OF ST. JOHN´S HARBOUR

Environmental Impact Statement

submitted to the

Development Control Authority

By

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ACKNOWLEDGEMENTS

This EIS was prepared by CJC+ Associates Inc. under the guidance of the Department of the Environment and the Development Control Authority. We take this opportunity to acknowledge all consultants and agencies who contributed to the final report to include Mr. Ruleo Camacho (MSc, MSc) - Marine Ecologist, the Department of Analytical Services and Caribbean Water Treatment Ltd. The report was prepared by Ms. Simone Dias (MSc) - Urban Development Planner/Environmental Consultant.

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EXECUTIVE SUMMARY

Global Ports Holding (GPH) was established in 2004 and is the world's largest cruise port operator. The group holds a unique position in the cruise port landscape and has positioned itself as the world's leading cruise port brand, with an integrated network of cruise ports operating 27 cruise ports in 14 countries including Antigua & Barbuda. GPH-Antigua Cruise Port ("GPH-ACP"), the project proponent is the gateway to the city and serves as a transit port handling over 800k passengers annually. GPH-ACP engaged Tabanlioglu Architects (The Architect) and CJC+ Associates Inc. (Local Consultant) to provide design for the construction of the entire leased area as per GPHS's Concession Agreement with the Government of Antigua & Barbuda (GOAB) with the final intention of investing over $25 million USD to the upgrade and revitalization of the St. John's downtown and Point Wharf areas.

The construction of the 5th berth by GPH and dredging of harbour basin was completed in December 2020 which gives Antigua the possibility to accommodate cruise ships up to 365m LOA. The redesigned area will promote a mix of viable social and economic opportunities in the area for both cruise visitors and locals including waterfront development for commercial and public uses and the integration of the such with the rest of the town which contributes to the activation of urban regeneration of St. John's City. The project site is located within downtown St. John's City between Newgate Street and Whapping Lane. The area of interest is a mixed used area, and home to a combination of residential and commercial/industrial enterprises. These include private homes, Barnes Funeral Home, parking lot, local shops, bars and restaurants and entities such as the Antigua & Barbuda Workers Union among others.

The current site is relatively flat however there is evidence of ponding throughout the terrain indicating poor drainage. The land is currently below the level of the fifth berth and would need to be backfilled to meet elevation requirements within the architectural, engineering designs and to avoid flooding. St. John's city is a core of predominantly commercial uses mixed with some residential, institutional and small pockets of light industrial activity. Specifically for the project site, the land use criteria are currently designated for Industrial, Urban Settlement and Transportation (port of entry).

The project proponent's investment will facilitate construction of a project site that spans 17,240 square metres. Features of the project includes a new terminal with the border security requirements of a port of entry, an ultramodern waterfront day club featuring several pools, a state-of-the-art casino, local food-and-beverage outlets, restrooms, parking lot, wastewater treatment plant and approximately 70 to 100 retail spaces for local entrepreneurs.There will be direct benefits to the surrounding community, residents, visitors, and cruise passengers by ultimately creating links between the commercial businesses and improvement of the community's social infrastructure, cultural sites, attractions, innovative public and commercial functions. Importantly, the construction and operational phases will create local jobs for the community. The project proponent has acquired some surrounding properties to facilitate the development and have cleared most of the land on the site. Site visit revealed evidence of minor "ponding" classified as unwanted pooling of water caused when water mostly from rainfall is diverted into a lower area that has no outlet or poor drainage. The land is currently below the level of the fifth berth and would need to be backfilled to meet elevation requirements

within the architectural, engineering designs and to avoid flooding. The project site already has infrastructure for public utilities (water and electricity), and site visit revealed that at least two community open drains outside the project site boundaries. However, the drainage pipes run through the project site for the outfall into the harbor. These drains are publicly managed by the Ministry of Housing, Works, and Urban Renewal, however in keeping with proposed designs GPH-ACP will endeavor to maintain the flow of this existing drainage channel in keeping with environmental standards to minimize flooding and other hazards.

The DOE reviewed Plan Application *"#A635- 2022-Cruise Port Terminal (Point Wharf)"* regarding the proposed development and its ancillary facilities and was accompanied by structural MEP details, a master plan with site and floor layout. On October 20th, 2022, a site visit was conducted by the DOE to the proposed project location. The DOE mandated the following conditions should be met and addressed: (1) Agreement with the DOE regarding permits to remove trees on the project site listed as protected under the Environmental Protection and Management Act (EPMA 2019), (2) National Office of Disaster Services (NODS) approved Disaster Plan and (3) Addenda to the EIA regarding sewage and wastewater treatment, and geotechnical surveys to gain full construction approval. The DOE recommended in its review, that the DCA confer conditional approval to the application and for the DCA to instruct the developer to conduct supplemental environmental studies to address the identified risks.

This document therefore serves as an addendum to the previously submitted EIA in 2017 covering; the table of combined risks brought forward from Application #G01-2018 related to development activities pre-and during construction, and construction oof the wastewater treatment plant. Additional risks identified concern sewage and wastewater treatment, water management, geology and hydrology, disaster management and tree removal. The main aspects that will be addressed in this assessment relates to the general issues from Application #G01-2018, construction and operation of the WWTP, where a coastal survey was recommended to determine how far out the effluent outfall should be, and soil/borehole testing (geotechnical survey) to advise on the ability to carry operating load of the structure. GPH-ACP was responsible for producing the disaster management plan.

To produce this report, several assessment methodologies were used including marine water quality testing, coastal/marine survey, site surveys, remote sensing using drone/ Google Earth, desk-based analysis of published literature, socio-economic data and other relevant information, and review of previous studies. To minimize the environmental impacts identified, GPH-ACP will employ mitigation measures that addresses general issues regarding the construction phase of the project and those specific to construction/operation of the Wastewater Treatment Plant. An Environmental Monitoring and Management Plan (EMMP) guideline as well as a Waste and Pollution Monitoring Plan (WPMP) has been developed to ensure the proper procedures are in place for compliance with health and environmental standards and regulations. The EMMP outlines plans for sewage treatment and stormwater runoff.

Based on the findings, including considerations for baseline conditions, environmental impacts, current land use and zoning, there were no major concerns identified that would prevent the project moving forward. This conclusion is also based on the project following the proposed design and mitigation efforts and implementing the proposed EMMP and WPMP.

1 INTRODUCTION

As mandated by the Physical Planning Act (PPA) of 2003, planning applications to the Development Control Authority (DCA) which require additional review and consideration for environmental impact is referred to the Department of Environment (DOE) for further recommendation on approval. The DOE reviewed Plan Application #A635-2022-Cruise Port Terminal (Point Wharf) via report (Annex 1), regarding the proposed development of a Cruise Port Terminal and its ancillary facilities.

The #A635-2022 submission was accompanied by structural MEP details, a master plan with site and floor layout. The report references previous applications namely, #G01-2018, #A381-16, #A193-17 and #A166-19 and a 2017 Environmental Impact Assessment (EIA) associated with this project, that provides the adequate baseline data toward the development albeit without associated building plans. The DOE previously identified in Application #G01-2018 a table of combined risks associated with the development pre- and post-dredging and pre- and during construction. The risks associated with the pre-construction phase have been reiterated by the DOE in #A635-2022 indicating they are still in effect, with additional risks namely, sewage and wastewater treatment, water management, geology and hydrology, disaster management, traffic, and tree removal.

On October 20th, 2022, a site visit was conducted by the DOE to the proposed project location. The DOE then prepared its review of Application #A635-2022 and provided CJC+ Associates Inc (Local Consultant) its report. The DOE recommended in its review, that the DCA confer conditional approval to the application and for the DCA to instruct the developer to conduct supplemental environmental studies to address the identified risks. Additionally, the DOE mandated the following conditions should be met and addressed: (1) Agreement with the DOE regarding permits to remove trees on the project site that are listed as protected under the Environmental Protection and Management Act (EPMA 2019), (2) National Office of Disaster Services (NODS) approved Disaster Plan and (3) Addenda to the EIA regarding sewage and wastewater treatment, reverse osmosis[1], and geotechnical surveys to gain full construction approval.

This document therefore serves as an addendum to the previously submitted EIA in 2017 covering; the table of combined risks brought forward from Application #G01-2018 related to the development activities pre- and post-dredging and pre- and during construction, details surrounding the construction and operation of the wastewater treatment plant (WWTP) where a coastal survey was also recommended to determine how far out the effluent outfall should be, soil and borehole testing (geotechnical survey) to advise on the ability to carry operating load of the structure. This document does not elaborate on disaster management/mitigation as the project proponent, GPH-ACP has accepted responsibility to produce this document which will be attached as an Annex to this report.

The document follows the format and addresses the issues requested by DoE to professional standards and engaged consultants with specialties in Urban Planning (Regeneration, Infrastructure planning etc.), Environmental Impact Assessment (EIA), Socio-economic

[1] As a point of correction on the project proponent's behalf, there is no reverse osmosis within this project, thus the study did not account for this feature or its technology.

assessment, Biodiversity, Marine assessment, Environmental monitoring, Stakeholder Engagement, and Geographic Information Systems (GIS). Several assessment methodologies were used including marine water quality testing, coastal/marine survey, site surveys, drone and satellite imagery, desk-based analysis of published literature, socio-economic data and other relevant information, and review of previous studies.

1.1 Project Proponent

Global Ports Holding (GPH) was established in 2004 and is the world's largest cruise port operator with an established presence in the Caribbean, Mediterranean, Asia-Pacific regions, including extensive commercial port operations in Montenegro. The group holds a unique position in the cruise port landscape and has positioned itself as the world's leading cruise port brand, with an integrated network of cruise ports operating 27 cruise ports in 14 countries. This network allows GPH to transfer best practices to its subsidiaries and contribute to the development of the cruise industry.

GPH Antigua Cruise Port ("GPH-ACP"), the project proponent has engaged Tabanlioglu Architects (Architect on Record) and CJC+ Associates Inc. (Local Consultant) to provide design for the construction of the entire leased area as per GPHS's Concession Agreement with the Government of Antigua & Barbuda (GOAB) with the final intention of investing over $25 million USD to the upgrade and revitalization of the St. John's downtown and Point Wharf areas and its tourism potential. Figure 1 outlines the areas of concession by ACP in magenta. The project proponent's investment intends to update and improve the offerings of the cruise tourism industry with objectives including but not limited to increasing the number of terminals for dockage by cruise ships, the activities available to tourist and locals, and improve the aesthetics of the area.The project proponent has also contributed the other areas nationally such as providing USD $5 million to the Prime Minister's Entrepreneurship Development Fund.

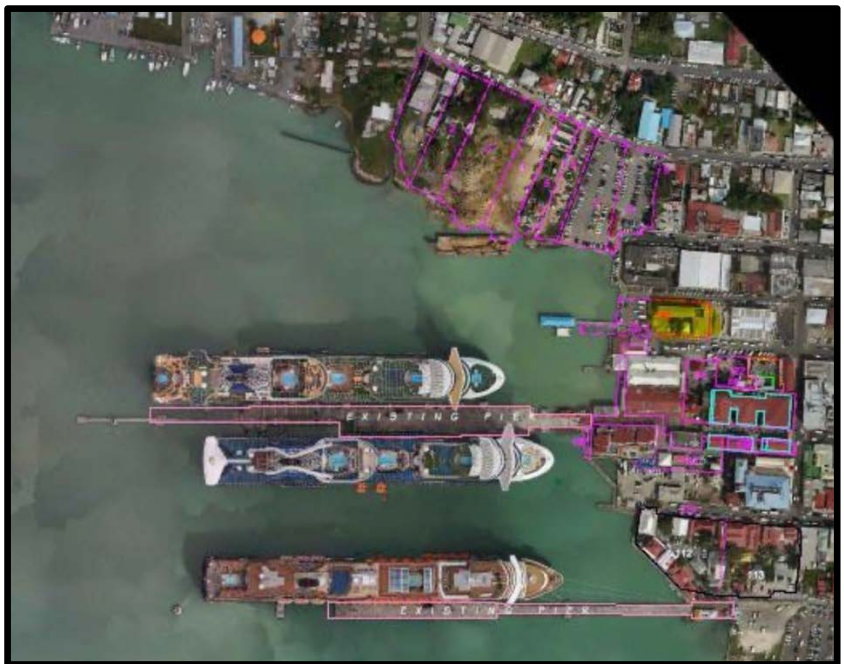

Figure 1: Outline of project boundary and areas under concession by ACP in magenta (ACP,2022)

1.2 Project Purpose

The overall purpose of the project is to develop the St. John's ACP's leased waterfront area, and refurbish the existing Heritage Quay Complex. The Project is expected to begin its upland development project by May 2023 and developers are redesigning the ACP leased waterfront area and refurbishing the existing Heritage Quay Complex.

The project proponent's investment will facilitate construction of a project site that spans 17, 240 square metres which includes: new terminal with the border security requirements of a port of entry, an ultramodern waterfront day club featuring several pools, a state-of-the-art casino, local food-and-beverage outlets, restrooms, parking lot, wastewater treatment plant and approximately 70 to 100 retail spaces for local entrepreneurs. This new attraction will be accessible to cruise passengers, other visitors, and locals and residents of all ages with consideration for circulation of vehicular traffic and patrons. The development is expected to accommodate approximately 1.2 million visitors per year, with a peak flow of 4,800 maximum visitors per day.

1.3 Project Benefits

Given the project site and its adjacent areas as an established and active cruise and shipping port, the marine area has been previously dredged and is therefore considered to be disturbed and not "virgin material". The proposed works will supplement the existing benefits of the area as a whole and improve the efficiency and ease of movement for passengers and locals to facilitate positive knock-on effects throughout the shipping, construction, pleasure craft , vending, entertainment, and commerce industries. The project is expected to provide a unique experience to the downtown core and serve as a creative center for locals and passengers to connect with St. John's in a way that has never been experienced.

This intended vision for the upgraded passenger experience will allow cruise passengers to connect with local artisans and entrepreneurs in the new retail spaces, an opportunity to experience local cuisine which will educate visitors about Antigua & Barbuda's culture and stimulate return visitors, increase attractiveness for passengers as Antigua becomes an irresistible stop for passengers who want to experience something a little more unique when booking a cruise vacation. The project also promotes improvement of basic services such as electricity, wastewater treatment through residual benefits by improving the functionality of the overall operations.

The successful implementation of this project will have many positive developments for the economy as it will expand the amount of shopping options offered within the Heritage and Redcliffe Quay areas giving locals the opportunity for entrepreneurship. The redesigned area will promote a mix of viable social and economic opportunities in the area for both cruise visitors as well as locals including waterfront development for commercial and public uses and the integration of the such with the rest of the town; contributing to the activation of the urban regeneration of St. John's City.

The attractive and functional waterfront area will be beneficial to the surrounding community, as well as, residents, visitors, and cruise passengers by ultimately creating links between the commercial businesses and improvement of the community's social infrastructure, cultural

sites, attractions, innovative public and commercial functions. Importantly, the construction and operational phases will create local jobs for the community. The redevelopment will also include upgrades to the Heritage Quay shopping Centre whose improvement is a matter of urgency for GPH-ACP and the GOAB owing to natural deterioration of long-standing drainage infrastructure, pavements, stairs, and other areas. The state-of-the-art project will include the implementation of solar panels to supplement power to the development.

In full complement to the project, the GOAB will also upgrade the road infrastructure conditions of Newgate Street (adjacent to the site) and the surrounding lanes to support these improvements. Similarly, the GOAB is also engaged in other investment opportunities to improve housing conditions a few roads from the development. Construction is expected to commence once full construction approval is received. The project is expected to have minimal environmental impact once all mitigating protocols outlined in the subsequent sections are fully utilized.

1.4 Project Site Location and General Conditions

I. Cruise Port Location

St John´s is a port town located in West Indies (Leeward Islands, Caribbean Sea) and the capital city of Antigua and Barbuda. Located on Antigua Island's northwestern coast, the town covers land area of approximately 10 km2 (4 ml2) and has population of around 22,000 people. St Johns is also the country's commercial center and main seaport. A major factor in the growth of businesses and other uses at the waterfront has been the growth of cruise tourism. Before 2020, Antigua had max capacity of 4 large-sized ships at a time at St John Ports' two quays. Most cruise liners were berthed at Heritage Quay pier, the newest and largest of the two quays. When the port had scheduled more than 4 vessels at a time, some of the ships were berthed at Deep Water Harbour Terminal. Heritage Quay and Redcliffe Quay are key shopping areas that depend on patronage by cruise passengers.

This facility is located approx 1.5 km (1 ml) from downtown. Sometimes, smaller- sized ships anchor at English Harbour (on the island's southern coast). The construction of the 5th berth by GPH and dredging of harbour basin was completed in December 2020 which gives Antigua the possibility to accommodate cruise ships up to 365m LOA.

II. Heritage Quay

Within the Heritage Quay there is a 2-story cruise terminal building and numerous duty-free shops selling electronics, jewelery, liquors, tobaccos / cigars, designer clothing and watches, local music, fine china and crystal, cosmetics, perfumes, sport equipment, swimwear. Shopping is easy as there are no restrictions to the duty free services once proof of travel status is provided. At the Heritage Quay terminal there are also specialty restaurants and bars. Heritage Quay's last renovation was in December 2006. Figures 2 and 3 showcases a view of the Quay with and without activity.

Figure 2: Heritage Quay Duty-Free Shopping Complex (Google Images, 2023)

Figure 3: Heritage Quay Duty-Free Shopping Complex with Tourists and Cruise Ships (ACP, 2023)

III. Redcliffe Quay

St Johns port's second Quay is located at one of town's oldest parts, dating back from the 17th century. The docking area used to be among the busiest Caribbean trading centers in the 18th century. The Redcliffe Quay terminal has boutiques, bars, cafes, restaurants (approx. distance between Heritage Quay and Redcliff Quay is 240m). Figure 4 showcases a view of a portion of the Redcliffe Quay and Figure 5 shows the locations of both quays relative to each other.

Figure 4: Entrance to the Redcliffe Quay (Google Images, 2023)

Figure 5: Relative Location of Redcliffe Quay and Heritage Quay (Google Images, 2023)

IV. The New Cruise Ship Pier in St. John's Bay

The third quay that can accommodate the largest cruise ships in the world was completed in December 2020 by GPH. The intention is to offer both transit and turnaround services. There is also 20,000m2 land at the back of the pier as part of the leased area, which will be developed by ACP well. Pre-pandemic, Antigua handled about 800,000 passengers annually. With the port's re-developmentunder Antigua Cruise Port through a 30-year lease agreement between GPH and Antigua and Barbuda Government, the destination will be able to serve as many as 1m cruise visitors every year. Figure 6 showcases the changes made since 2020.

Figure 6: Project Site, Fifth Berth, and Proposed location of Wastewater Treatment Plant (ACP, 2022)

The area of interest is a mixed used area, and home to a combination of residential and commercial/industrial enterprises. These include private homes, Barnes Funeral Home, parking lot, local shops, bars and restaurants and entities such as the Antigua & Barbuda Workers Union among others.

The project proponent has acquired some surrounding properties to facilitate the development and have cleared most of the land on the site (Figure 7). There is evidence of minor "ponding" such as in Figure 7 and in several other areas on the project site which is classified as unwanted pooling of water caused when water mostly from rainfall is diverted into a lower area that has no outlet or poor drainage. Over time, if not rectified, this will create deeper pools, allowing more water to sit, eventually creating permanent water features on the landscape. The land is currently below the level of the fifth berth and would need to be backfilled to meet elevation requirements within the architectural, engineering designs and to avoid flooding.

The project proponent's arrangements for water supply includes a direct service line from the Fort James Reverse Osmosis Plant as its primary source, while its secondary source of water

supply would be from the public water lines in St. John's from the Antigua Public Utilities Authority (APUA). In the event of emergencies where the mentioned water supply avenues are disrupted, project proponent will utilize pool water while potable water is trucked into the facility.

Figure 7: Overview of General Site Conditions including evidence of ponding

The project proponent requested permission from the DOE to remove at least eleven (11) trees from the project site with majority being West Indian Mahoganies (*Swietenia mahagoni*) which is listed as a protected species under schedule IX under EMPA 2019 (Figure 8).

Figure 8: Mahogany Trees currently on Project Site to be removed to facilitate construction

Because mahogany trees are listed under EPMA, 2019 as protected, the DOE assessed the site and determined their removal was unavoidable. A further recommendation was made that where trees are removed, re-vegetation should occur at a 2:1 ratio. The “Local Consultant” was advised to conduct negotiations with the DOE regarding remediation options for re-vegetation with the options outlined in Annex 2. The project proponent and the DOE decided on Option C and logistics are currently being coordinated to fulfill this.

The project site already has infrastructure for public utilities (water and electricity), and there are drainage lines running under the site given its previous use. Site visit revealed that at least two community open drains (Figures 9 and 11) run outside the project site boundaries with the drainage pipes run through the project site for the outfall into the harbor. These drains are publicly managed by the Ministry of Housing, Works, and Urban Renewal. However, in keeping with proposed designs, GPH-ACP will endeavor to maintain the flow of this existing drainage channel in keeping with environmental standards to minimize flooding and other hazards.

Figure 9 outlines the open drain to the west of Barnes Funeral Home, east of a residential property and its opening to the north. It is unknown the direction of the flow as the water was stagnant during the site visit, however further observation of the site suggests that several pipes from the community to be discharged into the harbor and are all connected. Additionally, the pipes in Figure 10 run from the project site to this drain based on similarities with the surroundings in Figure 9 (through the waterway).

Figure 9: Open Community drain from north of project site and west of Barnes Funeral Home

Figure 10: Observed drainage pipes within project site suggesting direction flow into community drain

Figure 11: Community Drain within project site which is disposed into St. John's Harbour

St. John's city has no central sewage treatment system to treat wastewater or other waste, therefore untreated waste and materials currently run directly from drains within the surrounding community or wider urban area via the observed black pipes in Figure 11, onto the project site and into the harbor. The formed waterway is partially covered with concrete as

observed in Figure 12 and traverses the project site up until the coastline where the water is then discharged into the Harbor as seen in Figure 13.

Figure 12: Concrete covering for formed waterway on project site

Figure 13: Continuation of concrete covering outlining discharge area from waterway on site

Figure 13 also displays the proposed location of the wastewater treatment plant which is currently outside of the fenced project site seen in Figure 12. The area comprises of derelict buildings (Figure 14) which were once residential properties. Adjacent to this location is another residential property then the Point Wharf Fisheries Complex.

Barnes Funeral Home is immediately north of the project site and could potentially be a point source of pollution where Persistent Organic Pollutants (POPs) may be utilized within their operations. CJC+ Associates Inc. contacted the manager for clarity on their waste disposal practices and it was outlined that the facility currently disposes of their waste within designated pipes which leads to a concrete receptacle within the property and is removed by a private waste management company every four to six months depending on workload (February 13th, 2023, pers. Comm.).

As construction and operation progresses, the project proponent would benefit from further discussions with the proprietors of the funeral home to determine the specific POPs utilized. GPH-ACP has no jurisdiction on the operation of the funeral home and there is no construction scheduled for this area.

Figure 14: Current site conditions of proposed wastewater treatment plant location

1.5 Methodology

The establishment of a Sewage and Wastewater Treatment Plant will present additional environmental challenges to the area. Principal among them will be the establishment of a discharge location for the effluent and the impacts that this effluent will have on the marine environment also taking into consideration cruise ship traffic and any coastal features given proximity to Rat Island, St. John's Port, and the Distillery (also has outflow pipes), surrounding areas, pollution, and flood risk concerns. Similarly, it is important to understand the conditions of the area post- dredging activity and to observe the current activity and potential changes, thus supplemental field visits were required to support the collection of data informing the

overall report. To better understand the area and impacts and to determine possible options for mitigation, the following was conducted:

I. Biological and Field Assessments

a) Coastal/Marine Survey

To understand the marine benthic make-up of the study area, a survey area was created on QGIS. This was done by creating a 50m buffer on the proposed area. This buffer zone was to ensure that all ecosystems associated with the proposed project area were captured. Visual assessments were conducted of the area for suggested construction of the sewage plant, the area where the facilities of the GPH will be constructed, and other marine environments adjacent to the site were taken.

No in-water surveys were conducted due to safety concerns for participating individuals and visual limitations due to the conditions of Deep-Water harbour. Prior to the actual survey, scoping was done to determine equipment and other factors. This was to ensure a thorough observation and identification process was completed. Using Google Earth and Maps for spatial analysis, an estimate of the proposed project area was established.

b) Marine Water Quality Testing

The team commissioned The Department of Analytical Services within the Ministry of Agriculture, Lands and Barbuda Affairs to perform water quality sampling within the site area to establish a baseline of existing marine quality conditions. Snapshot Samples were taken in (4) sites, over a one-day- outlined in Figure 15 to establish baseline measurements for possible impact zones for effluent material discharge. This will be used to decipher a holistic picture of the water quality prior to plant operations. The results from the sampling process will be reviewed in the future to measure the potential effects of the proposed wastewater discharge upon the quality of the marine environment.

Follow up sampling on the part of the project proponent and the WWTP maintenance team should be conducted to deduce this. During the surveys a sampling rod with a polycarbonate bottle attached was immersed one foot below the water's surface; in the direction of the flowing water to prevent contamination. The parameters tested included: Temperature (C), pH, Turbidity (NTU), Phosphate (ppm) Enterococci (cfu/100ml) Escherichia coli (mpn/100ml) Nitrate (ppm), Dissolved Oxygen (ppm), and Faecal Coliform (mpn/100ml).

Figure 15: Marine Water Sampling Site Locations (Google Earth, 2023)

II. Desk-Based Analysis

To complete the environmental report, existing data and reports were collected and reviewed with due consideration for the large amount of data available from previous studies, such as historic technical studies and reports relating to the site and surrounding areas which were critically appraised to determine existing circumstances. Additionally, assessment of maps, charts, and unpublished and published literature and technical/non-technical documents were also utilized to supplement an understanding of baseline conditions.

This collection of information was supported by professional expertise and literature review. These will be used to update the already established baseline for the project site and provide a baseline pre-construction. The information was also used to inform recommendations for the technical issues raised.

III. Stakeholder Consultation

Through inception meetings with the client, public and private sector actors, and commercial stakeholders, relevant information to inform report, construction methods, and issues regarding general implementation were received via liaising with relevant parties.

1.6 Policy and Legislation

The following policies and legislation have been considered and incorporated into this report:

- Physical Planning Act 2003
- The Fisheries Act 2006
- Coastal Setback Guidelines (2015 Draft)
- Environmental Protection and Management Act 2019
- The Sustainable Island Resource Management Plan (SIRMZP)
- National Solid Waste Management Authority Act 1995 and (Amendment) 2005
- Noise Abatement Act 1996
- Pesticides and Toxic Chemicals Control Act
- Litter Act
- Public Health Act

1.7 National Climate Change Commitments

As a Party to the Paris Agreement, Antigua and Barbuda through its projects and programs have committed to reducing greenhouse gas (GHG) emissions, despite its negligible contribution of less than 0.002% of all GHG emissions. In Antigua and Barbuda, the largest source of GHG emissions comes from the power and transport sectors. Thus, the country had set several aspirational targets through Intended Nationally Determined Contributions (INDCs) for emissions-reductions from these sectors. In 2020, as part of the revision process, the updated NDC aims to cut emissions from these sectors by developing more robust and implementable mitigation commitments. Several actions have been proposed to achieve these targets which include, enhancing the legal, policy, and institutional environment for low-carbon development pathways; establishing energy-efficiency policies for vehicles and appliances; elimination of a fuel surcharge tax on electricity bills; installation of over 270 MW of renewable energy; 100% renewable energy for all government operations; 100% electric vehicles for the government vehicle fleet; and a ban on imports of new combustion engine vehicles.

These national climate change commitments there include actions for mitigation and adaptation especially designed to achieve the 1.5-degree goal and to also fulfilling the following actions by 2030:

- Support youth with a gender-responsive approach for girls and boys of all income levels to meet the new challenges and opportunities that the process can provide
- Provide investment and business opportunities for local micro, small, and medium enterprises
- Reduce transitional risks
- Support an inclusive, gender-responsive approach to the energy transition with a special focus on women fully participating in the new economy

1.8 Limiting Conditions

Inherent in any environmental study are limitations on the content and scope of work included in the report. Evaluating the balance of possibilities regarding future events is not an exact

science but may be based on what has happened in the past, impacts that have occurred in similar situations or from scientific literature predicting future impacts such as those from climate change. Any time topography is altered, or natural environments are removed, predictions may be well informed based on extensive modelling, but possibilities for error will remain. Assumptions are made based on the willingness of the developer to follow mitigation plans, monitoring and recommendations made by this report. There are also assumptions related to the effectiveness of these mitigation efforts in reducing environmental impacts to acceptable levels. Other limitations include lack of long-term (10+years) marine water quality data to determine water quality trends to determine the significance of the impact of the construction of the wastewater treatment plant. Similarly, due to time and financial constraints the open drainage systems within the project site were not tested as point sources of pollution which would have established relevant baselines for pollution control after the establishment of the plant and its effluent discharge.

1.9 Analysis of Alternatives

I. No "Project" Action

The 'No-Project' alternative option concerns the environmental and social outcomes if the development does not gain the proper approval and does not proceed. With the no-project option, there is a risk of reduced attractiveness for cruise ship vessels to make Antigua & Barbuda their port of call. This also means low return on the investments already made by the project proponent. This would hinder economic development in Antigua & Barbuda, particularly relating to the construction industry and other industries which rely on cement and building materials. In addition, with the no-project option, the opportunity would be lost for environmental and social improvement of present cruise operation activities, creating limited capacity for the tourism product. Through the establishment the fifth pier, the Government of Antigua & Barbuda (GOAB) has essentially locked in a commitment towards the development of this area. Hence, failure to develop the necessary facilities, especially those for home porting, could result not only in the failure of the investment but also significant confusion due to the lack of facilities to manage the increased influx of cruise passengers. There is no other proposed alternative action to achieving the project objective apart from pursuing this development.

II. Use/Development of Alternate Location

The project proponent has not sought alternatives to the site because it is the most suitable access point where lands were leased through partnership with the GoAB and directly adjacent to ongoing developments. To this end, because of its favorability, the intention is to enhance the existing qualities and specifications and infrastructure of the area to ensure increased usage, safety, and attractiveness. Considering the infrastructure already exists, development at an alternate or new location is not the most cost-effective use of time and finances.

1.10 Environmental and Socio-Economic Conditions

I. St. John's

St. John's [City], situated in Antigua, is the capital of the three-island nation of Antigua, Barbuda and Redonda with a population of about 101,489. St. John's City, as the country's primary city has a population of about 25,000, which is estimated to be 25% of the country's total population. The parish of St. John's, which comprises St. John's City and St. John's Rural, administrative zones, accounts for most of Antigua's population and this high concentration of population reflects the concentration of employment opportunities, administrative functions, and social services in and around St. John's and the residential plots available within the parish over the past 30 years. This makes the downtown area dynamic due to the daily activities of residents, employees, and tourists, however, the city is congested and does not offer an attractive pedestrian environment. This congestion has increased over the years due to combined factors such as an increase in employment opportunities existing within the parish, ease at which persons are obtaining vehicles with inadequate infrastructure developments to accommodate parking in the city, increase in commercial activities, and to some extent urbanisation. St. John's city, at the head of a deeply indented harbour, is not only the residential capital of the country, but the commercial, entertainment and administrative centre and comprises several historic buildings and heritage sites, which are important for heritage tourism.

The St. John's Harbor is a primary port of entry within the island territory of Antigua and Barbuda, and provides safe anchorage for yachts, cruise ships and commercial shipping vessels. Extensive dredging has been carried out in the harbor to allow for the accommodation of larger and more vessels, which has been a driver of the local economy. Tourist cruise ships that visit the country dock in St. John's Harbour and the tourists disembark directly into downtown St. John's. The most intense area of tourism activity is located northeast of St. John's along Dickenson and Runaway Bays.[2] While hotels dominate the beachfront, inland development includes a mix of villas, cottages and medium to upscale residential housing. The expansion of the City of St. John's into St. John's Rural over the past twenty years is largely as low-density residential development that now encircles many older villages.

Further, the lack of rigorous building regulations and design standards for septic tanks results in many facilities that contaminate surface and ground water due to inappropriate siting or poor construction practices. These problems are especially present in St. John's where many lots are too small for septic tank use and effluents seep into open drains that are discharged into the harbour. For example, most residents and businesses in the city rely on septic tanks, a practice that is expensive and difficult to regulate. These problems are further exacerbated in communities such as the Point, where small lots have been further sub-divided; formally or informally, and there is increased density of residential properties as far back as from the public roadway.Development in and around St. John's continues to be influenced by the presence of the major shipping and cruise ship port. St. John's Harbour provides the infrastructure and services to support passenger and cargo sea transportation which are contributors to the local economy. Through this project, Provision has been made to continue

[2] Sustainable Island Resource Management and Zoning Plan (Genivar, 2011)

the cruise ship facility in its present location as it is ideally situated with respect to the shopping and tourism opportunities in St. John's.

a) Demographics

St. John's city comprises about 25% of the total population with about 25,000 persons inhabiting both St. John's City and St. John's rural. It is noted that the ethnic composition comprises persons of 87.3% African descent, 4.7% mixed, 2.7% Hispanic, 1.6% White, 2.7% other and 0.9% unspecified. The population growth rate is estimate at 1.17% annually, birth rate at 15.3 births per 1,000 population, death rate at 5.63 deaths per 1,000 population and net migration rate at 2.06 migrant(s) per 1,000 population. Additionally, the total median age is 32.7 years, which is further disaggregated by gender with males (30.7 years) and female (34.4 years). The population is generally youthful, comprising 41.7% of individuals between the ages of 25 and 54 years, 22.5% of individuals between the ages of 0-14 years, and 16.2% of individuals between the ages of 15-24. The population density is estimated at 4,338.0 /km² (11,235.4 /sq mi) with geographical coordinates at Latitude: 17.1167, Longitude: -61.85 and 17° 7′ 0″ North, 61° 51′ 0″ West. Of Antigua & Barbuda's 108 square miles (sq mi), St. John's occupies 3.86 sq mi.

b) Environmental Resources

Within St. John's, there is limited environmental resources due to the rapid rate of urbanization over the years. There is no beach within a walking distance from the port of Antigua. The nearest beaches to the cruise port are Dredge Bay and Pensioner's Beach, however their continued usability may be in question due to ongoing development. Fort James Beach, however is a popular beach for cruise tourism passengers (a 10-minute drive). Beaches within a fifteen-to-twenty-minute drive from the cruise port are Yepton's Beach, Runaway Beach, Deep Bay Beach, and Galley Bay Beach.

Industrial activity within St. John's has affected historical marine habitats within the bay through impacts related to contaminated overland runoff, direct discharge, dredging along with other commercial activities. Thus, the health of the marine environment has already been severely compromised and natural marine ecosystems long disturbed. Coastal observations within the previous EIA on this project as well as the coastal survey supporting this addendum report highlighted the sparse presence of Black and Red mangroves within St. John's which indicated mangrove wetlands were present and abundant in the past along the coast stretching from St. John's Public Market to the Antigua Fisheries Complex. This is confirmed closer to the project site in the Point Wharf as thriving mangrove wetland exists north of the project site. dredging to facilitate the expansion of the St. John's Harbour has decimated these ecosystems, and the area is now home to primarily benthic mud due to the frequent disturbances. Notably, the project contains at least 11 West Indian Mahogany Trees, which are protected species under EPMA 2019.

c) Land-Use and Zoning

The Sustainable Island Resource Management Zoning Plan for Antigua & Barbuda (SIRMZP, 2011) outlines the current and proposed land-use specifications for development trends in Antigua & Barbuda. Current land use indicates St. John's City as a mixed-use area comprising

of industrial activity, institutional use, transportation (port of entry), urban and rural settlements, and to some extent agriculture (rough grazing) as seen in the encircled in Figure 16. St. John's city is a core of predominantly commercial uses mixed with some residential, institutional and small pockets of light industrial activity. In most other parts of St. John's and the majority of rural settlements in the country, residential properties comprise the dominant use among building footprints.

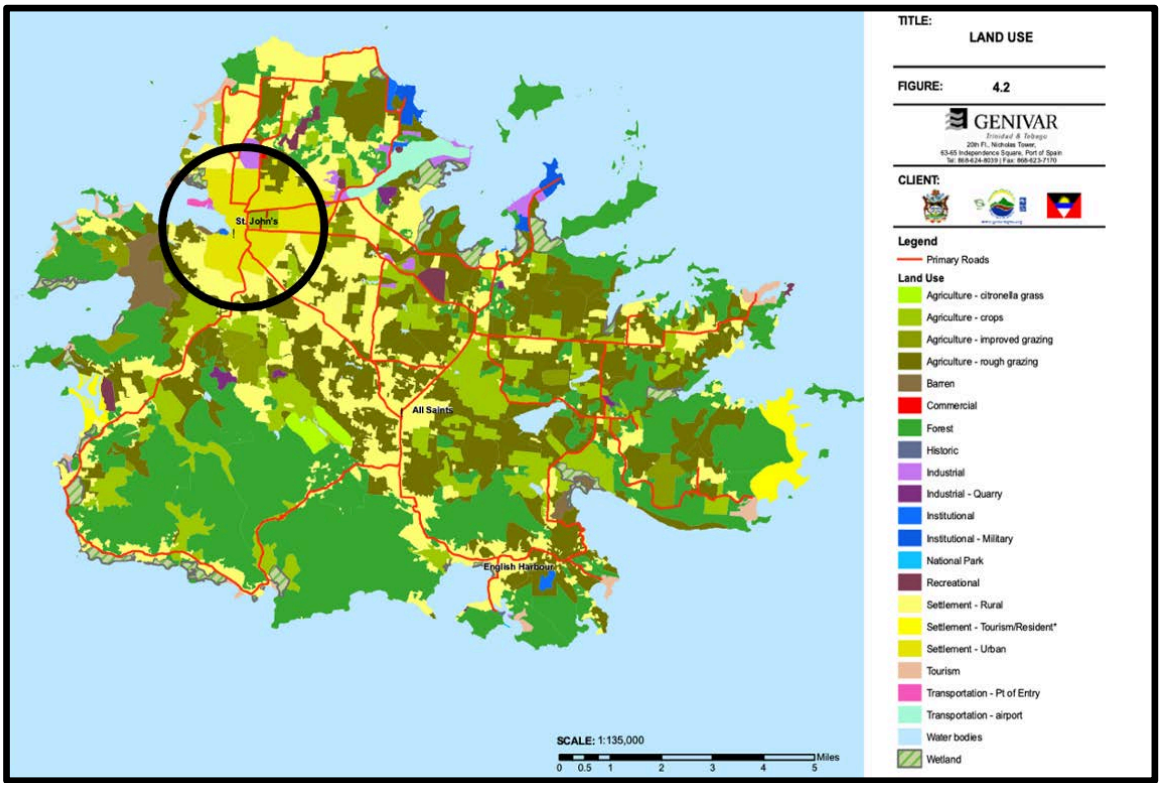

Figure 16: Current Land-Use Map of Antigua & Barbuda extracted from SIRMZP showcasing St. John's City encircled in black (Genivar, 2011)

d) Predicted Climatic Changes

As a Small Island Developing State, Antigua & Barbuda's vulnerability to the effects of climate change is well known, as the country has been historically hit by strong storms and more recently by two consecutive Category 5 Hurricanes in 2017 (one of which caused considerable destruction in Barbuda). This was detrimental to the economy. As more frequent major storms (i.e., Category 3 and higher) are expected to affect Antigua and Barbuda, there is a corresponding expectation of greater losses and damages particularly in the tourism, business, and housing/ construction sectors. Antigua and Barbuda is already experiencing some of the effects of climate variability and change through damage from severe weather systems and other extreme events, as well as more subtle changes in temperature and rainfall patterns. Temperatures are usually high year-round for the entire island, which is influenced by steady north-easterly trade winds.

The average daily temperature is around 25 °C around the beginning of the year and increases to around 28 °C during the summer months. The sea temperature ranges from 26 °C (79 °F) between January and April to 29 °C (84 °F) in September. Specifically, for the project site, although all impacts are pertinent, Hurricanes, SLR, Coastal erosion and storm

surge are significant threats to livelihoods. Fortunately, however, commencement of the construction activity falls outside of the slated hurricane season (June-November), thus storms present a low-medium threat on the project. However, the area is particularly vulnerable to the effects of storms and experience significant changes as a result. Table 1 elaborates on historically identified climate impacts, description and their risk significance and mitigation measures for this project. Detailed climate modelling projections for Antigua and Barbuda predict:

- an increase in average atmospheric temperature
- reduced average annual rainfall
- increased Sea Surface Temperatures (SST); and
- the potential for an increase in the intensity of tropical storms[3]

Table 1: Summary of Climate Impacts and Mitigation Measures

Impact	Description	Risk Significance High/Medium/Low	Mitigation Measures
Extreme Rainfall Event	Extreme rainfall is projected to occur during a tropical cyclone/ hurricane	High	Building resiliency at a national (Building Codes, adaptation policy) and community level
Extreme Drought	Increase possibility of dehydration, and disruption of water services	Medium	Ensure water/refreshment sources are available on compound for staff and clients Ensure sufficient water storage Mainstream water saving technologies and practices
Extreme Atmospheric Temperatures	Increased Surface Temperatures are likely Reduction in rainfall is expected to result in more frequent “hot days”	Medium	Integrate shade, ventilation, and adequate vegetation into the design for cooler temperatures
Hurricanes	Hurricane intensity in Atlantic is likely to increase, thus indicating stronger winds and increased rainfall which causes damage to ecosystems and coastal developments	High	Building resiliency at a national (Building Codes, adaptation policy) and community level
Sea Level Rise (SLR)	Climate change due to increased GHGs causes SLR Altered coastal processes due to construction activity	High	Coastal Defenses

[3] CARIBSAVE CLIMATE CHANGE RISK ATLAS (CCCRA), 2012. Climate Change Risk Profile for Antigua and Barbuda

e) Resources Uses

As part of Antigua & Barbuda's main industry Tourism, St. John's city plays a crucial role in catapulting Antigua & Barbuda as a regional cruise destination. Since the establishment of the 4th and 5th berths, the cruise tourism industry has diversified its audience attracting larger vessels bringing more passengers to the island. For example, the establishment of the 5th berth accommodates Oasis class ships, the largest cruise vessels in the world, capable of carrying over 5,000 passengers and 2,500 crew and requires a draught of 38 feet. Since the opening of the season, the first three months from October to December 2022 were very successful for ACP and the GOAB with more than a quarter of a million passengers arriving in the country. In January 2023, ACP welcomed Carnival Cruise Lines' biggest vessel – Arvia for homeporting. This vessel has a capacity of 5000 passengers but one thousand of them will board the vessel here in St. John's, arriving at the V. C. Bird International Airport on chartered flights and transported to the St. John's Harbor using local transportation. This progression is positive for the country's economy as stakeholders within the tourism industry will benefit from patronage of goods and services from the passengers, crew, and the vessels themselves as they stock up on supplies. Additionally, St. John's also serves as the commercial center of financial institutions, food and beverage services, retail, local/cultural vendors, and other commercial activities. Similarly, industrial activity such as operations such as ongoing construction, St. John's Deep-Water Harbour, Fisheries Complex and Antigua Distillery Plant are prominent industrial activities within St. John's.

f) Stakeholders

Within St. John's City, there are several stakeholders to consider where development is concerned owing to the variety of activities outlined. These stakeholders can be categorized into primary stakeholders who directly depend on the resources of the city for their livelihood and secondary stakeholders who do not directly use the city's resources but whose actions affect it and who use products from these resources.

Primary Stakeholders:

- National Government (DCA, DOE, APUA, NODS, MOWHUR, NSWMA, etc.)
- Project Proponent and associated partners
- Industries within Project Area
- Fishermen
- Tourists
- Vendors
- Tour and Charter Boat Operators within St. John's
- Taxi Drivers
- Storefront Owners/Restaurants within St. John's

Secondary Stakeholders:

- Hotels
- Commercial Businesses
- Developers
- Offshore Island Private Landowners
- Environmental Non-Governmental Organizations
- Civil Society and Faith Based Organizations within Community

2 PROJECT IMPLEMENTATION

2.1 Project Description

The proposal by the developer is for the construction of a cruise port terminal and ancillary infrastructure at the Point Wharf in St. John Antigua. Over the years, the cruise industry has become a major sector within Antigua & Barbuda's economy, which provides employment and business opportunities to various shops, taxis, vendors, and operators of various attractions. It is the fastest growing category in the leisure travel market, with an average growth of 7.2% per annum since 1980. The proposed project is expected elevate Antigua & Barbuda's current cruise tourism offering while maintaining its competitive edge as a destination within a popular regional cruising area. The project will have a positive impact on its stakeholders. The proposed development consists of the following features:

Parking Spaces

- 21 Small van parking space
- 29 mid-van parking space
- 26 Coaster Bus parking space
- 2 Loading parking space

Public Services

- 26 Retail Spaces
- 1 Casino
- 1 Open Kids Area
- 8 Local Bazaar Spaces
- 2 Kiosk
- 1 Baby Care
- 48 Seating Spaces in the Terminal Area
- 1 Ticket Office

Ancillary and Security Services

- 5 Security Checkpoints/ Booths
- 4 Offices
- 1 Immigration Area
- 1 Kitchen
- 7 Electrical Rooms

The development will accommodate a 71.27 m2 Sewage tank to assist with wastewater disposal and sewage treatment. An equalization tank will also assist with the alleviation of wastewater and sewage by acting as a buffer to collect the raw sewage and passing it onto the sewage treatment plant. The wastewater and disposal infrastructure will be placed on the western seaward end of the development and separated from the general property by a 12.33 ft separator wall. Green infrastructure is proposed to be woven into the development to provide recreation and environmental services such as absorption of air pollution and aesthetics. Two water and fire tanks are located on the western end of the proposed development behind a separator wall. Several hose reels to assist with fire suppression are placed through the proposed development. Site plan in Figure 17 elaborates on features of the development.

Figure 17: Site Plan with Ground Floor Plan of Project Site (Tabanlioglu Architects, 2022)

2.2 Project Duration

As a joint venture between GPH-ACP and the GOAB, there is an urgency for the project to commence due to its importance in recovering the cruise tourism sector in Antigua & Barbuda due to the negative ripple effects experienced from COVID-19. Thus, expediting this project is an important economic driver which will increase the revenue streams for the ACP and contribute to increased national gross domestic product (GDP). The timeframe for construction is estimated at 18 months with considerations for the full planning approval process. Once the approval is given, contracts will be finalized with construction commencing in May 2023.

2.3 Construction Plan/Phases

Currently, the project proponent is developing tender documents to procure a contractor to conduct the works. Therefore, details surrounding construction methods are yet to be determined as the bidding contractors would have to present their methodology within their tender submission. One requirement set by the project proponent is that the winning bid would ensure all construction phases fall within best practices that promote sustainable development. To this end, construction details are currently unavailable and will be submitted upon request once finalized. The project proponent has indicated that construction will occur in the following sequence:

- Clearing and Grubbing
- Backfilling
- Piling
- Wastewater Treatment Plant
- Utilities and Underground Infrastructure
- Super Structures
- Pavements
- Pools
- Landscaping

To address the main concern of the DOE regarding the construction of the Wastewater Treatment Plant, Section 2.4 elaborates and focuses specifically on these details.

2.4 Establishment of Wastewater Treatment Plant

2.4.1 Background

The project proponent intends to establish a Wastewater Treatment Plant (WWTP) that will facilitate the operations of the project only and will not be associated with outside sources within the St. John's area. The intention of the plant's construction is to transform the raw sewage into an easier manageable waste and to discharge the effluent to the nearest suitable point while retrieving and re-using portions of the treated water. From an environmental perspective, the most pertinent aspect of the establishment of a sewage treatment plant is the proposed disposal or use of the sludge and the treated sewage water.

The most common adverse environmental effects are on coastal waters connected with disposal or use of the sludge and the treated sewage water, are caused by: oxygen depletion due to high load of organic faecal matter, eutrophication caused by nutrients, microbiological contamination, and toxic and non-biodegradable substances originating mainly from contamination of sewage by industrial wastes.

Most sewage treatment and disposal processes are a serious source of offensive odour and some treatment processes may influence spread of pathogens through air transport. Improperly constructed, operated or ill-monitored WWTP's and improper disposal or use of sludge and treated sewage water may become a most serious public health problem. Therefore, the project proponent has sourced the technical expertise of the Caribbean Water Treatment Ltd. to carry out the scope of works, complying with national standards and internationally accepted environmental quality criteria, considering the recipient environment and the biological targets which may be affected, specifically human life. The Caribbean Water Treatment Ltd. (CWT) has recommended the installation and commissioning of a 30,000 USgpd membrane biological reactor (MBR) wastewater treatment plant for the above noted project.

The plant will be supplied by Enereau Systems Group out of Canada. The Enereau team have been involved in the design, installation and operation of MBR type wastewater treatment plants in resorts and developments across the Caribbean for over 20 years (see information sheet attached in (Annex 3). The Architect on Record, Tabanlioglu Architects has provided a wastewater plan as seen in Figure 18 which outlines mechanical wastewater lines (red) including pumping line, location of manholes, and pump station (see legend).

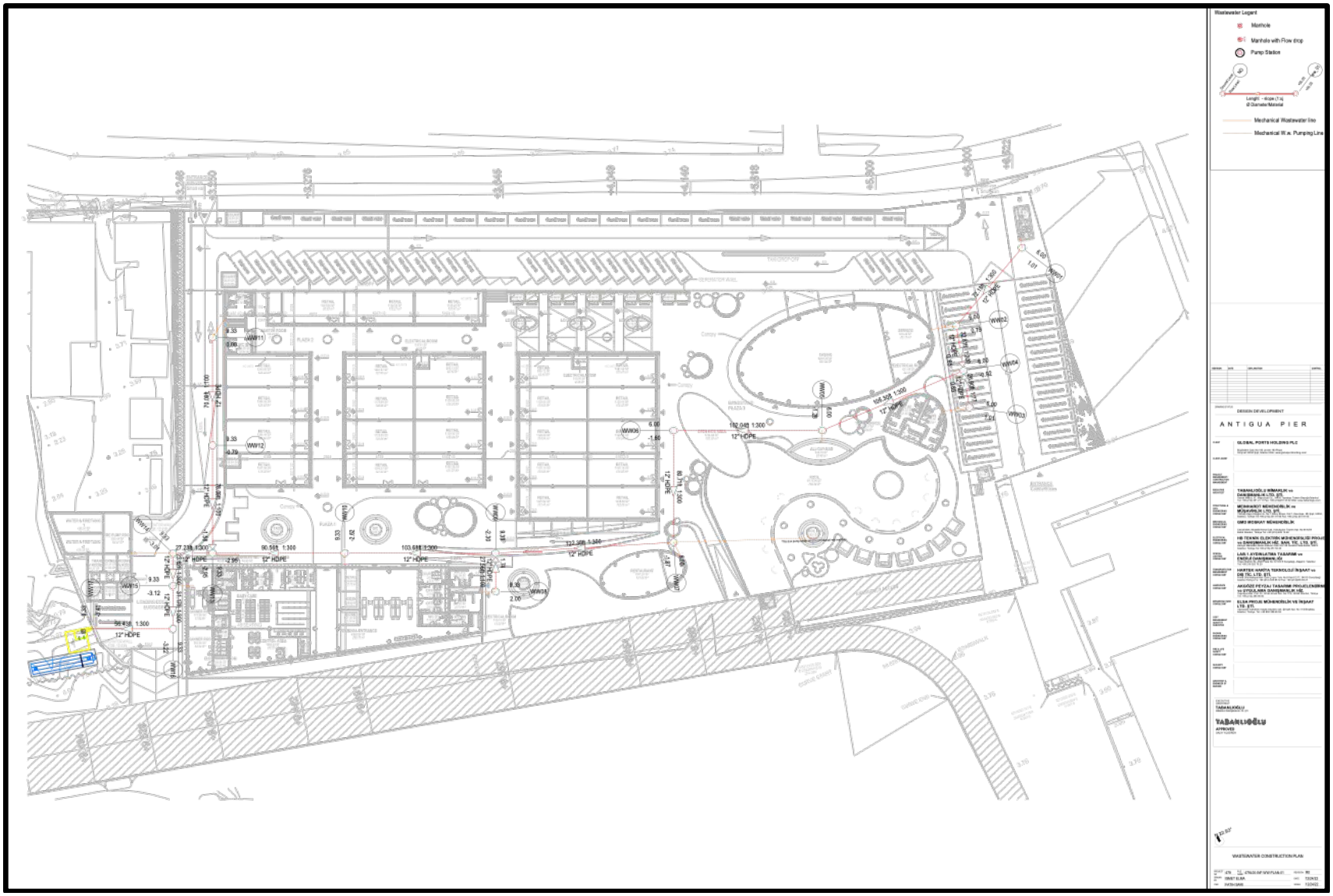

Figure 18: Wastewater Plan (Tabanlioglu Architects, 2022)

2.4.2 Proposed MBR Systems

I Enereau nrPURTM Platform

The standardized & modular design is developed around a series of standard, modular building blocks, the nrPURTM family of systems offers unparalleled flexibility and reliability for wastewater treatment systems from less than 500 USgpd to over 100,000 USgpd (2-400 m3/d). Factory assembled and tested prior to shipment, with integrated automation, permeate & CIP pumps, air scour blowers and instrumentation, the use of proven process modules to configure the specific treatment system for each unique application ensures that each platform goes together seamlessly on site and simplifies commissioning greatly. nrPURTM Technology: Best-in-Class Membrane Technologies

- Ultrafiltration separation technology (less than 0.1 micron)
- High flux with low pressure
- Low-fouling membranes
- Self-cleaning (air scour with optional backpulse)
- Temperature range: 10-45 °C

II nrPURTM Estate Series Wastewater Treatment Platform

The nrPURTM Estate is the most advanced solution for the treatment of small-flow sanitary wastewater. Featuring state-of-the-art Membrane BioReactor (MBR) technology, the Estate is designed to treat sanitary wastewater to reuse-quality standards in a compact, robust, easy-to-operate, Plug ‘n Play, modular platform. Designed and developed by a team of wastewater industry experts, the Estate offers the same, unparalleled treatment effectiveness and efficiency demonstrated in many of the world’s most advanced sewage treatment plants in a cost-effective configuration for flows of 500 to 2,500 GPD (2,000 to 10,000 L/day). With an above-ground footprint of less than 25 ft2 (2.5 m2) coupled to a small, below-ground balancing module, the Estate will fit easily into a small utility building and blend into any landscape design.

For standard domestic and light commercial sewage, the Estate will treat the wastewater reliably and consistently to an exceptionally clean, non-potable, reuse quality. For applications where enhanced nutrient removal is required, the Estate may also be configured to reduce the key Nitrogen and Phosphorus levels in the effluent to the discharge levels specified by most regulators and environmental agencies. Table 2 outlines the design parameters and Figure 19 the layout and process.

Table 2: Design Parameters of nrPURTM Estate Series MBR System

Parameter	Influent	Effluent	Units
BOD_5	250	<5	mg/L

Total Suspended Solids (TSS)	250	<2	mg/L
Total Kjeldahl Nitrogen (TKN)	55	<2	mg/L
Ammonia Nitrogen (NH_3-N	10	<1	mg/L
Total Nitrogen (TN)[1]	60	<10	mg/L
Total Phosphorous (TP)[1]	12	<1	mg/L

Notes:1 When designed for enhanced nutrient reduction

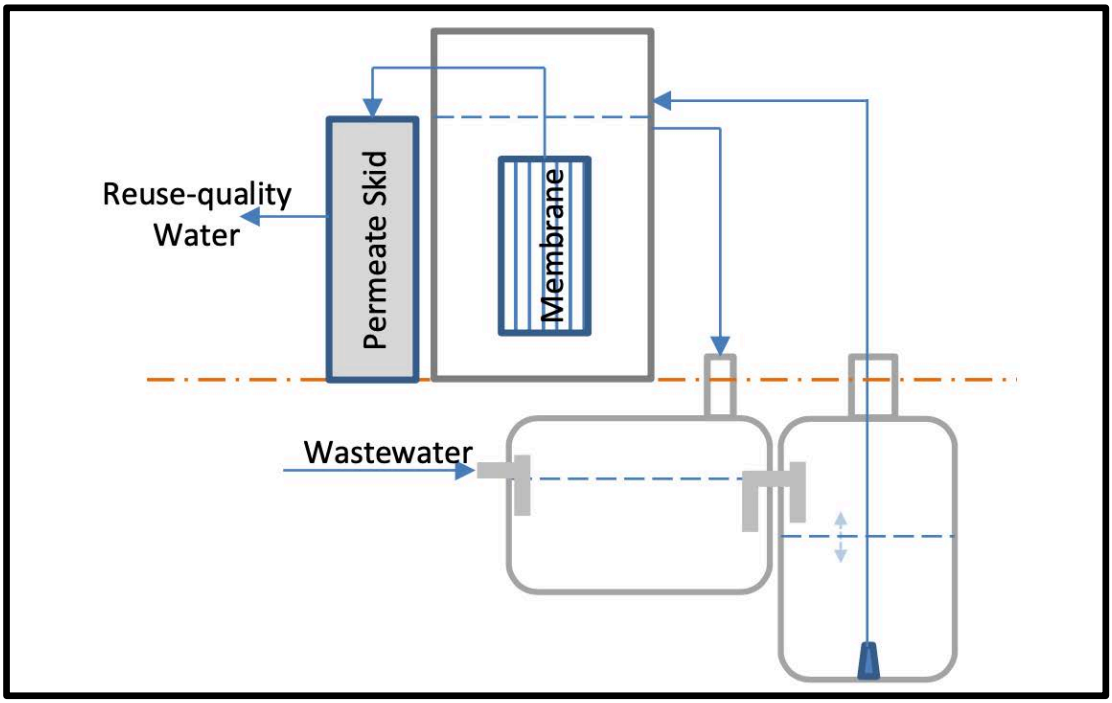

Figure 19: Layout and Process of MBR Estate Series Platform

2.4.3 Membrane BioReactor Process

Wastewater is centrally collected and pretreated to remove non-biodegradable solids and transferred to an Equalization (EQ) tank, where variations in flow and concentration are moderated. The balanced wastewater is transferred under level control to the system's BioReactor. Wastewater is recirculated between the BioReactor and the Membrane tank at a rate of 4-5 times average daily flow. The Bioreactor is a continuously stirred, complete-mix reactor designed to ensure effective biological digestion of the organic materials in the secondary aeration step of the activated sludge process. The appropriate BioReactor volume is dictated by the Food to Micro-organism (F/M) Ratio and the mass loading of BOD per cubic volume of reactor.The activated sludge process converts the soluble organic material present in the wastewater into CO2, H2O and biological cell mass.

An aeration system provides the oxygen required for this process. The mass of oxygen transferred is based upon the design daily influent BOD load. The liquid phase of the mixed liquor is pulled through the membrane at a predetermined rate, or flux, established for each specific application. The mixed liquor suspended solids (MLSS) are rejected and moved away from the membrane by the air scour and hydraulic action. Permeate is drawn through the membranes under suction by permeate pumps and discharged to a clean water storage tank or for further polishing. Typical System Results are BOD: < 5 mg/L and TSS: < 5 mg/L. Nutrient removal levels (e.g. Total Nitrogen, Total Phosphorus) may be tailored to specific discharge or reuse requirements.

2.4.4. Alternatives for Wastewater Treatment

Within scientific literature, the four common treatment options for wastewater includes aerated lagoons, conventional sludge treatment, tricking filters and deep shaft treatment. CWT has considered all possibilities and has recommended a system that is most appropriate for this development. Generally installation of sequencing batch reactors (SBR) type plants would be used such as in Heritage Quay and the Fisheries Complex in Point Wharf. These are much smaller plants and therefore have less impact on water quality in the St. John's Harbour. As this development is expected to be a direct discharge into the sea in a marine area with limited circulation and where the water quality is already very challenged, tighter effluent guidelines (tertiary rather than secondary) would need to be met.

The MBR system, although a more expensive and sophisticated system to operate can meet these tight tertiary effluent guidelines(< 5 ppm BOB, < 1ppm TSS) reliably. Given the magnitude of the project, this is the most appropriate option. On comparing these with parameters such as plant operation, maintenance needs, land requirements and treatment reliability, the project proponent has accepted the advice of consultants for utilizing the MBR system for maximum efficacy.

2.4.5 Type of Effluent

The establishment of the MBR type WWTP has been selected to provide a very high and consistent quality of treated effluent, suitable for unrestricted landscape irrigation. The plant has been sized to handle all industrial and commercial toilet and gray water generated from the Cruise Ship Terminal Facilities.

2.4.6 Number of clients to be served by the plant

The proposed treatment plant has been sized based on the following assumptions that there will be a maximum of 6,800 commercial cruise tourist passengers per day and a maximum number of 113 staff per day. The type of clients that will also utilize the services of the plant is also assumed to be locals leasing and utilizing the facilities and vendors within the retail areas. During operational phase, project proponent will have to assess whether the current system is adequate for additional users and make the necessary system adjustments in collaboration with the designated contractor.

2.4.7 Quantity of Wastewater Generation

It is estimated that there will be a maximum daily wastewater generation from passengers (6800 @ 4 gpd) totaling 27,200 gpd. It is estimated that there will be a maximum daily Wastewater generation from staff (113 @ 15 gpd) totaling1,700 gpd. It is estimated that there will be a maximum wastewater generation from local customers of 1,100 gpd. This estimation totals to a maximum daily Daily Wastewater Generation of 30,000 gpd.

2.4.8 Quality of Effluent and Wastewater Flow

All wastewater will flow by gravity from the buildings into lift stations which will then pump the wastewater to the wastewater treatment plant. The treated effluent leaving the MBR treatment system will be of very high quality and is to be discharged directly into the St. John's Harbour. Sampling Sites in Figure 15 were taken to determine marine water quality surrounding the proposed plant location. There are no pre-determined discharge sites by the project proponent and the purpose of the coastal survey in the next section is to make this recommendation. Expected effluent quality are as follows:

- BOD5 Concentration:<5 mg/L
- TSS Concentration: <5 mg/L
- Fecal Coliform Bacteria <10/100 mL

2.4.9 Treatment Methodology

Wastewater (WW) from the resort development is collected, pretreated with an effective grease trap or similar for Fats, Oils & Grease (FOG) reduction and transferred to a variable depth Equalization (EQ) tank of approximately 8-10,000 USgal capacity. On a level-controlled basis, a submersible pump in the EQ tank transfers WW through a fine screen into an Aerobic BioReactor (ABR) tank of approximately 10,000 USgal capacity. The ABR is a continuously stirred, completely mixed reactor designed to ensure effective biological digestion of the organic materials in the aeration step of the activated sludge process.

The appropriate BioReactor volume is dictated by the Food to Micro-organism (F/M) Ratio (typically around 0.8) and the mass loading of BOD per cubic volume of reactor. A submersible jet aeration system is installed in the ABR tank and provides the oxygen required for respiration by the beneficial micro-organisms used to digest the organic materials in the WW. This high strength biological broth is termed mixed liquor. The activated sludge process converts the soluble organic material present in the wastewater into CO2, H2O, and biological cell mass. A submersible Feed-forward (FF) pump, installed in the ABR tank, transfers the mixed liquor on a continuous basis to the Membrane Tank at a rate of 4-5 times average daily flow which, in turn, overflows from the Membrane Tank back to the ABR tank by gravity. This continuously recirculated flow of WW is defined as Return Activated Sludge (RAS).

Based on the flow of raw WW into the EQ tank, as noted by the EQ tank level control sensor, a permeate pump on the Enereau Membrane Filtration Module (MFM) pulls the liquid phase of the mixed liquor (Permeate) through the membranes under suction at a predetermined rate, or flux, established for each specific application and discharges the treated effluent to a clean water tank. The mixed liquor suspended solids (MLSS) are rejected and moved away from the

membrane by the air scour and hydraulic action. While the faecal coliform concentration in the ultrafiltered permeate from a MBR process is typically <200 cfu/100mL, an optional ultraviolet (UV) disinfection module may be installed on the permeate discharge line. Surplus biomass generated by the conversion of BOD into cell mass is wasted periodically from the system, on an as-needed basis, as Waste Activated Sludge (WAS), for off-site disposal or for further processing.

2.4.10 Design Parameters

Due to growth in population, the number of industries has exponentially increased. This results in either severe environmental challenges or huge demand for water supply. According to the status of our water sources, it is utmost importance to utilize novel solutions to improve water cycle management in public, industrial, and commercial areas. The implementation of sustainable techniques in the water cycle are required to consider the true value of water. Recovery of the wastewater therefore can be a highly valuable resource which can be accomplished with the aid of advanced technologies. The MBR process has shown several advantages over conventional activated sludge (CAS) treatment, such as small footprint, stable effluent quality, high tolerance to high concentrations of organic matters, and lower sludge production.

Due to the benefits of MBR over CAS reflected in better effluent quality, no additional chemical products being needed and less sludge production, the MBR process has been proved in Life Cycle Assessment (LCA) studies to be a more eco-friendly option, especially in environmental impact related to global warming potential, abiotic depletion and acidification. The choice of the Membrane Bioreactor (MBR) therefore aligns with the project proponent's intended operations to do little harm to the marine environment with the production of its high-quality effluent as it is a mature technology to treat wastewater.The key design parameters for the proposed MBR system are:

Table 3: Design Parameters for MBR System

Parameter	Influent	Effluent	Units
Average Daily Flow (ADF)	30,000	30,000	USgpd
BOD_5 Concentration at ADF	300	<5	mg/L
TSS Concentration	300	<5	Mg/L
Design Water Temperature	25	-	°C

2.4.11 Infrastructural Requirements

The Caribbean Water Treatment Ltd has recommended that an inground, two-compartment concrete tank will need to be constructed as well as an equipment room measuring approximately 30 feet long x 20 feet wide. The first compartment of the concrete tank will serve as equalization tank and the second compartment will serve as the bioreactor tank. The

equipment building will house the permeate skid, CIP tank and membrane tank. See preliminary layout drawing attached within Annex 3.

2.4.12 Environmental Impact of MBR System

With MBR treatment, the main factors affecting Human Health due to electricity consumption are Climate Change, Human Health, and Particulate Matter formation categories. Meanwhile, the major impact on the ecosystem is attributed to climate change, while agricultural land, terrestrial ecotoxicity, natural land transformation, urban land occupation, and terrestrial acidification had a lower impact on the Ecosystem category. MBR demonstrated more environmental advantages since its impacts were the lower in all the categories, especially in Climate Change, Human Health, Marine eutrophication, Terrestrial ecotoxicity, Freshwater ecotoxicity and Marine ecotoxicity, thanks to the high quality of the effluent treated by MBR and the avoidance of using extra decolorizing agent. Additionally, the MBR can produce highly clarified water without the need to add the coagulation products, for example with a 99% TSS removal rate.

2.4.13 Plant Layout

The following has been proposed for the project like an established plant at NOBU Resort.

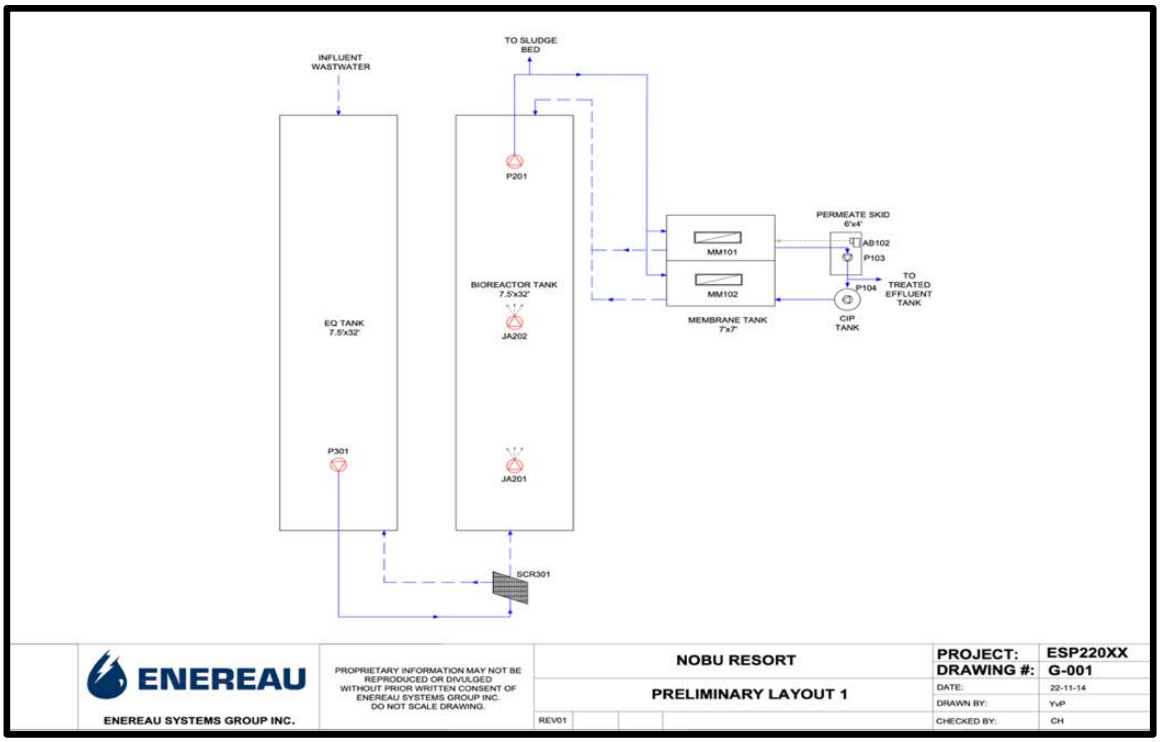

Figure 20: Proposed Plant Layout similar to NOBU

2.4.14 Sludge quantity and quality

Because the project is a seasonal operation, estimating sludge quantity will be difficult. Sludge production, however, is generally much less and the waste sludge much better stabilized with an MBR plant because of the higher sludge retention times in the process.

2.4.15 Sludge management, treatment, and disposal

Because of the limited available space, it is assumed that there will be no sludge management facilities onsite. Waste sludge would need to be hauled offsite to Cooks Landfill once or twice per year (in addition e pumping out grease traps more frequently from restaurants and kitchens) through onsite maintenance procedures.

2.4.16 Responsibilities of Caribbean Water Treatment

- Supply of all equipment and controls to install a 30,000 Usgpd Enereau MBR wastewater treatment plant as outlined above.
- Supply of hinged aluminum manhole covers rated for pedestrian traffic for concrete tank.
- Supply of UV sterilizer system for treated effluent disinfection
- Complete installation of all equipment required as part of the wastewater treatment
- system (except for gravity sewers to the lift station and pressure sewer form lift station to the treatment plant).
- Start-up and commissioning of the wastewater treatment system.

2.4.17 Responsibilities of Project Proponent[4]

- Construction of the concrete tanks for the treatment plant, lift station or grease traps.
- Construction of a 30 ft x 20 ft building to house the MBR membrane skid, control panel and CIP tank.
- Removing all formwork from the tanks, cleaning them out and static testing them to
- ensure there are no leaks.
- Bringing all sewer piping from the buildings into the lift station and from the lift station to the wastewater treatment plant.
- Installing discharge piping from the plant out to the harbor.
- Bringing a 460V / 3 phase electrical supply up to the wastewater treatment plant.
- Designing, supplying and installing the lift stations, gravity and ser force main as part of a sewage collection system

The chosen contractor is anticipated to construct the tanks and equipment room, and CWT Ltd. Is expected to order and install the equipment to get the plant operational. Once in operation and commissioned once significant sewage starts to be generated in the facility monitoring will be required.

2.4. 18 Proposed Monitoring Regime by CWT

An Environmental monitoring plan, developed for treatment facility construction and operation project aims at solving following problems:

- Monitoring of compliance with environmental legislation during construction and
- operation processes;

[4] Project Proponent has indicated during construction of the WWTP, contractor will nominate CWT Ltd as a Sub-Contractor falling under their responsibility

- Ensuring controllability of risks and environmental impacts;
- Provision of stakeholders with relevant environmental information;
- Confirmation of mitigation measures' implementation, determination of their efficiency and their adjustment whenever necessary;
- Permanent environmental control throughout the project implementation period (construction works and operation)

Monthly effluent samples can be sent to the government chemistry lab for BOD, total nitrates and TSS testing if the project proponent is willing the cover the cost to do so. The plant operator can do quick turbidity tests with a meter onsite at least weekly to ensure there is no membrane damage that would compromise the effluent quality. CWT would be available to provide operation and maintenance services to ensure the plant is properly operated and maintained. Environmental monitoring plans for construction and operation phases are provided in a subsequent section. It is noteworthy that this is a general plan, and it may be detailed and adjusted during the working process.

2.4.19 Institutional Arrangements

Because the operationalization of the wastewater treatment plant is prone to some level of pollution, it is important to acknowledge provisions under EPMA 2019, Noise Abatement Act, 1996, Solid Waste Authority Act, 2005 and other relevant policies which speaks to pollution control. Part 5 of EPMA 2019 Section 26 (I) states that, *"No person shall deposit or release a pollutant on or into land, water or the air, except in accordance with a pollution control permit issued by the Department".* With the intention of the project proponent to discharge treated effluent into the St. John's Harbour, it should be expected that before construction commences, an application should be made for a pollution permit from the DOE by the designated contractor. Project proponent should give due consideration for adhering to the environmental standards within Schedules 2 (Pollutants), 7 (Water Quality Management Criteria and Guidelines) and 8 (Air Quality Criteria and Guidelines) when producing its Environmental Monitoring and Management Plan.

Other governmental agencies that should be consulted and included in the establishment and monitoring of the WWTP includes the Central Board of Health (CBH) and the National Solid Waste Management Authority (NSWMA). CBH would be responsible for managing waste and materials in the interest of public health and NSWMA's responsibility lies with managing collection and disposal. Throughout the operation of the project, and in accordance with the policies/laws of Antigua and Barbuda, a designated representative of the CBH should conduct annual visits and meet with the project proponent's representative to monitor and audit the operation of the WWTP inclusive of operation logs, testing input/output effluent, ensuring tank for treated sewage is adequately aerated and safety protocols implemented to handle and store hazardous material.

2.5 Description of Environment

I. Physical Environment

a. Meteorology, Rainfall, Waves and Tides

Antigua has a semi-arid tropical climate with a mean annual temperature of 28°C and a mean annual rainfall of 1110 mm. The quantity of rainfall generally increases with elevation in Antigua, but the Antigua's limestone belt, which is the driest part of the country, receives less than 900 mm of rainfall annually. The dry season extends from January to April, with the worst drought in Antiguan history since 1928 occurring from July 2013 until 2016. The wet season occurs from August to November and coincides with "hurricane season" (Figure 21).

Evapotranspiration rates are relatively high, averaging from 87 mm/month in November to 143 mm/month in March, and annual potential evapotranspiration exceeds effective precipitation, with an average annual effective precipitation to evapotranspiration ratio of about 0.57 (UNCCD 2005).

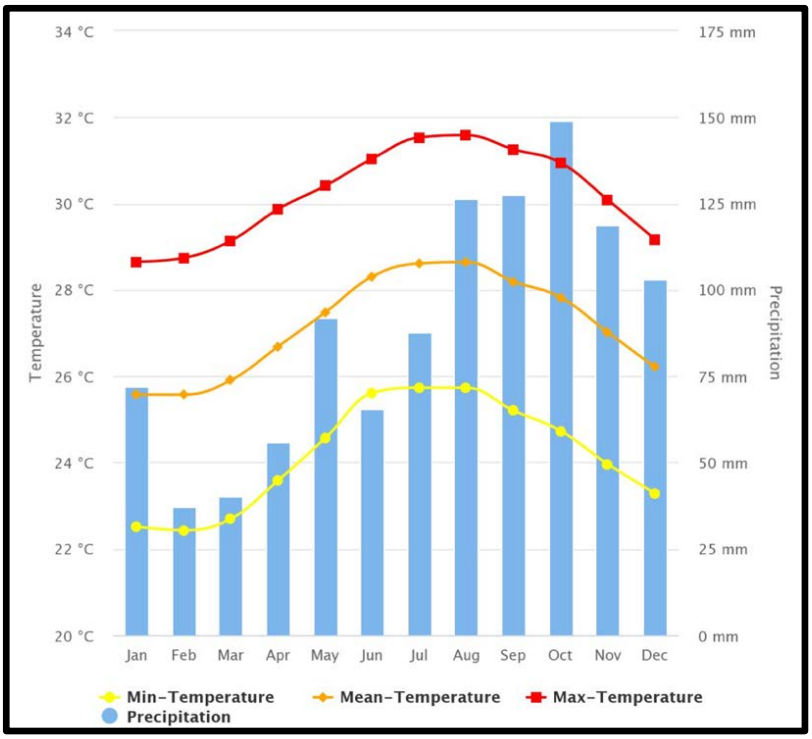

Figure 21: Mean historical monthly Temperatures and Rainfall for Antigua and Barbuda during 1991-2020 (WBG, 2023)

Prevailing trade winds are from the east (Figure 22) at a mean (surface) speed of 9.1 knots (10.5 mph). The windiest month is July with 13.6 knots (15.6 mph) and the calmest is October with 9.2 knots (10.6 mph). The winds rarely exceed 21 knots (24 mph) but stronger winds can occur over open waters and elevated terrains by as much as 25 knots. However, an extreme event (1%/yr, 100 yr return) indicates winds can reach a maximum of 180km/hr (50m/s), see Figure 23.

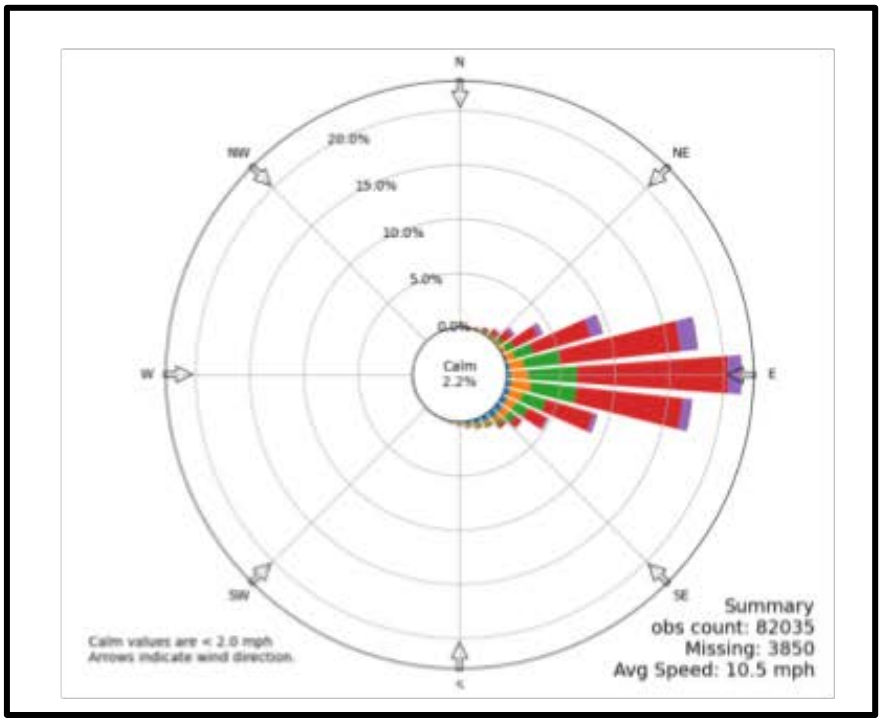

Figure 22:Wind Rose Developed from the National Climatic Data Center (NCDC)

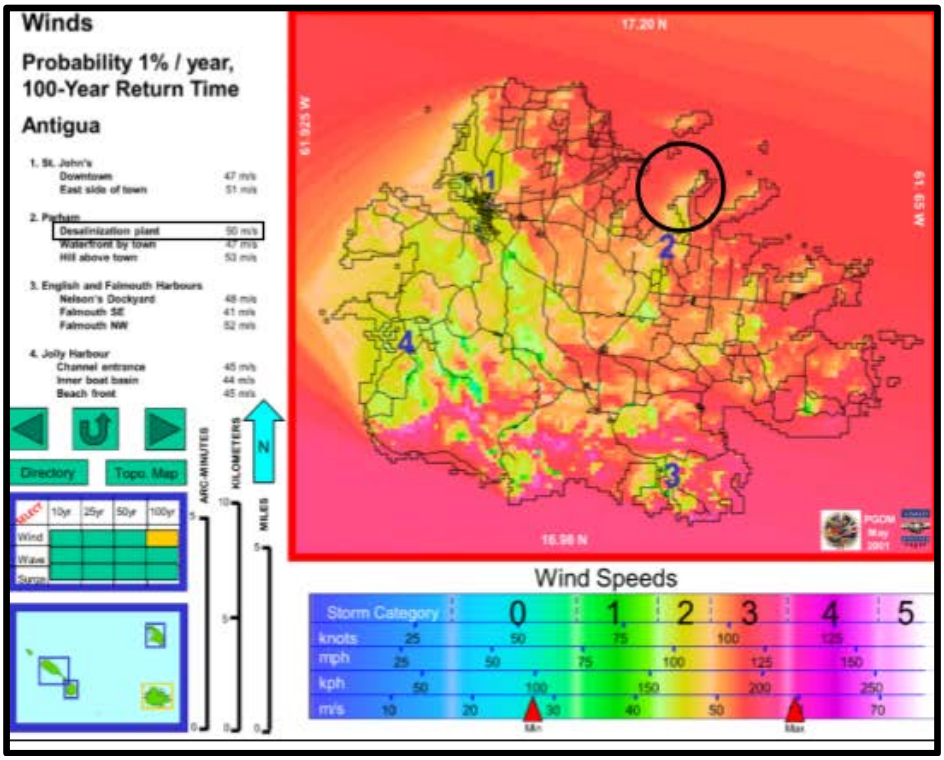

Figure 23: Wind Probability Map in Extreme Events

The hurricane season extends from June to November, with August and September being the most active. Hurricane events that have affected Antigua since 1851 were extracted from the NOAA database. Three “buffer” zones were created based on category and proximity to the

islands, respectively of 30 km diameter for storm events up to Hurricane category 2; 60 km diameter for category 3; and 100 km diameter for categories 4 and 5 (Figure 24).

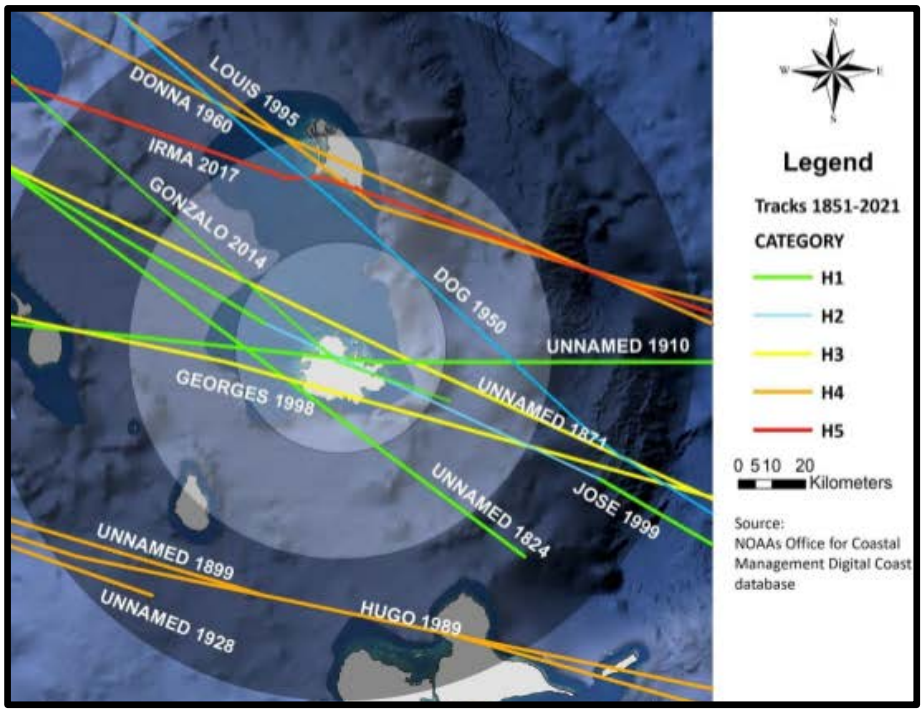

Figure 24: Hurricane Tracks based on category and distance from Antigua

b. Sea Current

Sea currents around Antigua are primarily wind driven, and flows northwest to west.The tidal range is semi-diurnal with significant wave heights ranging 1 to 2 metres. Seas may exceed 2.5 metres (8 feet), mainly due to long period swells generated by extra-tropical cyclones.

c. Environmental Quality (Air, Noise, Water Quality)

Air

As the project area is surrounded by industrial activity, there is expected to be high dust levels. The project area is located in an existing port of entry and industrial zone where the airshed is expected to be degraded with certain particulate matters and pollutants associated with exhaust engines such as SO2, NO2 and potentially industry specific emissions such as dust from the commercial activity, ongoing construction, St. John's Harbour, the Fisheries Complex, and the Antigua Distillery Plant.

Noise

Baseline levels for noise and vibration are assumed to be relatively high due to the location of the site in a known industrially zoned area with high levels of activity within the city, port operations, economic zone, marine and occasional air traffic, and other industries. Construction activity therefore will contribute to higher-than-normal baseline noise levels and add to the existing ambient noise experienced by neighboring residents and commercial businesses albeit temporarily.

Water Quality

In many areas, a combination of aging septic infrastructure and flooding, especially in high-density developments, often contributes negatively to water quality. The impacts of inadequately treated sewage have the potential to pollute soils and water, increase nutrient flow into receiving water bodies, contribute to excessive algae growth, and lead to adverse public health effects. Other potential risks arise from extreme rain events causing spills into the local environment. The water quality results below, shown in Figure 24 below indicates the parameters tested during the water quality assessment which was conducted over a 1-day period by the Department of Analytical Services (DOAS).

The results from the marine water quality baseline assessment indicated that most parameters fell within their respective acceptable range. However, at sample sites 2 & 3, Faecal Contamination Indicators, Enterococci and Faecal Coliform were above their acceptable standards, inferring that (waste which may be of human, or animal origin) was present in the area. These sites were located closest to the residential homes on the western end of the project site.

It is known that the water from the drains in the area do not undergo treatment before entering the harbour. The effluent from the sewage plant is expected to fall within the acceptable ranges for the chemical water quality parameters, and specifically have a Faecal Coliform Bacteria count of <10 mpn/100 mL. This is significantly lower than the acceptable standard of <200 mpn/100 mL (EPMA 2019). As the area is already receiving untreated wastewater, it is not expected that effluent would cause further degradation of the area's water quality. It should be noted that the results are restricted to a limited time and a more consistent monitoring regime is needed to make definitive conclusions.

Department of Analytical Services
Friars Hill
St. John's
Antigua
T: 462-9437/462-6281
E: linroy.christian@ab.gov.ag

Certificate of Analysis

Date of Issue	:2023-01-16
Client	:Simone Dias
Report #	:GPA001
Sample Submission Date	:2023-01-11
Temperature on Arrival (°C)	:<10
Sample Type	:Marine water

Lab ID	Sample ID	Sample Description	Enterococci[1] (<35) cfu/100ml	Faecal coliform (<200) mpn/100ml	Escherichia coli (<126) mpn/100ml	pH (6.5-8.5)	Dissolved Oxygen (>2) ppm	Turbidity NTU	Nitrate ppm	Phosphate ppm
GPA-202211-01	Marine water	#4- Point Wharf Dock- Gas Room	30	20	20	7.75	6.65	2.82	0.01	1.15
GPA-202211-02	Marine water	#3- Point Wharf Dock- Southeast	47	110	20	8.35	7.71	8.17	0.01	1.50
GPA-202211-03	Marine water	#2- Outlet	58	220	40	8.33	6.28	16.9	0.03	0.27
GPA-202211-04	Marine water	# 1- Reference	1	ND	ND	8.19	6.42	4.84	0.03	0.32

ND: Not Detected

Remarks:

Faecal contamination indicators were detected at #2 and #3 sample sites.

Approved by:

Dr Linroy Christian
Director

[1]Guidelines for recreational water have been adopted from the United States Environmental Protection Agency (EPA).

Page 1 of 1

Figure 25: Certificate of Analysis for DAY 1 Water Quality Sampling in St. John's Harbour (DOAS, 2023)

II. Biological Environment

a) Marine Ecology/Coastal Survey

Visual assessments were conducted of the area for suggested construction of the sewage plant, the area with the facilities of the GPH-ACP will be constructed, and other marine environments adjacent to the site were taken. No in-water surveys were conducted due to safety concerns for participating individuals and visual limitations due to the conditions of Deep Water Harbour. Given the heavy commercial and industrial activities in and around the GPH site area, many of the natural marine ecosystems had been long disturbed. In the immediate vicinity (Figure 26), there were a few mangrove plants, mostly Black (Avicennia germinans) and the Red (Rhizophora mangle) variety.

The existence of these plants could be an indication of the existence of a mangrove wetland in the area in the past. Further to the south, a mangrove wetland was observed in the vicinity of the Antigua Fisheries Ltd building. Additionally, a thriving mangrove wetland system was observed to the North of the facility. From the designated industrial zone outlined in red, the identified mangrove plant is along the property boundary of the project site. Mangrove plants to the south, in the vicinity of the Fisheries, West Bus Station Area are 545 and 635 meters respectively. The mangrove ecosystem to the north is 880 meters from the project site.

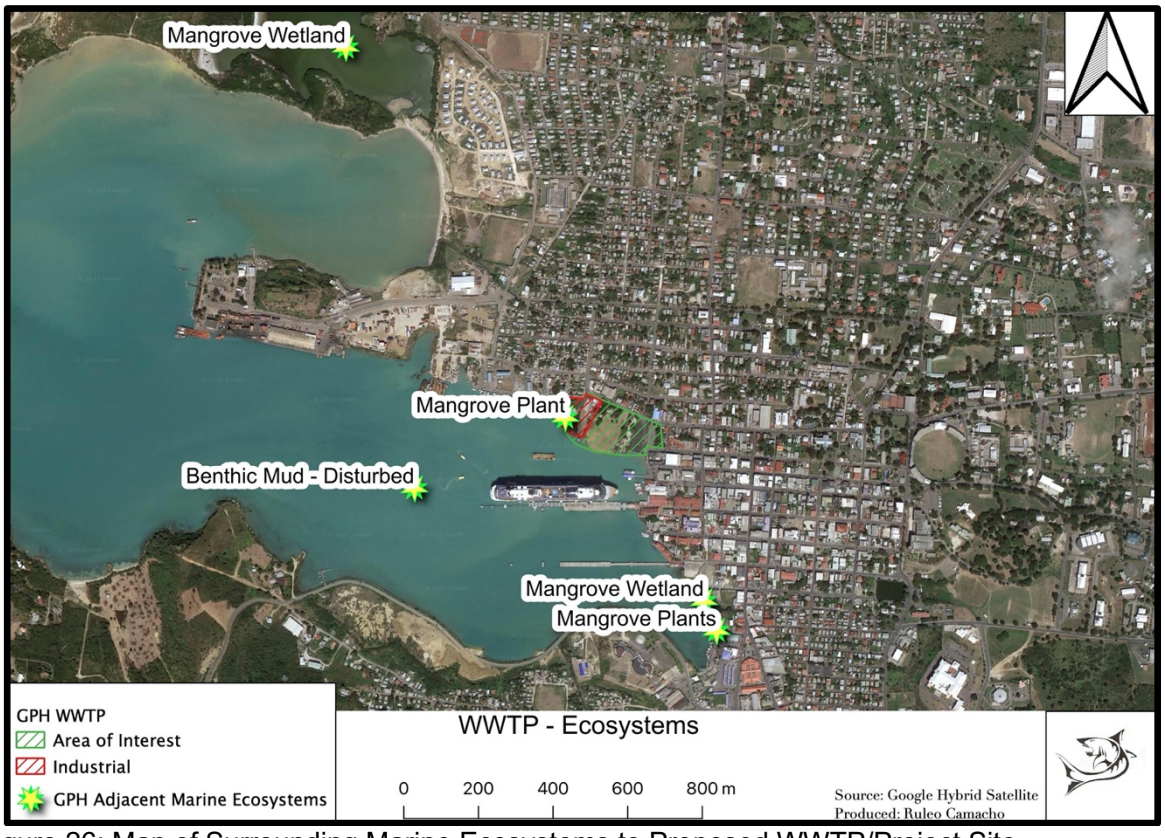

Figure 26: Map of Surrounding Marine Ecosystems to Proposed WWTP/Project Site

The marine benthos is reported as being home to extensive seagrass beds, as per The Nature Conservancy (Figure 27) encircled black). However, substantial dredging to facilitate the expansion of the St. John's Harbour has decimated these ecosystems, and the area is now home to primarily Benthic mud due to the frequent disturbances. No other significant marine

or coastal ecosystems were observed in or adjacent to the project site. The turbidity and nutrient load of the marine environment within the St. John's Harbour is suspected to be significant, given the high presence of green algae growing on the rocks (Figure 28). This is a known bioindicator for long-term nutrient pollution in coastal areas. [5]

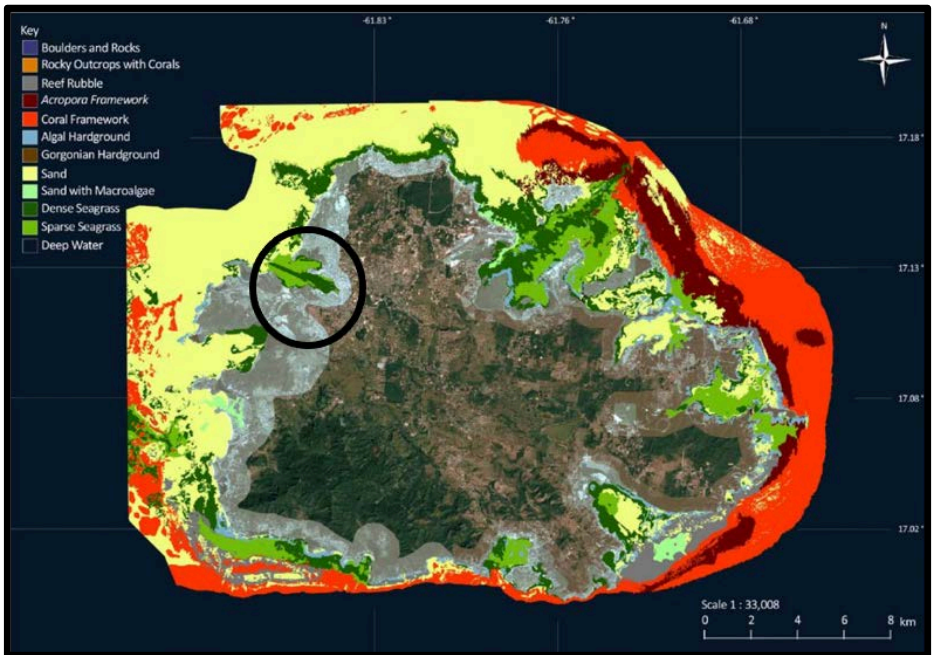

Figure 27: TNC Benthic Habitat Map (marineplanning.org)

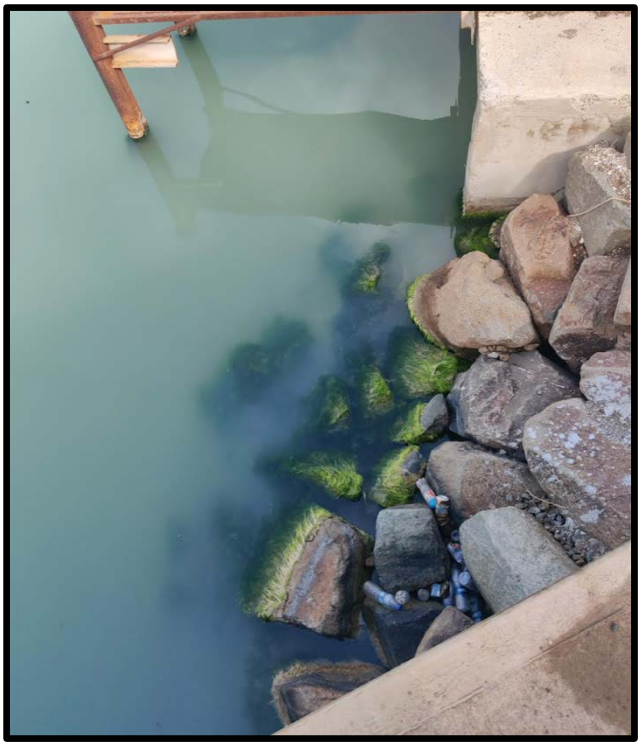
Figure 28:: Heavy Green Algae Growth

[5] "Green Algae as bioindicators for long-term nutrient pollution along a coastal eutrophication gradient." Salo, T., Salovius-Lauren, S. *Ecological Indicators*, 2022. https://doi.org/10.1016/j.ecolind.2022.109034

Several drains were observed flowing into the St. John's Harbor through the project site (Figure 29). These drains are fed from the surrounding communities and no treatment areas were observed for these sites. These drains are heavily congested with physical waste, and there are no known treatment of the water flowing within these drains (Figure 30). The presence of these drains, along with those flowing from the city of St. Johns result in a large amount of wastewater flowing into the harbor.

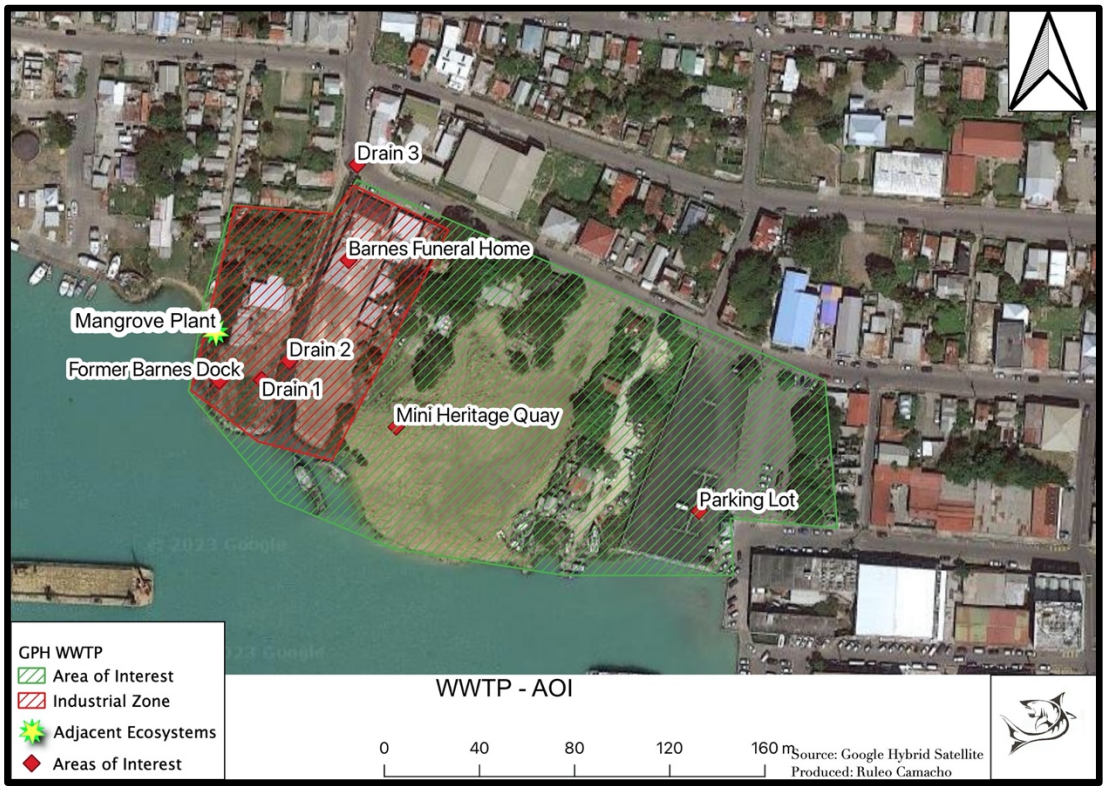

Figure 29: Map outlining Area of Interest including adjacent features


Figure 30: Open Drain 3 to the West of Barnes Funeral Home and North of Project Site

II. Aesthetics

Given the apparent existing high level of nutrients in the marine environment around the project site, based on the high growth amounts of green algae, the aesthetics of the coastal areas should be considered in this development. A recommendation could be to plant the Red Mangrove (*Rhizophora mangle*) along the coastal areas to the West of the project site. This provides multiple benefits through:

- Assistance in the absorption of nutrients in the water
- Providing a visual block of the coastline, thus improving the aesthetics of the individuals in the area
- Enhancing the health of the marine environment by providing habitat for marine birds and fish species.

III. Recommendations

The St. John's Deep-water Harbour is known to be a heavily disturbed Harbour due to the large amount of commercial and industrial activities which occur in this area. Additionally, the conditions of the drains and the large presence of waste materials within these drains, along with the high level of green algal growth observed in the marine environment are likely indicators of a strongly eutrophic marine system. The installation of a Sewage Plant to service the facilities of the GPH should have no negative impact on the surrounding marine and coastal environment once the plant is designed to handle the purported wastewater which is expected to be generated, and its operation are kept strictly within its issued operational protocols.

b) Monitoring Protocol

To ensure that the GPH Sewage Plant does not become a burden to the surrounding marine and coastal environment, a monitoring protocol should be established to regularly document the biological parameters of the effluent being released into the marine environment. This should be done in association with the local testing facility, The Department of Analytical Services and with further recommendations from the Central Board of Health where necessary. At minimum, the following steps should be carried out:

- Establish the current existing water quality of the marine waters and drains in the vicinity of the GPH site. This will establish a baseline of current marine and drainage conditions and provide a comparison factor for future measurements. Additionally, this will allow the classification of the marine water as per the Environmental Protection and Management Act (2019), Schedule VII.

- Conduct bi-annual water quality testing of the effluent from the sewage Plant. These should be completed in the low-tourist season (June – October) and in the high-tourist season (December – May). The operational procedure of the Sewage Plant may require further/more frequent testing, but these timelines will ensure that heavy usage

of the plant does not negatively impact the effluent and in association the marine environment.

b) Discharge Areas

The existence of existing drains in the project site presents opportunities for the discharge of the effluent. Two options are to be considered for the discharge locations.

- **Option 1:** This drain runs from the surrounding communities (see Figure 30). and flows onto the project site into a further drain within the site (see Figure 31) before discharge into the harbour.

- **Option 2:** This area is at the western end of the project site, and in visual proximity to the residential homes in that area (see Figure 32).

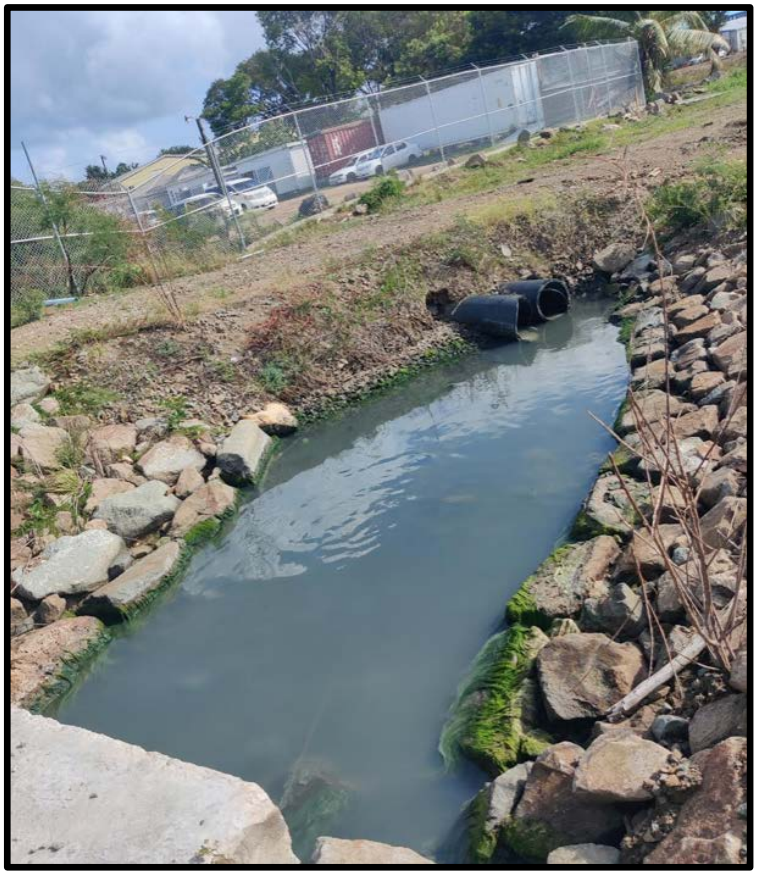

Figure 31: Open drain within Project Site and Option 1 for WWTP Effluent Discharge Site

Based on the observations via coastal survey, Marine Ecologist recommended that the ideal preference for discharge would be **Option 1**, as this will provide visual coverage for the discharge by the project proponent and other designated personnel which would assist in monitoring protocols. Further, because of the existing drainage infrastructure it is opined that it will be more economical to utilize the channel that already exists in the project area for further discharge.

Figure 32: Surrounding Area for Option 2 for WWTP Effluent Discharge Site

Figure 33 outlines the location of both options. If this recommendation is considered by the project proponent, additional construction efforts such as concrete coverings, would have to be incorporated into design conceal potential odors and the unsightliness of the drain.

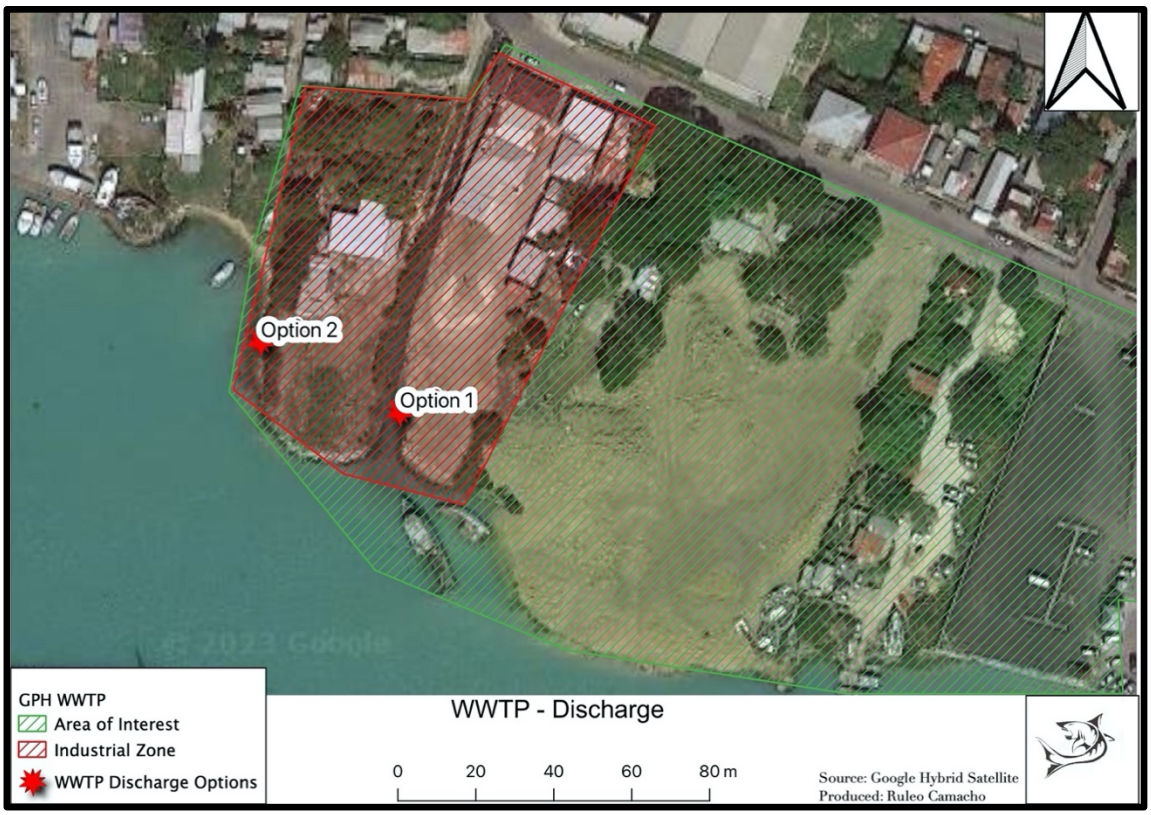

Figure 33: Map outlining locations of Discharge Options

b) Hydrology and Geology

The terrain of the project site is relatively flat and much of the city is built on sandstone, conglomerates and shale (Figure 34) or reclaimed land. A comprehensive geotechnical survey was conducted by international consultants to conduct soil and bore hole testing to determine carrying capacity of the load of the terminal building due to the identified high water table within the project area.

Although Antigua is described as relatively dry island, it can and from time to time does experience heavy and unexpected flooding from intense rainfall. Due to the soil types present, run-off occurs due to little penetration by storm water, hence development activities require provisions for collection and safe disposal of storm water. Hence, water must be redirected by the adjustment of ground levels away from the building to prevent/reduce seepage into the foundation material to limit possibility of swelling which can cause damage to the building's floor.

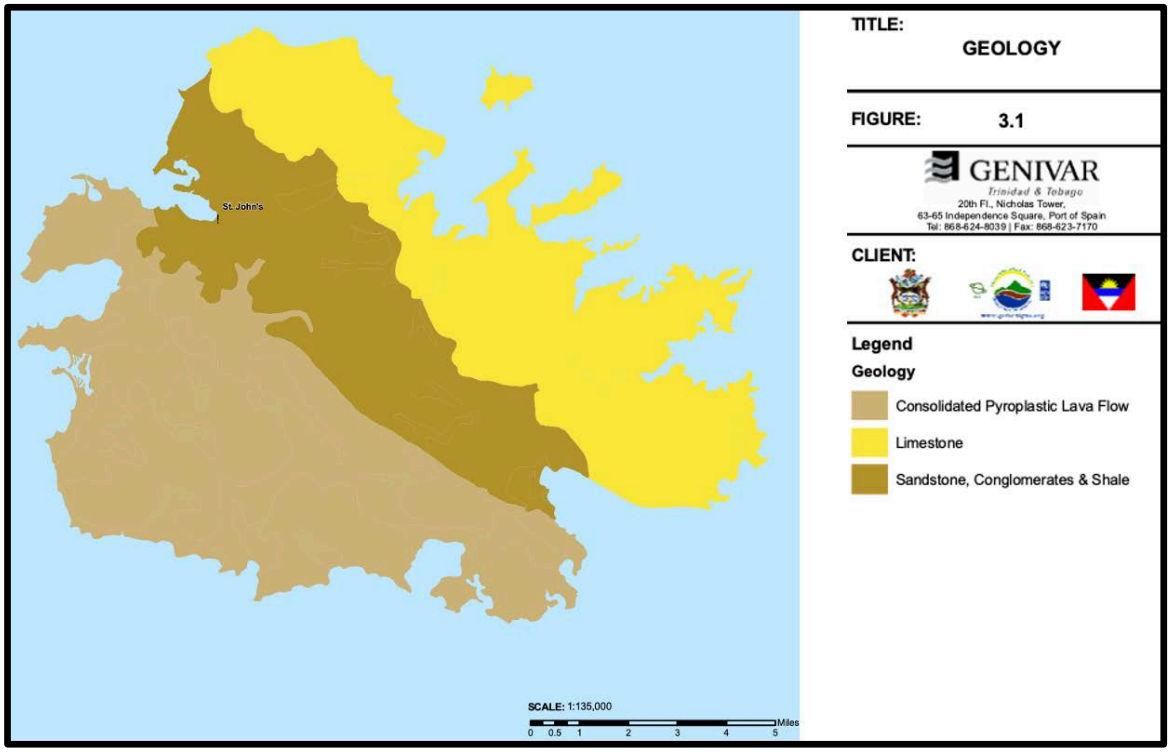

Figure 34: Geology Classifications for Antigua, specifically St. John's (Genivar, 2011)

Due to the presence of a very weak, compressible clay layer, the proposed terminal building will have to be founded on piles. The same weak clay layer will also be subject to substantial compression when a surface load is applied on top of it, like placement of a fill. This compression will be followed by pavements and structures with shallow foundations above the top of this clay layer, resulting in settlements.

For the project site, on various locations, the difference between existing ground level and design elevation of ground floors and pavements will be approx. 2.2 m (7 ft). If sand is used for the fill, this corresponds to a substantial increase of load on the weak clay layer, resulting in settlements that in this case are expected to become more than 0.1 m (= 4").

The complete project comprises the development of several commercial buildings, a casino, swimming pool, playground, and a parking lot, next to the recently completed new cruise pier. For the anticipated structures and (type of) pavement a (residual) settlement larger than 0,1 m (3-4") is probably not acceptable. Figure 35 contains an overview of the terrain, the (tentative) locations of the available boreholes and cross sections (B, F, E) and longitudinal section (J) that have been selected for further elaboration in Annex 4. The new cruise pier is marked in grey.

Figure 35: Overview Terrain, borehole locations and cross sections

The figure below contains a selection from the above cross section, showing an example of the (net) fill required to raise the ground surface level from its current elevation to the design level of the pavement and building floors. The fill is marked in grey in Figure 36. Detailed findings and recommendations of the Geotechnical Survey are outlined in Annex 4.

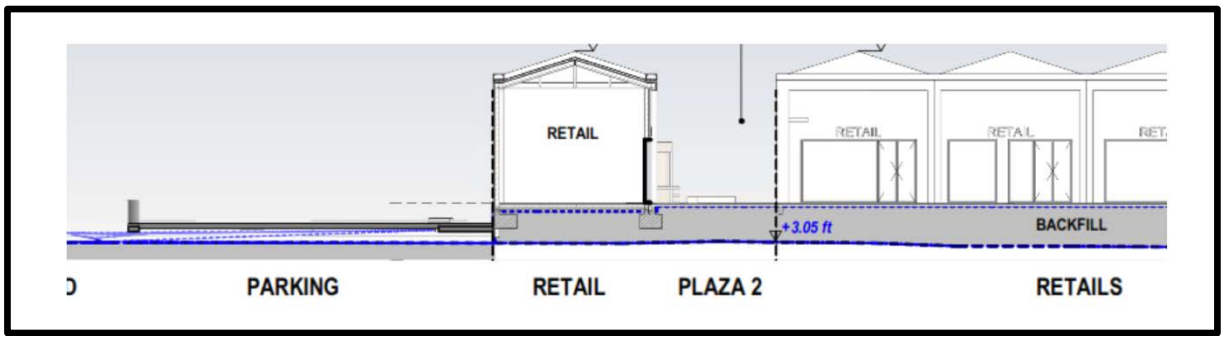

Figure 36: Section B showing the required fill between existing ground level and elevation of the pavement

III. Socio-Economic Environment

a) Present Land Use of Project Site and its Surroundings

In a former section, the general land use in St. John's City was discussed. Remote sensing analysis of the project site indicated that the mainland uses within and surrounding the project site are no different than the rest of the city- industrial (blue) and transportation: port of entry (red). Specifically for the project site however, its location is within land designated for urban settlements (yellow) as seen in Figure 37 encircled in red.

Figure 37: Present Land-Use at Project Site and Surrounding Areas

As mentioned in a previous section, lack of enforcement regarding land-use planning policy/legislation has allowed rapid urbanization where densely populated residential settlements, commercial and industrial businesses interact spatially and there is no definite distinction between "town" or city". Hence, due to the location of the project site, there is no immediate land-use restriction for the proposed development activity.Although historically, the area has been significantly commercialized and industrialized, a level of environmental sensitivity remains as it comprises protected flora species directly within the project site, is near the marine environment comprising important marine species and mangrove ecosystems and is near the surrounding communities.

The location of the St. John's Port is historically rooted in the progress made by Antigua & Barbuda in the shipping/tourism industry since Independence as a main economic driver, and urban development over the years has evolved in a way that supplements or enhances the initial uses of the harbour due to the high valuable placed on port lands. Because of this, lack of alternatives for intended land use and the importance of the project for economic activity for improved trade, tourism, provision of jobs in construction, and other residual sectors, the project proves viable for facilitating expansion and enhancement of St. John's City, the tourism

sector, and the overall economy. Thus, given its necessity there is recognition that there will be some level of environmental degradation particularly for the marine environment (pollution and benthic species/habitats). Therefore, pursual of adequate mitigation measures and a robust environmental management plan by the project proponent are important for minimizing extensive damages to the marine environment.

b) Industry & Commerce

Industrial activities near the project site mainly comprises of the operations of the Antigua & Barbuda Port Authority situated at the St. John's Deep-Water Harbour, Antigua Distillery, Fisheries Complex which all contribute to the social environment of the country. Within the surrounding communities there are also micro and commercial businesses within various industries such as food and beverage, media and communications, retail etc, social services such as community clinics, schools, and churches. The cruise tourism industry is concentrated along the boundaries of St. John's City from Heritage and Redcliffe Quays, to the public market, in addition to other dispersed locations within the city and St. John's rural. Most tourists from cruise ships tend to explore the city's attractions through walking tours visiting the museum, craft market, Antigua Recreation Grounds, and the historic St. John's Anglican Church while others would venture out on day trips and nature tours at the Nelson's Dockyard National Park, various beaches, or the offshore islands for example.

These activities support local entrepreneurs such as local food, souvenir vendors, restaurants, taxi drivers and other relevant service providers during high cruise tourism season. As Antigua is now a home porting country, there is also the added benefit of increased commerce for the country's local businesses as cruise ship operations would then purchase items on a large scale to accommodate passenger and crew needs. Within St. John's City there is one known hotel, "Heritage Hotel" that can accommodate overnight stays, however most hotels are scattered along the country's coastline in various parishes.

c) Stakeholders

Key project stakeholders have been identified which include stakeholder groups including:

- National Government (DCA, DOE, APUA, NODS, CBH, MOWHUR, NSWMA, etc.)
- St. John's Development Cooperation
- Project Proponent and partners
- Industries within Project Area
- Fishermen
- Tourists
- Tradesmen and other Construction Workers
- Taxi Drivers/ Stores/Restaurants/Vendors within St. John's
- Commercial Businesses
- CSOs, NGOs within St. John's/Community

Before the expansion begins, the project proponent will host consultative meetings with stakeholders who are directly impacted by the project to ensure that this development positively impacts their community, businesses, aligns with national legislation and does little to no harm to the work of NGOs and the community.

3 POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Environmental impacts are the result of changes that occur to environmental factors in time and place compared to what will happen if the project is not implemented as illustrated in Figure 38. Identified impacts can affect environmental factors and elements, deteriorate landscapes, people's health as well as natural resources surrounding the construction site. Impacts are mainly from construction phase and may include noise, dust, increased traffic flow and accidents, labor and public safety, erosion, flooding, solid wastes, and wastewater.

These impacts however can be minimized, managed and/or overcome once mitigated measures are properly implemented by the project proponent. This section identifies these potential impacts and other general issues that could arise from project implementation, and are based on predictions and research from similar port development experiences. The mitigation measures presented are recommendations by CJC+ Associates Inc. to the project proponent GPH-ACP.

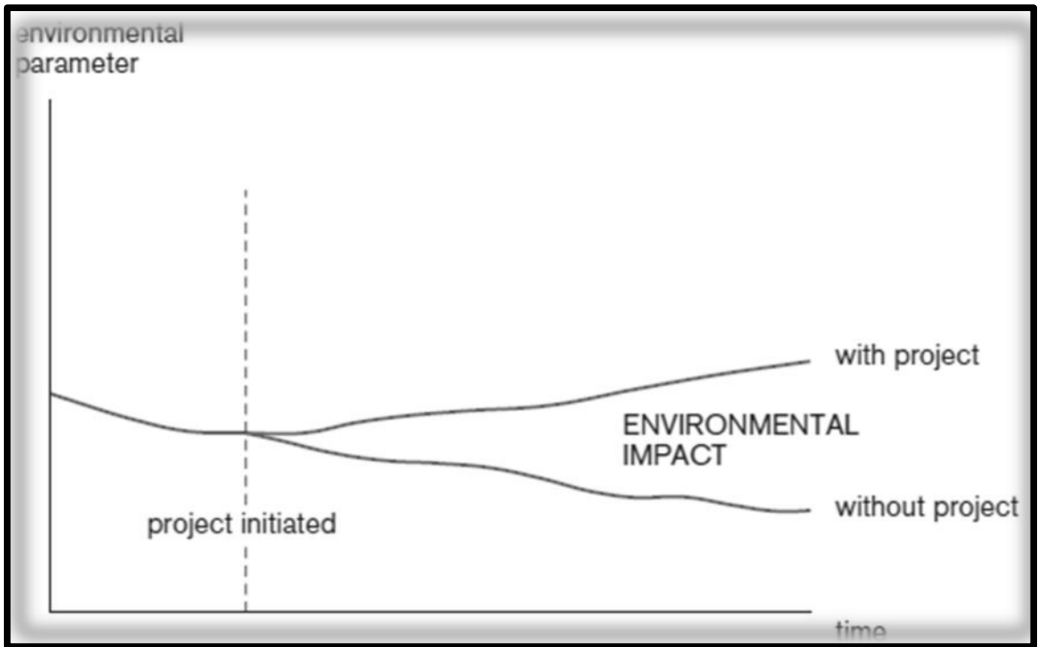

Figure 38: Nature of Environmental Impact: General Scenarios for Impact with/without project

3.1 Risk Assessment Criteria

Project activities during construction and operation could potentially generate a range of pollution and waste sources that requires proper planning from project inception to minimize impacts to human, biological or other environmental receptors. These include accidental emissions to air, water, and soil, etc that could affect workers, community and surrounding environment. The project proponent will endeavor to proactively manage these potential pollution sources to achieve the project objectives in a safe and sustainable manner. Table 4 outlines the risk criteria utilized and is classified into high, medium, and lows risks. A high level risk classification has a higher likelihood of occurrence and can cause significant damage to the organization's operations. Medium risk has a 50% chance to occur and will cause damage

but moderately. A low risk has low chances of occurring and will cause marginal damage. In some cases, the chances of the risk appearing might be low, but it could cause severe damage. A risk assessment matrix depicts a visual form of risk assessment with highest level of risks at one end, the lowest level on the other, and medium risks in the middle. Color-coding is used in Table 4 to represent different levels of risks to identify where to give more attention. Sources of risk and impacts are assessed based on the likelihood of impacts occurring and the consequence of those impacts occurring without mitigation measures. The overall assessment (low, moderate, or high) is defined in Table 4 and expressed in Table 5.

Table 4: 3*3 Risk Matrix Criteria

		SEVERITY		
LIKELIHOOD		Critical: 3	Moderate: 2	Marginal: 1
	Probable: 3	High (9)	High (6)	Medium (3)
	Occasional: 2	High (6)	Medium (4)	Low (2)
	Improbable: 1	Medium (3)	Low (2)	Low (1)

3.2 General Environmental Risks and Mitigation Measures Identified in #G01-2018

The DOE previously identified in Application #G01-2018 a table of combined risks associated with the development pre- and post-dredging and pre- and during construction. The risks associated with the pre-construction phase have been reiterated by the DOE in #A635-2022 indicating they are still in effect (Table 5), with additional risks associated with sewage and wastewater treatment, water management, geology and hydrology, disaster management and tree removal identified as potentially impacting the environment and community. To address these concerns, identification of impacts and mitigation recommendations will surround firstly, the general issues in Table 5, other relevant issues arising from baseline conditions and the construction/operation of the WWTP as per DOE ToR.

Table 5: Proposed Development Activities, Associated Environmental Risks & Mitigation Measures

Activities	Associated Environmental Risk	Mitigation Measures	Risk Level *Rating Scale 1- 10 with 10 being highest risk*
Demolition of Existing Structures			
	Noise	1. Extensive Community & Stakeholder Consultations 2. Scheduling the of use of extremely noisy machinery during agreeable hours (eg. 7 am – 6 pm) 3. Erection of enclosures around machines to reduce the amount of noise emitted into the workplace or environment. 4. Use of an Integrating Sound Level Meter (SLM), and/ or a Dosimeter to measure the quantity of sound emitted.	High
	Traffic	1. Implementation of a Traffic Management Plan	Medium
	Solid Waste (generation, removal, transportation, disposal)	1. Waste should be collected by a licensed sanitary contractor and disposed of at landfill	High
	Pollution (Air & Water)	1. Water suppression and soft stripping of any infrastructure in the area 2. Careful demolition practices to prevent contaminaton of marine environment	High
	Pests (roaches, rodents, flies, mosquitoes)	1. Creation of an Integrated Pest Management Plan 2. Implementation of pest control measures prior to demolition such as poisoned bait, fumigation, sterilization, insulation.	Medium

	Combustion Emissions	1. Surface Suppression Measures	High
	Fugitive Dust	1. Creation of wind barriers and Construction of fences/structures or plant woody vegetation perpendicular to the prevailing wind direction to reduce wind speeds and capture larger particles.	High
	Demolition Waste: Concrete, steel frame, glass, wood, ceiling materials, cables, and pipes etc).	1. Separation of waste based on “reduce, reuse, recycling”criteria and adequate disposal plan utilizing Antigua & Barbuda Waste Recycling Corporation (ABSWREC) as necessary	Low
	Removal of Derelict Vessels Vehicles	1. Extensive Community Consultations and Dismantling for recycling or scrapping and transportation/disposal to Cook’s Landfill	Low
Reclamation			
	Noise	1. Extensive Community & Stakeholder Consultations 2. Scheduling the of use of extremely noisy machinery during agreeable hours (eg. 7 am – 6pm) 3. Erection of enclosures around machines to reduce the amount of noise emitted into the workplace or environment. 4. Use of an Integrating Sound Level Meter (SLM), and/ or a Dosimeter to measure the quantity of sound emitted.	High

	Pollution (Air)	1. Wind - Erect physical barriers or wind breaks to minimise dust generation. Use screening materials (e.g. shade cloth) on three sides where possible (with no less than 50% porosity to the material being contained). 2. Use a windsock to increase workers' awareness of wind direction and strength. Cease operations when emissions exceed relevant health standards and/or average wind speeds exceed 15 m/s. 3. Install air pollution monitoring equipment/gauges to regularly measure pollution levels.	High
	Plumes from suspended solids	1. Modelling of the sediment dispersal pre reclamation. 2. Installation of turbidity barriers during reclamation	Medium
Construction of New Buildings			
	Noise	1. Noise monitoring devices and extensive public consultation and notification	Medium
	Pollution (Air)	1. Water suppression, retain vegetation around the area and install air pollution monitoring equipment/ gauge 2. Erect physical barriers or wind breaks to minimise dust generation. Use screening materials (e.g. shade cloth) on three sides where possible (with no less than 50% porosity to the material being contained).	Medium
	Fugitive Dust	1. Create wind barriers such as construction of fences/ structures or plant woody vegetation perpendicular to the prevailing wind direction to reduce winds speeds and capture large particles. 2. Water suppression techniques	Medium

	"Site construction will be screened based on international green standards, to be presented on second submittal to include tree protection, pollution and community protection"		
Construction Camp			
	Domestic wastes from workers: food containers, juice boxes, bottles, paper	1. Installation of recycling bins in and around the site. 2. Implement extensive public awareness and education programmes re: "reduce, reuse, recycle".	High
Maintenance of Construction Equipment			
	Oily Rags	1. Hazardous solid waste including waste oil, oily and greasy rag is collected into separate casks (each construction site/ workers camp is arranged 02 casks for storage).	Medium
	Spent Lubricants	1. Use of biodegradability or eco-friendly lubricants that will not have adverse effects on environment in case of oil spills/leaks 2. Ensure proper capture and disposal of lubricants	Medium
	Wash Water-oil and grease	1. Establish designated wash bay area to contain cleaning waste 2. Dismantle equipment to prevent spreading of oil and grease to cleaner parts 3. Utilize pressure washer which is effective for oil and grease removal 4. Use proper cleaning and degreasing agents that are environmentally friendly	Medium
Haulage of Construction materials and Solid Waste			

	Emissions	1. Haul to Cook's Sanitary Landfill during outside of peak traffic hours t reduce exposure to other road users and ensure dumping tickets are collected and stored as part of record keeping. Minimize haul distances. Securing a facility close to the job site for storing needed equipment and materials reduces both time and distance required to transport supplies. 2. Select vehicles that are appropriately sized for the job. By carefully selecting the right size and type of equipment for the job, the number of trips from site to storage can be minimized which reduces the idling time of construction vehicles and prevent unnecessary emissions	High
	Traffic Congestion (slow moving vehicles)	1. Initiate traffic management plans and schedules 2. Limit the number of vehicles entering the site 3. Use traffic light methods on site (green, red and amber light)	Medium
	Noise along transportation corridors	1. Extensive Community & Stakeholder Consultations 2. Scheduling the transport of extremely noisy machinery during agreeable hours (eg. 7 am – 6 pm) 3. Erection of enclosures around machines to reduce the amount of noise in the environment. 4. Use of an Integrating Sound Level Meter (SLM), and/ or a Dosimeter to measure the quantity of sound emitted.	High
	Fugitive Dust along transportation corridors	1. Water suppression on haul roads 2. Restrict vehicle speed to 10 mph 3. Cover excavated areas and material after excavation activity ceases	Medium
Stockpiling of Construction Equipment			

	Site run-offs (rainwater)- suspended solids, petroleum hydrocarbons, potential floatable	1. Install rock or other appropriate materials such as netted bags to cover the storm water drain inlet to filter out trash and debris. 2. Maintain the filter inlets regularly	High
Accidental Oil Spill			
	Possibility of hydrocarbons to the marine area	1. Chemical treatments: Implementing emulsifying and dispersing agents 2. Biological treatments: Bioremediation-Introduction of bacteria, fungi, yeasts, molds into the affected area	High
	Dispersant residues	1. Chemical treatments: Implementation of oil catchers	High
	Used sorbent materials	1. Chemical treatments: Implementing emulsifying and dispersing agents	High
Construction Site Incidents			
	Emissions in the event of a fire	1. Preventative and Suppression strategies such as fire-resistant safety glass, metal doors, electric cables fire wool, water sprinklers, fire alarms, smoke seals, smoke detectors	High
	Chemical exposure from cargo or firefighting foam	1. Develop fire safety plan comprising handling of firefighting foam to include cautioning users for improper disposal near to marine environment, plants used for landscaping and electrical units 2. Incorporate recommendations by Fire Department for Fire Prevention in Annex 5	High

3.3 General Impacts and Mitigation Measures

I. Soil Erosion

a) Anticipated Impacts

The works related to the project site includes engineered construction and rehabilitation via backfilling which may lead to the temporary increase of SS concentration in the nearest waterbody, but its impact will be temporary and limited in scope, which will disappear soon after project completion. The loss of topsoil, either by removal with heavy equipment or erosion by wind and water for example reduces the soil's natural ability to provide nutrients due to washing away of organic matter and water flow regulation due to increased soil density and compaction affecting infiltration rate and water holding capacity. These impacts are detrimental to the public health and ground water sources nearby as the inability of the soil to absorb fertilizer causes these chemicals to end up in nearby water catchments through run-off. On-site impacts if left untreated will affect the off-site environment.

For example, excess nutrients can impact water quality through eutrophication causing unwanted biological growth. Additionally, sedimentation reduces water quality by increasing turbidity preventing sunlight from penetrating the water effectively reducing health of marine ecosystems. Sedimentation also affects waterways by reducing flow capacity where water bodies will receive larger amounts of water in shorter periods of time causing flooding in new areas. These compounded effects if not addressed or minimized through this new development will be a long-haul financial burden for the project proponent as well as for the government as off-site public goods such as roads, drains, and culverts will be affected by improper management of the development. Annex 6 outlines the current measures by project proponent via general and landscaping drainage plans.

b) Mitigation Measures

- Conducting excavations during periods of minimal rainfall and excavate efficiently so that soil is not exposed for a prolonged period
- Strip and stockpile topsoil, cover or seed temporary soil stockpiles
- Lay straws or cloths at the entry/exist of each construction site
- Limit construction and material handling during periods of rains and high winds
- Limit use of heavy equipment to reduce soil compaction
- Soils compacted by grading need to be broken up or tilled prior to vegetating or placing sod.
- Carry out embankment protection and rehabilitation works section by section with greenery works implemented at the same time in order to avoid large scale soil erosion
- Cover disturbed soils with vegetation or other materials (mulch) to reduce erosion potential
- Properly slope or re-vegetate disturbed surfaces
- Ensure soils on the tires of construction vehicles will be regularly cleaned
- Construction phasing and design diversion channels and ditches for post-construction water flows from disturbed areas in accordance with designs
- Control concentrated flow and runoff to reduce the volume and velocity of water from work sites to prevent formation of rills and gullies.

II. Water Management (Stormwater Runoff)

a) Anticipated Impacts

Antigua experiences variable rainfall throughout the year, with pronounced wet and dry seasons. This variability in rainfall highlights two important considerations, the importance of water storage on property and the increased likelihood of flooding from stormwater runoff on property causing erosion. This poses a risk because as the project site is in a highly developed area, stormwater flows rapidly and aggressively and carries sediments into receiving waters.

Due to the design and layout of the project site, impermeable surfaces can increase runoff which can affect adjacent soils which are significantly affected via erosion and compaction during rainy periods. Paved surfaces also contribute to increased heat island effect which causes increased heat absorption and in turn temperatures on site.

b) Mitigation Measures

- Development and implementation of preventative maintenance program and appropriate follow-up for drainage lines to include regular clearing of lines from debris etc.
- Designate personnel responsible for the maintenance program
- Implement measures within Landscape Drainage Plan and consideration for other green infrastructure related preventative measures for water absorption and management including choice of plants (native vegetative plants)

III. Traffic Congestion

a) Anticipated Impacts

Traffic congestion may worsen as construction traffic in urban areas increases especially during rush hours. Construction activities tend to have a poorly managed logistical approach to haulage of materials and other related activities which results in a high amount of waste and could be a deemed a major inconvenience for road users especially within the city and surrounded by such a diverse range of activities surrounding the project site. This is due to the broad variety of involved processes on- site and off-site including factors such as location of construction site, accessibility, availability of storage space, and distribution of material etc.

The project site is partly located close to residential and commercial areas, presenting where roads and intersections may be partially closed due to limited passageway for both regular vehicles and heavy-duty equipment and temporarily blocking pavements for pedestrians which causes temporary inconveniences to traffic, residents, commercial operations, and institutions and is a threat to public health and safety. Furthermore, transports and workers going to and from the construction site also contributes to an increased congestion level. Other disturbances include extra traffic load on the traffic network caused by potential operations of Barnes Funeral Home, coordinated off-site activities, increased noise levels and decreased air quality (increased emissions).

b) Mitigation Measures

- Development and Implementation of transport planning plans/measures

- Establishment of construction consolidation area
- Allocation of delivery times and checkpoints
- Construction vehicle holding areas
- Designated parking for workers
- Dedicated logistics teams to handle haulage of project materials
- Traffic control must be exercised to mitigate growing congestion from an increase in cruiseship and ferry passengers

IV. Spills and Leaks

a) Anticipated Impacts

Potential oil spills and leaks from construction related activity would be detrimental for both the terrestrial and marine environments. Construction equipment and vehicles being used on the project site should be in good working order (i.e. not leaking fuel or oil), and should also be checked for leaks on a daily basis. Vehicles, watercraft and equipment should not be fueled or have their oil changed on-site, but when this is necessary the procedure should be carried out as far away from the shoreline as is feasible.

b) Mitigation Measures

Spills or leaks should be immediately dealt with by first identifying and remedying the source followed by the application of absorptive material to prevent or minimize soil/ groundwater contamination.

V. Network Construction

a) Anticipated Impacts

This impact is typical of all construction activities and usually unavoidable, however its impact can be minimized by special precautions such as silt screens, spraying water on site, reinstalling pavements immediately upon completion of works, and disposal of surplus material to an approved site. Nuisance arising from network construction is reversible and short termed, and will be totally reverted once the project is completed. To this end, due care and responsible supervision by the project manager is necessary during construction.

3.4 Wastewater Treatment Plant Anticipated Impacts & Mitigation Measures

The management of sewage treatment on small islands is a well-recognized challenge. In many areas across St. John's City and throughout the island, there is a combination of aging septic infrastructure and prevalent flooding events especially in high-density developments. The effects of untreated wastewater could result in pollution of surrounding soils and water on and off-site, nutrient loading into receiving waters, and excessive bacterial growth which all affect public health. The major aim of wastewater treatment therefore is to protect human health and prevent environmental degradation by the safe disposal of domestic and industrial wastewater generated during the use of water. Once treated, this encourages conservation applications through recycling wastewater for reuse in irrigation, thereby preserving water resources, which is scarce in drought prone developing countries such as Antigua & Barbuda.

I. Human Health/Communities/Socio-Economic Environment

a) Anticipated Impacts

The city's residents will experience environmental benefits because of the construction of the project. There will be a marked improvement in the public health of the community relative to the improved standard of wastewater management. There will be financial gain opportunities for local population during the construction and operational stages. A Clean environment will encourage the development and establishment of projects and other activities in the area, particularly use of the marine environment. There is also expected to be an overall positive impact on the viability of the development because of the improved aesthetic conditions of the area.

Workers, however, might experience negative health effects, particularly during the removal and collection of greases. Hazards/accidents from handling of hazardous materials such as flammables, explosives and toxics may ensue, communicable diseases, respiratory illness from escaping dust and particulates. Most health impacts (except communicable diseases) will generally be confined to the immediate port vicinity/ work environment. Occupational health programmes should be established and provisions should be made for adequate medical emergency services.

b) Mitigation Measures

- WWTP site fencing is required to contain hazards away from the community.
- Fire alert system should be installed in the plant and chemical fire extinguishers should be available at the site.
- Training of workers on safety measures.
- Controlling of pests breeding due to unsanitary conditions
- Consulation with stakeholders who should be notified of the planned construction activity and alerted when the start date is determined

II. Air Pollution and Odours

a) Anticipated Impacts

The project area is located in an existing port of entry and industrial zone where the airshed is already degraded with certain particulate matters and pollutants and potentially industry specific emissions such as dust from the commercial activity. During the construction phase, it is expected that some localized increase in air pollution and dusty conditions will occur during excavation, backfilling, and other related construction activities where gaseous and particulate emissions will have an impact on the surrounding environment. These effects on air quality will likely originate from use of construction materials, transport vehicles for materials, and temporary use of diesel generators. For example, particulate matter from unvegetated soils may become airborne by equipment movement, wind speed/direction particularly from increased dust aggravation from unprotected aggregate piles, potential emissions from burning waste materials, secondary developments such as urbanization and increased vehicular traffic, common in port and capital cities.

In terms of odor, because the project is a seasonal operation, sludge production would generally yield fewer offensive fumes in addition to the higher sludge retention times in the proposed MBR system which would be much better stabilized. The size of the plant will not accommodate on site sludge management facilities; thus, haulage would take place to the landfill in addition to frequent pumping of grease traps from restaurants and kitchens to reduce odor. The proposed site of the WWTP lies within the project site along the coastline which somewhat isolates the plant away from the adjacent community, although one residential home is directly to the west and along the Point Wharf Fisheries Complex coastline (Figure 32). Unfortunately, prevailing winds will direct any offensive odor from the plant in this direction if management procedures are not followed or in the event of plant failure. During the construction phase there will be some localized increase in air pollution resulting from the operation of construction equipment. Nevertheless, no long-term air pollution problems are expected to be associated with the plant operation.

b) Mitigation Measures

In managing air pollution, EPMA, 2019, Schedule VIII prefaces the threshold criteria are crucial for the project proponent to consider minimizing the amount of dust movement, particularly during windy conditions to curtail pollutants of carbon monoxide, lead, nitrogen dioxide, ozone, and sulfur dioxide. Due to commonly dry weather in Antigua, hired construction managers and contractors should incorporate management actions for dust generated during the construction phase. Dust minimization using the following steps is one of the best mitigating measures to manage air quality:

- Site roads should be dampened using water trucks every 4-6 hours or within reason, given weather conditions to prevent a dust occurrence. Frequency should be increased on hotter days taking onto account the minimization of cleared areas that are needed to be utilized.
- Cover the construction materials such as cement to prevent a dust nuisance during haulage on public roads
- Plan haulage routes on sealed surfaces and using dust suppression on unsealed roads within construction site
- Enclose dust sources either fully or partially to prevent or inhibit particulate matter from becoming air borne because of disturbances created by wind or other factors
- Sealing and/or re-vegetating disturbed areas as soon as possible after completion of each stage of construction works.
- Seeding, stabilizing, covering or containing stockpiles where necessary.
- Incorporate trees in areas where they may be high dust emissions during operations as trees remove pollutants from the air and reduce emissions from parked vehicles.

III. Noise Pollution

a) Anticipated Impacts

Construction activities will generate noise pollution and eliminating this completely is not feasible until works are completed. Because the commercial complex is already in an industrial area, there are sources of commercial external noise including from high-traffic volumes and site activities. However, construction noise level will increase as the complex is built. Noise will be generated, during site preparation, building infrastructure, road construction works, and

their associated use of heavy equipment during the early phases of the project, but it should not be any consequence to adjacent communities and that are located sufficiently far away from the site. In this case, there is a mixed land use profile within the area comprising of a residential community, commercial entities, and vendors directly opposite the site and there is concern that this will be a nuisance given proximity.

Construction noise pollution should be largely temporary.Noise from operations will be largely associated with activities such as generators for electricity production, traffic, local maintenance, operation of WWTP, and associated cruise tourism activities. The concern here is that once the project is completed and in operation, due to the increased economic and social growth within St. John's city such as noise from cruise tourism activity, there will be an increased impact on the community. The present noise level, however, seems to be tolerable and accepted by the people of the community. Noise pollution control measures should be initiated from the construction phase of the project and should include the necessary precautions in accordance with the Noise Abatement Act, 1996 for site construction and operation.

b) Mitigation Measures

The influence of ambient noise must always be minimized from its source and measurements should be done to ensure that the noise is within the acceptable limits.The following actions are required:

- Use equipment that has low noise emissions as stated by the manufacturers and that is properly fitted with noise reduction devices such as mufflers.
- Confine construction and operation of noise-generating equipment during regular working hours (e.g. 7 am – 6 pm) to reduce the potential of creating a noise nuisance during the night.
- Relating staff in the operation of noise-generating equipment should be equipped with noise protection. Workers exposing to noise level of ≥ 80 dB continuously for 8 hours or more should use personal protective equipment (PPE) such as ear muffs.

IV. Solid Waste

a) Anticipated Impacts

Waste production on its own is not an impact, however disposal of construction wastes could have adverse impacts on the soil, water and health of workers and the community. Waste streams during construction period includes: inert construction waste such as soil, debris, concrete, community solid waste such as food and packaging from consumables, and hazardous wastes such as fuel containers, oil filters, oily rags. The potential impacts arising from solid waste production and disposal will be mitigated through a number of activities elaborated in the Waste and Pollution Management Plan (WPMP) which should be incorporated in the bid documents and construction contracts. The direct impacts include unpleasant odors, pollution, and infestations while indirect impacts relate to human and environmental health.

b) Mitigation Measures

- Provide appropriate waste storage containers for worker's construction and hazardous wastes

- Install confined storage points of solid wastes away from sensitive receptors
- Regularly haul hazardous waste to an approved disposal facility
- Prohibit burning of waste on site and where necessary, permit should be obtained from Fire Department
- Multi-compartment collection bins should be installed to facilitate reuse, recycle of solid wastes where appropriate and possible and sent to the Antigua and Barbuda Waste Recycling Corporation (ABWREC)
- Acquire necessary permits from public agencies such as the NSWMA and CBH for clearance regarding earthworks and disposal of waste materials
- Hold contractors responsible for proper removal and disposal of any significant residual materials, wastes and contaminated soils that remain on the ground after construction

Table 6: Solid Waste Types, Description and Management Recommendations

Type of Solid Waste	Description	Management
Recyclable Materials	Tin, Cardboard, Paper Plastic, Glass	Collection on site then transported to ABWREC
Regular Disposable Waste	Daily Waste that cannot be recycled	Landfill Disposal
Large Disposable Waste	Electronics, including Appliances, Light and Heavy-Duty Machinery/Equipment, Construction Waste etc	Landfill Disposal

V. Water Quality

a) Anticipated Impacts

Several project operations already mentioned could potentially contribute to adverse effects to the water quality of the marine environment and groundwater sources. The establishment of the WWTP therefore exacerbates the potential for water contamination.

b) Mitigation Measures

The WWTP is intended to only treat effluent generated on site and not from vegetation and other areas. Based on the magnitude of the project, it is anticipated that the project activities and accrued benefits will stimulate development in the adjacent areas. With this increased development, economic activity, and other human activities, it is possible that levels of pollution may increase especially if means of abating pollution are not integrated into the rate of development in the surrounding community. To this end, the likelihood of contaminating groundwater sources becomes more prevalent in the wake of completion of this project.

The project proponent cannot however absorb all responsibility regarding this impact as rate of urbanisation is already occurring faster than public infrastructure is upgraded and there is untreated wastewater flowing onto the project site from community drains due to the lack of a municipal wastewater facility. Thus, to ensure the water quality of the sewage effluent meets

health and environmental standards, and there is no added impact to the marine environment, regular water quality monitoring of the discharge should be performed in agreement with relevant government authorities by the project proponent. The project proponent has the option of performing sample collection by designated personnel which can then be sent to the Department of Analytical Services Laboratory for physical, chemical, and biological analyses.

The only potential adverse impact of the new plant will be in the immediate vicinity of the plant's outfall. The effluent, although superior to the quality of the current sewage discharges, will contain residual amounts of chlorine, harmful to current biota.The effluent will also produce localized changes in water quality and circulatory patterns. These potential impacts are not viewed as serious but will require monitoring.

VI. Soils

a) Anticipated Impacts

Construction activities, such as excavation, grading and filling, drastically reduces soil quality on construction sites and it is a major source of sediment because of the potential for erosion on highly disturbed land. If left unprotected, the affected,areas will be vulnerable to erosion by surface run-off and will be further degraded by erosion and begin to adversely affect the surrounding environment. Although limited quantities of soil will be excavated,during the construction phase,of the WWTP, there will be some level of soil erosion, especially in the rainy/hurricane season. For direct impacts of the WWTP operations, if treated effluents are deemed unacceptable, there will be contamination for the receiving water body if disposed at sea along with improper handling of grease and sludge which can contaminate nearby soils and create unpleasant odors.

b) Mitigation Measures

- The staff should be trained in proper management of oil and grease disposal to avoid soil contamination
- Periodic tests should be done to assure the quality of effluent water and to avoid partially treated wastewater reaching the soil
- Prevent sediment movement off-site to reduce potential for contamination especially in the event of plant failure
- Excavated soil should be utilized for landscaping and tree planting purposes
- Exposed areas should be replanted with grass as soon as possible after construction

VII. Climate and Landscape

a) Anticipated Impacts

Construction of any project will normally have a negative environmental impact, in this case the surrounding landscape of the WWTP. This however is a short-term impact which will disappear after completion of the works.

b) Mitigation Measures

As much as possible, the existing landscape should be maintained and if the site plan allws, additional trees should be planted around the plant and within the project site so that unsightly operations can be camouflaged behind hedges of adequate landscaping which can help blend

the site with the surrounding environment. This generally improves the local climate by acting as a buffer, the trees would assist in removing added air pollutants and there is [potential for making use of the effluent treated water for irrigation purposes.

VIII. Tree Removal

a) Anticipated Impacts

Within the project, tree removal of the protected West Indian Mahogany trees has already been deemed necessary and unavoidable and remediation measures established through negotiation between project proponent and the DOE. In terms of the WWTP, tree removal is the last resort during selection of routing, treatment plant sites and all construction activities. If unavoidable, erosion will be minimized through implementing temporary or permanent soil stabilization procedures.

b) Mitigation Measures

- Temporary measures include installation of silt screens
- Long-term measures include replanting of trees

IX. Plant Failure

a) Anticipated Impacts

Operational difficulties may arise at the at the start of operations or during periods when equipment malfunctions.The effluent discharged under these emergency conditions howeverwould still be of improved quality over the existing condition where raw sewage is discharged directly into the harbor.

b) Mitigation Measures

The frequency of such incidents is likely to remain low as long as adequate training of operator personnel is maintained and supplies of spare parts are kept available and utilized as recommended to keep all units operational at close to design efficiency levels. Under these circumstances however, increased chlorination of the effluent could be used to kill pathogenic organisms if this need arises. Additionally, the plant could benefit from installing an alarm system to signal malfunction in electrical/mechanical components and making provisions for backup power for electrical components. To this end, additional contingency plans should be developed also in the case of fire, where alert systems should be installed, and chemical fire extinguishers made available.

4 ENVIRONMENTAL MONITORING AND MANAGEMENT PLAN (EMMP)

GPH-ACP proposes to implement its project in an area that has previously been heavily impacted by development. To reduce further impacts of this project, and to be in compliance with national legislation, an Environmental Monitoring and Management Plan (EMMP) is required. The EMMP outlines the responsibilities of those designated by the project proponent and is a framework for environmental monitoring to ensure the environmental integrity of the site is maintained before, during and after construction works and that all works adhere to the relevant laws and policies outlined in Section 1.6. CJC+ Associates Inc. will be responsible for production of guidance for development of the EMMP by GPH-ACP, who will develop and implement the plan and its procedures once construction details are finallsed.

The objectives of an EMMP should be to:

- Ensure that preventative measures are in place before and during construction works
- Ensure any environmental issues are addressed if they arise and the chain of command and relevant personnel are identified
- Ensure materials are recycled/ properly disposed of & compliance with mitigation measures
- Detect issues before they become problems and demonstrates the effectiveness of environmental actions taken by the developer.

Based on assessment of environmental impacts and the mandate of this EIS report, the following would need to be monitored[6] before during and after operation: marine water quality (general), water quality of sewage effluent, general WWTP plant operations, stormwater run-off behavior and drainage systems, and materials used in construction to adhere to national building code. For a project of this magnitude, monitoring, review of findings and revising the document as necessary is the best approach. The areas to be reported on include water management and WWTP- Wastewater Use and Disposal.

Specific monitoring roles of operations personnel should be established, and an onsite environmental representative identified. This individual should set objectives and targets; report on its operations and environmental performance in the operational phase; and document any preventative actions taken.The DCA with DoE will provide guidance on frequency of monitoring and reporting. The following government agencies should be engaged:

- Development Control Authority (Planning Agency; Building Codes and Standards)
- Department of Environment (Environmental Management/Monitoring)
- Central Board of Health (Management of Waste and Materials)
- National Solid Waste Management Authority (Waste Management/Disposal)
- Ministry of Works (Drainage Management/Maintenance)
- National Office of Disaster Services (Disaster Management)

[6] The following online tool can also be utilized to assist in monitoring real time environmental conditions of water quality: Home | RealTMS (uwiclimatetools.tech)

4.1 Development of Environmental Monitoring and Management Plan

Within Part Seven: Section 48 (1)-(7) of EPMA 2019, the DOE mandates that*, "The owner of a commercial or industrial facility shall prepare and submit for the approval of the Director, not later than two years after the commencement of this Part of the Act or such other time as the Director may direct, a site environmental management plan where the commercial or industrial facility-(a) discharges any waste or pollutant into the environment or (c) produces or generates any waste, pollutant or hazardous substance."* GPH-ACP recognizes that a comprehensive Environmental Monitoring and Management Plan (EMMP) is necessary to implement protocols and necessary oversight as the development moves forward and to comply with legislative mandates. The EMMP will be drafted and submitted by the Contractor once awarded and prior to construction. This section therefore outlines the suggested components to GPH-ACP to develop its EMMP. These approaches ensures that the EMMP elaborates on environmental policies, objectives, targets, monitoring and management strategies for the project. Additional guidance is also provided in EPMA , 2019 Part 7 Section (4)-(a)-(i).

1. **Identify and Articulate Measurable Environmental Goals and Timelines**
    1. The impacts identified in this report and mitigation recommendations should be used as targets within the EMMP.
    2. Outline established schedules for implementation, monitoring, assessment, and reporting

2. **Adaptive Management**
    1. Present framework for analyzing and presenting results for management decisions and other adjustments as needed.
    2. Outline conceptual understanding of the system and an evaluation of its current condition.
    3. Identify issues that could adversely impact natural resources of the area.
    4. Develop monitoring plan that includes collection of data, evaluation of results, and response options.
    5. Plan for re-assessment of the system and an ability to implement changes/adapt management protocols as necessary.

3. **Training Plans**
    1. Training needs should be outlined in the EMMP, highlighting potential trainers and establish a training schedule to ensure ongoing learning/knowledge exchange (importance of EMMP implementation and general environmental awareness)
    2. Training is an essential and cost-saving investment that enhances worker's skills and helps ensure all personnel are aware of the EMMP's benefits, objectives, procedures, and targets.

4. **Project Management and Communication with:**
    1. Local community, educational, government, and non-governmental organizations.
    2. Contractors, suppliers, construction crews, and on-site workers.

3. Investors, shareholders, residents, and visitors.
4. Local business sector and the general public.

5. **Monitoring, Reporting and Verification using Data outlining:**
    1. Chain-of-command for site management.
    2. Documentation and accountability to policies outlined in this EIS.
    3. Incident reporting and management plan.
    4. Reporting responsibilities.

4.2 Monitoring Recommendations for Construction/Operation of WWTP

Environmental monitoring plans for construction and operation phases for the WWTP are outlined below. It is noteworthy that these are general recommendations, and it may be detailed and adjusted during the working process.

I. Monitoring During Construction Phase

1. Construction work should be monitored on a daily basis by the project manager and supervisor to avoid a dust nuisance at the cleared areas and access roads and other impacts identified..
2. Daily inspections should be conducted to ensure that trucks carrying raw materials and heavy equipment are parked at designated holding areas to prevent traffic congestion and accidents.
3. Subject allowable standards to gaseous emissions generated by construction vehicles, equipment, and machinery
4. Properly treat solid waste generated during construction, and at camp sites and safely disposed of waste disposal sites after been approved by supervisor.
5. Staff Training about safety procedures, equipping them with PPE such as hard boots, helmets, gloves, and protective masks, and monitoring their proper and sustained usage.

II. Monitoring During Operation Phase

1. Flow metering with automatic samplers are supposed to be provided for the WWTP facilities to measure and monitor inlet, outlet, return sludge and excess sludge flow continuously.
2. A periodic monitoring report should be submitted to the responsible authority to assess the monitoring measures and deciding suitable actions to reduce pollution effects.
3. Maintenance monitoring for all WWTP units to ensure the performance of the treatment plant equipment.
4. Periodic sample collection and laboratory tests should be done to the inlet and outlet flow to ensure that its parameters are within the allowable limits.
5. Sludge management plan should be submitted to the responsible authority including a monitoring program to ensure the correct testing of sludge, and a proposal for the appropriate disposal.
6. Develop and Review operation logs, testing input/output effluent to report to relevant authorities

7. Water quality samples should be collected at a frequency indicated by the relevant government authority for the treatment plant effluents to test for the parameters indicated in the sewage treatment anticipated impacts section.
8. Implement safety protocols to handle and store hazard material.

Elements specifically recommended for inclusion in the follow-up monitoring and re-evaluation programme are: compliance with approved methods for sewage treatment and disposal (use of treated sewage water, seepage of contaminants from WWTP or sludge disposal sites into coastal waters), wind transport of pathogens originating from the treatment plant, and recommendations for monitoring of sewage outfalls.

4.3 Monitoring Recommendations for Drainage/Stormwater Runoff

Drainage and Stormwater run-off should be monitored by the representative designated by and/or by the relevant government authority to ensure drainage systems are designed in accordance with approved plans and utilizing the proposed materials and that they are effective in diverting runoff into designated drains and to ensure contaminated water is pumped and drained from excavations and filtered through silt traps. These parameters in addition to water quality of the runoff should be monitored and any breach or complaints remedied, and a report submitted to DCA.

4.4 Data Management and Compliance

As part of the EMMP, a data management system should be established to collect and manage the environmental data which informs response actions. These data should be made available to the relevant government agencies and should be backed up to ensure that valuable data and information are not lost through natural disaster. This will allow the project proponent to document its own actions and confirm compliance with development permissions and also serve as part of a database for future commercial developments with the goal of reducing costs as well as reducing environmental impact.

The Contractor is unlikely to have the time required to fully supervise mitigation, thus a designated senior member of the construction team should be given the task to:

- Ensure that proposed mitigation measures are performed
- Liaise with regulating authorities to schedule site visits and reporting to ensure compliance
- Perform necessary works in the event of a pollution incident or event and to ensure compliance with conditions specified in development approval and NODS Approved Disaster Management Plan (Annex 7)

It is also important that the project proponent provide necessary covering clauses in tender documents referencing the proposed measures to prevent or reduce environmental impacts and to ensure responsive actions by the entire construction team. impact. Further, project proponent should designate a member of staff to handle health and safety matters during operational phase to continue these duties.

5 WASTE AND POLLUTION MANAGEMENT PLAN (WPMP)

5.1 Introduction

This Waste and Pollution Management Plan (WPMP) details how waste generated from the construction and operation of the St John's Harbour Redevelopment will be managed. The WPMP has been developed to ensure that the wastes will be managed in accordance with all legal requirements and to meet current best practice in waste management. It has been compiled as part of the project Environmental Management Programme (EMPr) and includes waste stream information available at the time of compilation. Construction practices and operations must be measured and analysed in order to determine the efficacy of the plan and whether further revision of the plan is required. This plan should be further updated should further detail regarding waste quantities and categorisation become available, during the construction and/or operational stages.

Additionally, the WPMP seeks to ensure that waste is managed in accordance with the waste hierarchy (Figure 40) such that opportunities for waste reuse and recycling are maximised and the amount of waste sent to landfill is minimized. St. John's lacks a municipal system for collection and disposal of sewage wastes and within the project site several drains flow into the St. John's Deep-Water Harbour for example in Figure 39.. These drains (which are also fed from the surrounding communities) are heavily congested with physical waste, and the water does not undergo treatment before entering the drains. Additionally, poorly drained soils in some areas and the ineffectiveness of septic and soakaway systems to treat wastes result in untreated wastewater flowing in street drains which discharge into the Harbour.

Figure 39:Public Drain on Western end of Barnes Funeral Home that flows into the St. John's Harbour

5.2 Projected Wastewater Management Needs

Waste generation in the Development area will generally include domestic waste, commercial waste, construction and demolition debris, sanitation residue and waste from streets. These wastes will be in solid or semi-solid form and will potentially include very low quantities of industrial hazardous wastes and bio-medical waste. All industrial hazardous waste and biomedical waste must be disposed of properly by the respective industries and cannot be included in the site wide waste management system. The main waste categories anticipated are: Biodegradable waste (food and kitchen waste, green waste (vegetables, flowers, leaves, fruits) etc.; Recyclable material (paper, glass, bottles, cans, metals, certain plastics, etc.); Inert waste (construction and demolition waste, dirt, rocks, street sweeping, drain silt, debris, etc.) and sewage.

5.3 Waste Hierarchy Management Strategies

The following section outlines proposed strategies for effectively managing waste generated by the project in order of priority (Figure 40), that if followed by the project proponent promotes environmental stewardship.

1. Using less material in design and manufacture. Keeping products for longer; re use. Using less hazardous materials
2. Checking, cleaning, repairing, refurbishing, whole items or spare parts
3. Turning waste into a new substance or product. Includes composting if it meets quality protocols
4. Includes anaerobic digestion, incineration with energy recovery, gasification and pyrolysis which produce energy (fuels, heat and power) and materials from waste; some backfilling
5. Landfill

Figure 40: Waste Management Hierarchy

I. Re-Use

If surplus materials can be used in future operations, they are classified as materials which can be re-used. Materials that can be reused in their present form are surplus to requirements and need to be removed from site will be reused. The surplus products will be labelled, and storage area recorded for future reference.

II. Recycling

This should be considered when reuse can no longer be carried out. Recycling refers to the collection of the recyclable waste streams that can be reused on site. For the recycling practices to be effective, onsite waste segregation must also be implemented as the quality of recyclable materials is higher when separated and not when mixed with other waste.

III. Residual Waste

Residual waste can come in several forms including waste that cannot be disposed of due to its category, class or material. Ways of reusing or disposing of the waste from the site needs to be found. Residual waste can be an eyesore, fire hazard and has potential to impact on the environment through leachates. All residual wastes will be identified, and new residual wastes will be added to the residual waste catalogue for quarterly auditing. Residual wastes that are deemed essential or have the potential for future use will be stored in a neat and tidy manner and where possible under cover to avoid or reduce the potential for further corrosion or damage to the product.

IV. Landfill

If the above options cannot be satisfied, then the only alternative left is to send the surplus materials to landfill. Only the government approved landfills will be used.

5.4 Waste Management Actions

The objectives of the WPMP are implemented through the steps outlined in this section. To comply with the WPMP guidelines, management actions are taken at each stage of the management process, such as demolition, sorting, or disposal.

I. Subcontractor Management

All subcontractors are required to operate with the requirements of the WPMP and associated documents. Their contracts will include a copy of the WPMP and be informed of the intention to reduce and recycle waste.

- Any demolition, civil and landscape subcontractors will be required to develop a WPMP for their Scope of Work detailing the type of waste generated and waste avoidance, reduction, reuse, and recycling strategies.

- The subcontractor will be responsible for ensuring that all their crews adhere to the plan by encouraging good environmental awareness as part of on-site health and safety orientation or training.

II. Storage Areas & Recycling

It is anticipated that on commencement of works, a main skip will be utilised to collect the site's general solid (non-organic/biodegradeable) waste. This bin will be emptied at whatever

frequency is required to ensure that waste is not placed in the bin beyond its rim, to prevent potential overflowing waste. Lidded bins separate to this skip will be located at site amenities areas for the removal of general solid waste (organic biodegradeable).When possible, the designated subcontractor will transfer the waste straight from the point of creation to a centralized waste storage area for that specific type of waste, where it will be safely held until being disposed of according to one of the methods outlined in Table 6 below. For efficiency, management may erect intermediate storage spaces or collecting locations. Any such areas will also adhere to the safety protocols.

III. Internal Bin System

All waste produced onsite will be delivered to the skip bin as detailed in the previous section. Smaller quantities of waste will be collected in wheelie bins andwill be emptied regularly into the site's main skip bin. These smaller bins will be positioned to accommodate waste expected to be produced during construction.Contractors will also be responsible for supplying bins for their own waste generation activities. These bins will be transported to the internal collection point and emptied into the skip bin as required. No binswill be left full in the storage area. Bins for general organic waste and recycling will be established at site amenity areas and will be removed separately to the main skip onsite.

IV. Waste Transport

The official dump site in Antigua is the Cooks Sanitary Landfill located at Cooks St. John's Antigua. This facility currently receives solid, commercial, and green waste, white goods, end-of-life vehicles, hazardous and construction wastes. All wastes that cannot be reused or recycled will be transported to this site. The following waste disposal principles should be adhered to:

- All waste taken from the site should be recorded and kept on file;
- The contractor must return disposal certificates received from the landfill, which should be kept on file.

V. Dust Control

All powdery/dusty materials to be stored in enclosed containers or covered to avoid wind dispersal. Dust producing activities to be reduced during strong winds or to be controlled by dust suppression techniques e.g. water sprinkling.

VI. Noise Control

- Provision of noise barriers for static equipment where appropriate especially when noisy work (eg. hammering) is being conducted.
- Silent generators and water pumps will be screened/located as appropriate to reduce noise;
- Any cranes, pulley wheels, and moving parts of working equipment will be adequately lubricated to prevent undue screeching.
- Placing sources of noise in areas that are less sensitive to take advantage of distance and shielding.
- Selecting equipment with lower sound power levels.
- Enclosures for equipment radiating noise such as diesel generator sets.

VII. Hazardous Substances

Hazardous substances supplied to the project shall be isolated, registered, correctly stored,

decanted, used, and disposed in accordance with the material safety data sheets (MSDS) and regulatory requirements. Hazardous waste to be landfilled will be transferred and disposed of at authorised hazardous landfill sites (by the subcontractor). Employees shall be trained in the safe work method statements based on the MSDS and provided with the appropriate PPE.

VIII. Sanitary, Grey and Black Water Wastes

- Restrooms will be available for construction workers and use of the outdoors for restroom purposes will be prohibited. All sanitary products will be contained within receptacles supplied by a subcontractor. The subcontractor will also be responsible for disposal of these wastes.
- A wastewater treatment plant will be installed to handle sewage during the operation of the waterfront. The WWTP will be adequately sized for the development. After undergoing treatment will be disposed into the drain. Under no circumstances will untreated biological or non-biological waste be dumped into the ocean.
- Because of the limited available space, sludge management will not be done onsite. Waste sludge would need to be hauled offsite to Cooks Landfill once or twice per year (in addition to pumping out of grease traps more frequently from restaurants and kitchens in the facility).

IX. General Good Practices

The following actions/strategies are implemented across site to maximise efficient waste management:

- All personnel working onsite will undergo a site induction. The induction will include a section on waste management practises on site;
- Clear instructions detailing recycling procedures and waste segregation procedures are to be maintained at various locations across site;
- All waste receptacles and storage areas are to be clearly identifiable;
- A contract waste management company is employed to transport waste and monitor and report compliance to waste regulations; When feasible, different waste types produced by the construction crews will be separated into general, non-hazardous and hazardous wastes as they are produced;
- The subcontractor will not be permitted to bury or burn any garbage or building debris;
- The subcontractor should ensure construction site remains clean and litter free and trash removed from the site regularly
- All plants, vehicles and equipment will be regularly inspected to prevent leakage/emissions.
- Standard industry refueling protocols will be followed including secondary spill containment such as drip trays, rags and sand used wherever refueling

5.5 Waste Minimization and Management Sub Plan

Waste can affect different aspects of the environment and may cause contamination, impacts on visual amenity and health effects. Waste materials that may be produced on the Project include:

- Building material waste – off cuts, overspill of concrete, packaging, steel, etc.
- Work compound (on-site employee) waste - litter including food and drink packaging etc.
- Packaging waste
- Black and grey water and sludge – Onsite portable toilets, WWTP
- Office equipment (portable offices) – Paper, cardboards, etc.

The table below provides the main objectives these actions aim to achieve:

Table 7: Waste Minimization and Management Objectives, Targets and KPI's

Objective	Target	Key Performance Indicator
» Solid and liquid waste to be disposed of as per Regulatory requirements.	» All waste to be disposed of by a licensed waste contractor.	» Onsite waste disposal facilities confirmed and documented.
» No waste to affect nearby premises.	» No complaints related to construction waste affecting nearby premises during construction.	» Number of complaints relating to waste.
» Minimize waste and recycling generated on site	» Ensure all subcontractors are informed of and implement site waste management procedures.	» Waste reporting by waste contractors
» Segregate waste on site to maximize reuse and recycling	» All waste to be segregated into provided separate waste type storage.	» Waste reporting by waste contractors
» Segregate contaminated or hazardous waste for appropriate treatment and disposal, where applicable.	» All hazardous waste to be disposed of in accordance with EPMA 2019	» Waste reporting by waste contractors

Table 8: Identification of On-Site/off-Site Materials, Disposal Method and Location

MATERIALS ONSITE	REUSE AND RECYCLING		DISPOSAL
ONSITE OFF-SITE			
Type of Materials	Methods	Contractor and Recycling Outlet	Disposal
Concrete	General waste bin	Transfer for reprocess or recycle	Landfill
		- Waste contractor	
Masonry, Brick & Tile	General waste bin	Transfer for reprocess or recycle	
		- Waste contractor	
Wood	General waste bin	Transfer for reprocess or recycle	
		- Waste contractor	
Metal	General waste bin	Transfer for reprocess or recycle	
		- Waste contractor	
Mixed waste	General waste bin	Transfer for reprocess or recycle	
		- Waste contractor	
Glass	General waste bin	-Transfer for reprocess or recycle – Waste contractor	
Packaging/ Paper/ Cardboard	Separate in designated bin	Transfer for reprocess or recycle	
		- Waste contractor	
	Separate in designated bin	Transfer for reprocess or recycle	
		- Waste contractor	
Food waste	dedicated general waste bins	- Waste contractor	Landfill
Grey and Black Water	Wastewater Treatment Plant	WWTP Contractor	Drain
Sludge			Landfill
Subcontractors will be responsible for recycling and reuse of their waste material and for removing non-recyclables from the work area to the main bin onsite.			

5.6 Proposed Monitoring

A subcontractor will be responsible for monitoring compliance with various aspects of this WWMP. This will include the following:

- Checking the waste deposited in the bins to make sure it complies with the waste segregation requirements.
- Checking on the permit of the waste collection contractor prior to contract award and periodically throughout the contract.
- Checking on the suitability of the vehicle and security of the waste as the waste is collected by the waste transporter.
- Ensuring that all wastes are being taken to appropriately licensed waste processing/disposal facilities.
- Periodically checking the facilities to which the building's waste is taken to make sure it is being managed appropriately and as much as possible is being recycled.

In addition, records will be kept of the volumes of waste produced from operation of the building together with data regarding the proportion of waste that is recycled and disposed (landfilled and incinerated). The effluent from the WWTP will be monitored in line with the Environmental Monitoring Plan. This plan will focus on biological parameters of the effluent being released into the marine environment and will be developed in association with The Department of Analytical Services and with recommendations from the Central Board of Health where necessary.

Data on waste production and disposal should be gathered continually via logbooks and registers. Records should be maintained on site and made available to the Central board of Health, Department of Environment, authorities, and any other party contracted to audit or assess the waste management practices on site.The data should include the destination of each waste stream and where disposal hasoccurred proof of safe disposal will be required, such as a date stamped waste disposal ticket issued by a sanitary landfill. A cost should be paid for safe disposal of wastes. Evidence of waste disposal and payment should also be maintained.

6 SUMMARY AND CONCLUSION

GPH-Antigua Cruise Port ("GPH-ACP"), the project proponent intends to invest in the re-development of the lower portion of St. John's City. The project site is located within downtown St. John's City between Newgate Street and Whapping Lane. The proposed site is within a mixed used area, and zoned for industrial, urban settlements and transportation land uses and is home to a combination of commercial/industrial enterprises and adjacent to a residential community that is considered densely populated.

GPH-ACP's investment will facilitate construction of a project site that spans 17,240 square metres. Features of the project includes a new terminal with the border security requirements of a port of entry, an ultramodern waterfront day club featuring several pools, a state-of-the-art casino, local food-and-beverage outlets, restrooms, parking lot, wastewater treatment plant and approximately 70 to 100 retail spaces for local entrepreneurs.There will be direct benefits to the surrounding community, residents, visitors, and cruise passengers by ultimately creating links between the commercial businesses and improvement of the community's social infrastructure, cultural sites, attractions, innovative public and commercial functions which will all boost Antigua & Barbuda's tourism product. Importantly, the construction and operational phases will create local jobs both in construction and operation phases.

The land is currently below the elevation level of the fifth berth, thus backfilling activity will be conducted to meet elevation requirements within the architectural, engineering designs and to avoid flooding. The project site already has infrastructure for public utilities (water and electricity), and site visit revealed that at least two community open drains outside the project site boundaries. However, the drainage pipes run through the project site for the outfall into the harbor. These drains are publicly managed by the Ministry of Housing, Works, and Urban Renewal, however in keeping with proposed designs GPH-ACP will endeavor to maintain the flow of this existing drainage channel in keeping with environmental standards to minimize flooding and other hazards.

GPH-ACP has contracted Caribbean Water Treatment Ltd. to assist in the establishment of the WWTP where the company recommended the installation and commissioning of a 30,000 USgpd membrane biological reactor (MBR) wastewater treatment plant for the project. The plant will be supplied by Enereau Systems Group out of Canada. The Enereau team have been involved in the design, installation and operation of MBR type wastewater treatment plants in resorts and developments across the Caribbean for over 20 years. The Architect on Record, Tabanlioglu Architects has provided a wastewater plan which outlines mechanical wastewater linesincluding pumping line, location of manholes, and pump station.

Potential impacts of the project relate to the construction and operation phases of the overall project and construction and operation of the Wastewater Treatment Plant. These impacts include an increase in pollution (air, water, solid waste, and noise), pests, traffic congestion, emissions, stormwater runoff, chemical exposure, soil erosion, spills and leaks, human health risks, sewage effluent discharge and plant failure.

To minimize this combination of anticipated impacts, several mitigation measures have been proposed which will alleviate or eliminate the associated risks during construction and after operations within Section 3 of this report.

The environmental and technical sustainability of the project however depends on the development and application of a robust environmental management and monitoring plan (EMMP). GPH-ACP recognizes that a comprehensive Environmental Monitoring and Management Plan (EMMP) is necessary to implement protocols and necessary oversight as the development moves forward and to comply with legislative mandates. The EMMP will therefore be drafted and submitted by the Contractor once awarded and prior to construction.

This report outlines recommendations to GPH-ACP to develop its EMMP which should include components such as: articulation of environmental goals with appropriate timelines an adaptive management framework, training plans, project management, communication, monitoring reporting and verification of data collected. These approaches ensures that the EMMP elaborates on environmental policies, objectives, targets, monitoring and management strategies for the project.

The overall project will generate construction debris, electronic waste, and daily disposable waste. Thus, within the Waste Management and Pollution Plan outlined in Section 5 of this report, construction waste and refuse will be removed to Cooks Landfill in accordance with the National Solid Waste Authority Act, 2005 and recycling occurring once feasible and transported to the Antigua and Barbuda Waste Recycling Corporation.

Based on the assessment conducted and findings of this report, with consideration of the project benefits and land use and zoning regulations, there are no major concerns preventing project operationalisation. The installation of the WWTP to service the facilities should have no negative impact on the surrounding marine and coastal environment once the plant is designed to handle the purported wastewater expected to be generated, and its operation are kept strictly within its issued operational protocols. With regards to the WWTP, the following recommendations should be adhered to:

- Conduct bi-annual water quality testing of the effluent from the sewage Plant. These should be completed in the low-tourist season (June – October) and in the high-tourist season (December – May)
- Establish a monitoring protocol to regularly document the biological parameters of the effluent being released into the marine environment in collaboration with the DOAS and CBH

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8 ANNEXES

Annex 1: Plan Application #A635-2022-Cruise Port Terminal (Point Wharf)
Annex 2: Tree Removal Decision
Annex 3: Wastewater Treatment Plant Proposal
Annex 4:Geo-Technical Survey
Annex 5: Recommendations from Fire Department
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