SEV Consulting Group

Environmental Impact Assessment for BPL Station D Power Plant, New Providence

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1.0 EXECUTIVE SUMMARY

1.1 Project overview, location, nature of the development

Bahamas Power and Light Company Limited (BPL), the government-owned national power company of The Bahamas, intend to develop a liquefied natural gas (LNG) to Power Project that will serve fuel and electricity needs for customers of BPL in New Providence. The power plant component of the project and associated relevant infrastructure will be developed by BPL and the LNG Regasification infrastructure and multi fuel jetty will be developed by Shell Gas and Power Developments B.V. or affiliates (Shell). The commercial structure of the LNG to Power project, subject to ongoing negotiations, anticipates that the facility will be jointly owned by Shell, BPL and a consortium of local investors.

BPL's main priority that shapes the development of the new power plant is to modernize power generation that increases efficiency and reliability while reducing cost to the consumer.

Wärtsilä will be the Engineering, Procurement and Construction (EPC) contractor for the new power plant referred to as Station D. Upon completion of the new power plant, Wärtsilä will operate and maintain the plant via an Operation and Maintenance Agreement using a fully trained Bahamian workforce.

The overall LNG to Power project consists of the following physical components:

1. Power plant and related infrastructure.
2. Regasification terminal and related infrastructure including a new bi-directional, multi-fuel jetty and regasification facilities.
3. LNG supplied from Shell's global portfolio.

This EIA is limited to Component 1 – the power plant and related infrastructure.

Station D is intended to replace some of BPL's existing aging generation fleet at Clifton Pier Power Station (CPPS) as baseload generation for the island. This new power plant is not intended to increase the overall generation level on the island, but rather transfer generation from existing inefficient and old assets to newer, more efficient technology. Assuming natural gas is ultimately used as the primary fuel, the substitution of power generation to the new power plant from BPL's older generation assets is anticipated to lead to net reductions in the emission of particulate matter, CO_2 and related greenhouse gases, with corresponding benefits to the local airshed.

If the proposed regasification facilities are not constructed, the supply of diesel and heavy fuel oil (HFO) will come from BPL's existing storage tanks.

1.2 Summary of significant environmental impacts and proposed mitigation

Table 1-1 provides a summary of those environmental impacts from the project that have been identified as significant along with mitigation measures proposed to address them.

Table 1-1: Summary of Significant Environmental Impacts and Proposed Mitigation

	Impact	**Mitigation Measure**
Avifauna	Fumes, dust and noise from development and operations activities will disrupt bird behavior beyond the physical boundaries of the site. The onsite avifauna diversity impacts are permanent.	Planting native trees on property and supporting local terrestrial conservation will help mitigate effects on native and migratory birds.
Invasive species	The site harbors invasive plants, birds and rodents. When allowed to proliferate within the site, they then spread to surrounding natural areas, damaging the ecosystems and killing native wildlife.	Removal of invasive Casuarina trees will occur during clearing of the site. Any landscaping that will occur will utilize native or endemic plant and tree species.
Occupational health and safety	Workers can be put at risk during construction phase through failure to wear protective personal equipment (PPE), improper handling of equipment and materials, and not adhering to standard safety procedures. These failures can result in loss of life or permanent physical damage. COVID-19 virus poses a health risk to workers if they are in close proximity to each other.	Workers will be provided with appropriate protective personal equipment (PPE) for the assigned tasks, including hard hats and high0visibility safety vests. All workers will receive training in proper handling of equipment and materials as a part of their orientation before being admitted to the site. There will be regular reinforcement of occupational health and safety procedures during weekly meetings. Information on health and safety procedures (e.g. Material Safety Data Sheets) will be accessible to staff during working hours. At least one staff member will be assigned to ensuring health and safety procedures are being followed during construction and operation activities. Workers will adhere to COVID-19 Emergency Orders requirements inclusive of wearing masks and social distancing.
Human health	Chemical emissions, particulate matter, and vapour intrusion can impact individuals with chemical sensitivities, asthma, respiratory ailments and migraines	Vapour collection systems and/or vapour barrier for new and existing buildings. Air quality monitoring at regular intervals throughout the year.

	Impact	Mitigation Measure
		Continual remediation of groundwater and soil impacts to reduce odours and vapour intrusion. Maintain a record of any complaints related to emissions and respond to complaints by taking mitigative action, if warranted. Notify local community when emission levels could impact health.

2.0 INTRODUCTION AND OBJECTIVES

2.1 Objective and Scope of the EIA

Environmental Impact Assessments (EIAs) in The Bahamas are conducted within the context of the regulatory framework of the country or area where the proposed project is to be undertaken. For this proposed project, Bahamian laws, regulations, policies and standards will form the basis for assessing this project. These include the Conservation and Protection of the Physical Landscape of The Bahamas Act 1997, Environmental Health Services (Collection and Disposal of Waste) Regulations 2004, Planning and Subdivision Act 2010 and Environmental Protection and Planning Act 2019.

Additionally, relevant recognized international standards such as the International Finance Corporation (IFC) Performance Standards and the World Bank Environmental Guidelines, and BPL's Health, Safety and Environmental (HSE) policies will be applied, as appropriate.

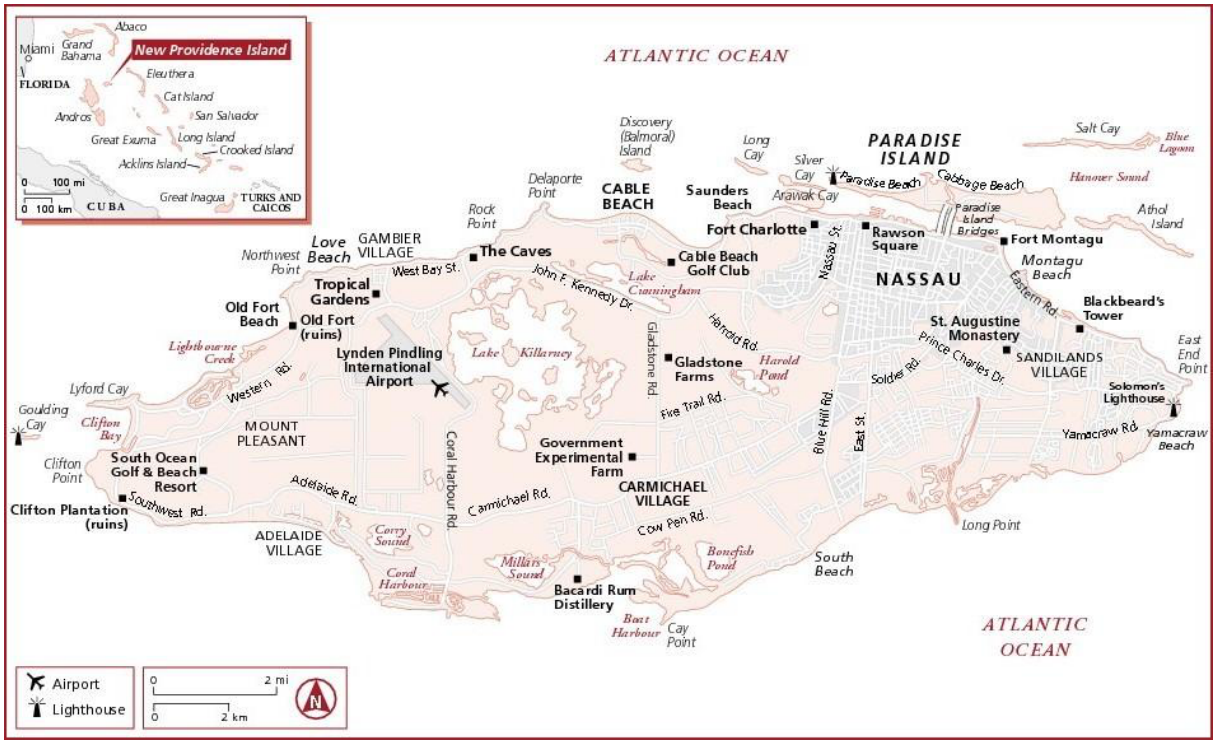
The objectives of the EIA are to:

1. Evaluate potential environmental impacts of the proposed Station D Power Plant project;
2. Recommend potential mitigation measures that can be implemented to reduce or eliminate any negative environmental impacts; and
3. Evaluate whether the proposed project can be implemented in a manner that is environmentally sustainable.

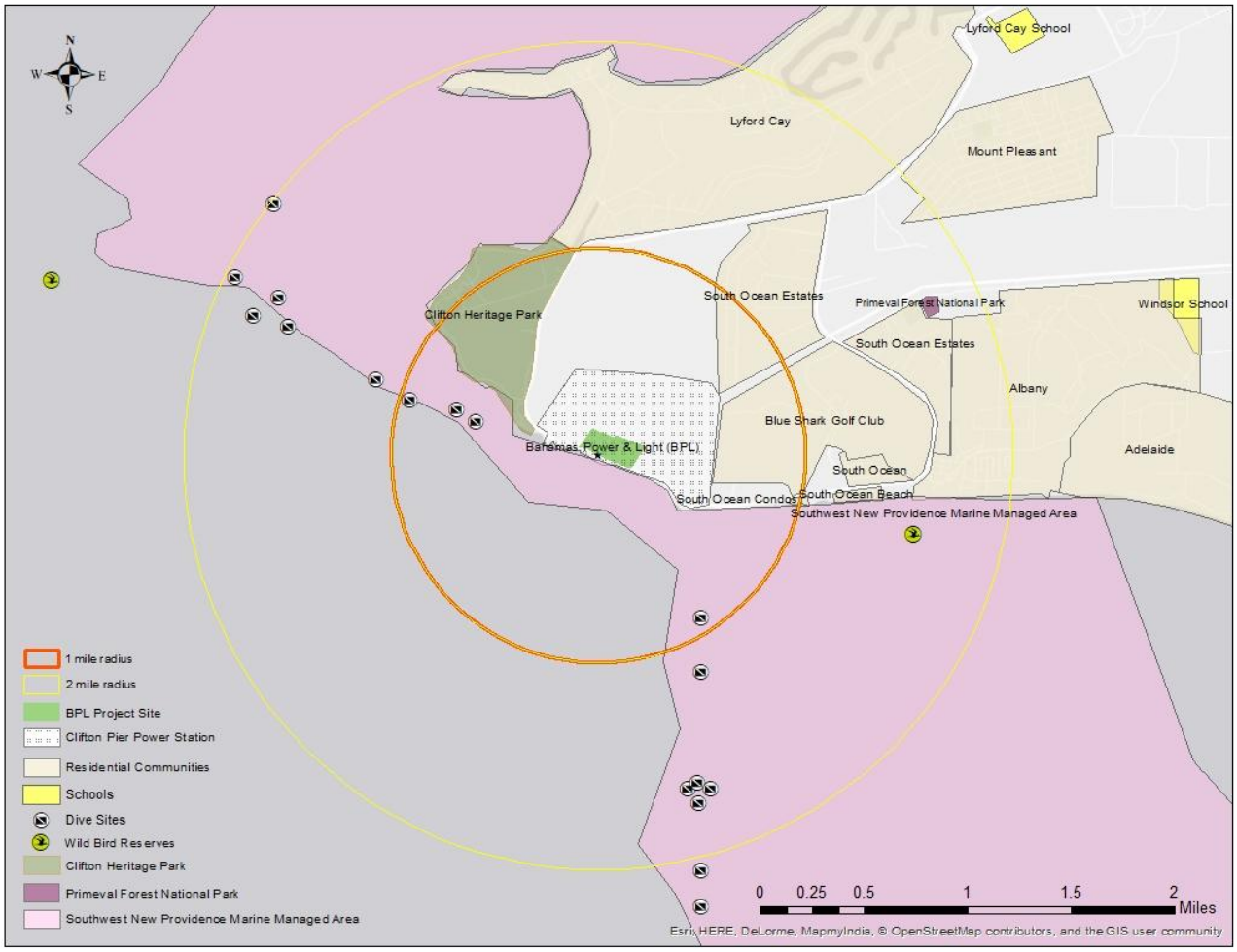
The scope of the EIA is confined to the Station D project site and its immediate environs. The project is located in The Bahamas on the island of New Providence at the Clifton Pier Power Station. Maps 2-1 through 2-3 show the location of the project site from country-level to site-level.

Map 2-1: The Commonwealth of The Bahamas

Map 2-2: New Providence Island



Map 2-3: Clifton Pier Power Station and Environs



2.2 Present and Proposed Energy Usage and Impacts

Station D will have a generating capacity of 85-102 MW. Together with Station A (recently constructed by Wartsila), the combined complex will allow for approximate installed capacity of 200-220 MW. The engines for Station D can operate on three fuels – automotive diesel oil (ADO), heavy fuel oil (HFO; also known as Bunker C) and LNG. BPL reserves the right to operate the plant on any of these fuels at any time.

One of the impacts of using hydrocarbons as an energy source is the resultant greenhouse gas emission (GHGs). Table 2-1 below describes the content and density of the fuel types utilized by BPL while Table 2-2 details the emission factors for each fuel type.

Table 2-1: Fuel Content and Density by Fuel Type

Fuel Type	Content and Density
Heavy Fuel Oil (HFO)	
Carbon content	87.26%
Sulfur content	2.06%
Density	8.23 lb/gal
No.2 Light Fuel Oil (ADO)	
Carbon content	86.25%
Sulfur content	0.47%
Density	7.22 lb/gal
Lube oil	
Density	7.25 lb/gal

Source: BPL, 2012

Table 2-2: Emission Factors by Fuel Type

Fuel Type	Emission factor ($lb/10^3 gal$)
Heavy Fuel Oil (HFO)	
CO_2 emission factor	25,000
SO_2 emission factor	3,245
NO_x emission factor	55
CO emission factor	5
No.2 Light Fuel Oil (ADO)	
CO_2 emission factor	22,300
SO_2 emission factor	66
NO_x emission factor	20
CO emission factor	5

Source: BPL, 2012

Greenhouse gas emissions at CPPS for 2014, 2017 and 2018 are detailed below in Table 2-3. 2014 is presented as the most recent complete annual dataset and 2017 and 2018 as the most recent datasets.

Table 2-3: CPPS GHG Emissions (2014,2017-2018)

CPPS	CO2 produced (tonnes)	SO2 produced (tonnes)	NOx produced (tonnes)
2014			
January	60,643.96	7,425.01	128.84
February	31,498.12	3,696.37	65.27
March	39,843.29	4,764.47	83.48
April	36,438.05	4,651.06	79.36
May	38,219.02	4,842.13	82.87
June	35,551.16	4,527.20	77.32
July	34,219.92	3,956.12	70.30
August	42,682.21	4,808.43	86.39
September	34,713.10	3,814.87	69.28
October	32,686.70	4,032.70	69.76
November	26,402.06	2,979.30	53.49
December	27,595.67	2,482.16	49.41
Annual Total	**440,493.26**	**51,979.82**	**915.77**
2017			
January	24,055.93	3,032.27	52.00
February	N/A	N/A	N/A
March	N/A	N/A	N/A
April	N/A	N/A	N/A
May	32,890.49	3,720.95	66.73
June	23,098.93	2,736.15	48.13
July	26,127.94	3,351.00	57.07
August	33,283.04	4,047.64	70.43
September	34,121,14	4,367.55	74.44
October	29,410.96	3,553.97	62.00
November	14,349.94	1,804.71	30.98
December	20,916.82	2,665.63	45.51
Semi-Annual Total	**238,255.19**	**29,279.87**	**507.29**
2018			
January	23,688.06	3,021.48	51.57
February	24,310.25	2,922.63	51.09
March	25,185.53	3,199.08	54.69
April	21,917.24	2,442.34	44.09
June	20,923.10	2,664.44	45.51
July	17,007.90	2,207.28	37.42

Semi-Annual Total	**133,361.01**	**16,458.23**	**284.67**

Source: BPL, 2020.

The projected GHG emissions with construction of Station D are detailed below in Table 2-4. The specifications for the engine and site design conditions[1] are:

- **Engine specifications:** Wartsila 18V50DF at 514 RPM (constant speed), CR12, NO_x tuning 970 ppm at 15 vol-% O_2, dry
- **Site design conditions:**
  - Intake air or ambient temperature 30°C (86°F)
  - Relative humidity 78%
  - Minimum absolute humidity $6g_{water}/kg_{dry\ air}$
  - Altitude above sea level 15 m (49.21 ft)
  - Heat rate (LHV) for HFO 8,433 kJ/kWh
  - Heat rate (LHV) for LNG 8,071 kJ/kWh

Table 2-4: Projected GHG emissions for Station D

	GHG emissions (g/kWh)
HFO	
CO_2 emissions	652.7
CH_4 (as CO_2 equivalents)	0.6
N_2O (as CO_2 equivalents)	4.5
Total	**657.8**
LNG	
CO_2 emissions	452.8
CH_4 (as CO_2 equivalents)	65.8
N_2O (as CO_2 equivalents)	3.8
Total	**522.4**

Table 2-4 indicates a reduction in GHG emissions with use of LNG as a fuel source at Station D.

GHG data sheets and information on indicative flue gas emissions as provided by Wartsila can be found in Appendix A.

2.3 Current and Future Energy Mix

BPL's current energy mix consists of two fuel types – No. 2 Light Fuel Oil (ADO) and No. 6 Heavy Fuel Oil (HFO). Only ADO is used at Blue Hills Power Station. Both fuel types are utilized at the Clifton Pier Power Station. Please see Table 3-1 for statistics on use of each fuel type for the period 2008 – 2019.

[1] Data provided by Wartsila, April 2020.

3.0 PROJECT DESCRIPTION AND ALTERNATIVES

3.1 General

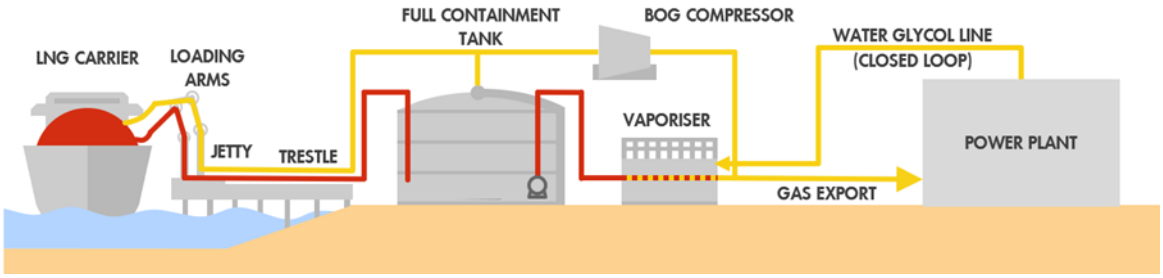
The overall LNG to Power Project consists of the following physical components:

1. A new power plant and related infrastructure.
2. A Regasification Terminal and related infrastructure including a new bi-directional LNG jetty and regasification facilities.
3. LNG Supplied from Shell's global portfolio via a dedicated LNG supply vessel.

This EIA is limited to Component 1. Components 2 and 3 are subject to a separate EIA being undertaken by Shell.

Figure 3-1 below depicts a high-level schematic of the overall project.

Figure 3-1: High-Level Schematic of the Bahamas LNG to Power Project



The new marine terminal, jetty with pipeline, regasification facilities and power station will be developed in the area of Clifton Pier. The regasification terminal will be designed to supply natural gas to the two Clifton Pier power plants (BPL's Station A and the proposed new power plant, Station D). It will also be designed to provide LNG via bunkering vessels to nearby cruise line vessels and to the Family Islands for local power generation.

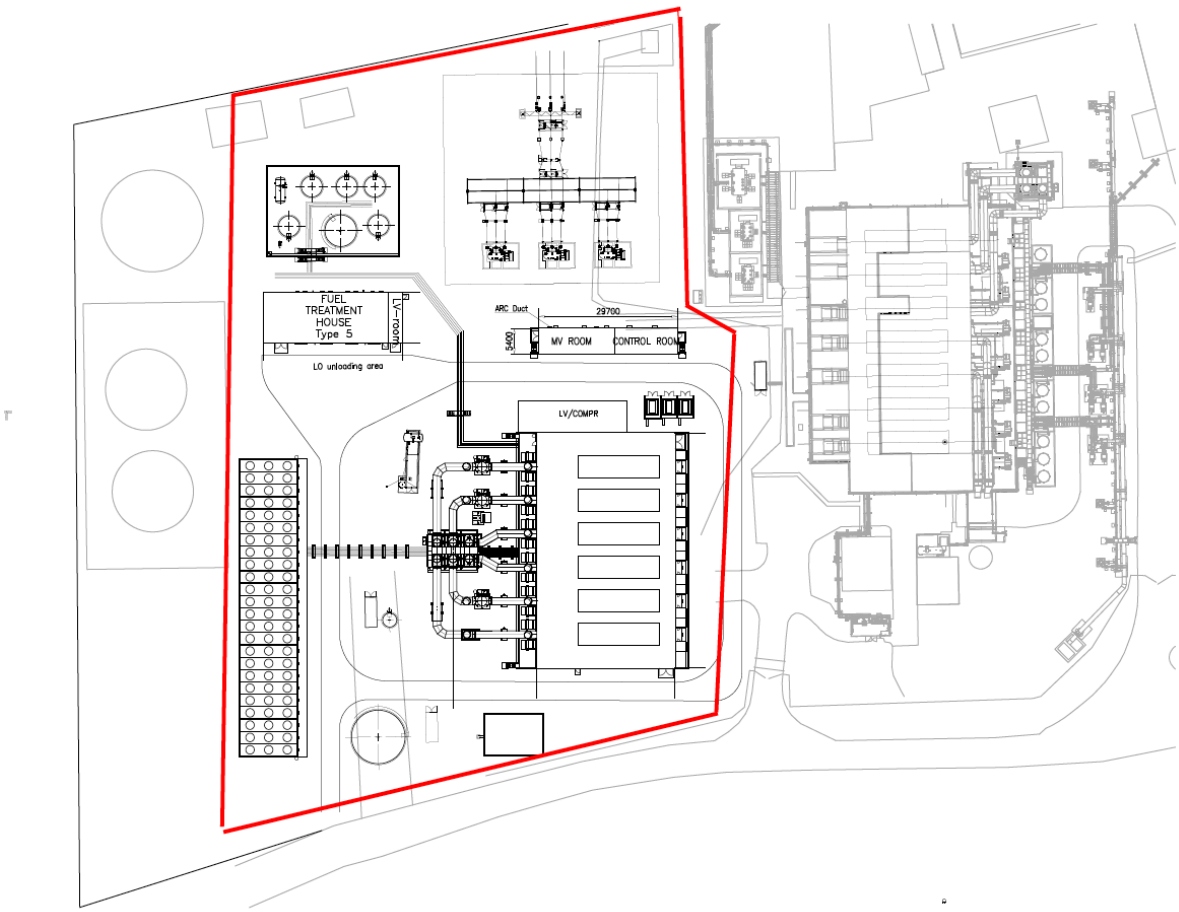
Figure 3-2 below is an aerial image showing the proposed location of the new power plant (Station D) on a brownfield plot of land on the grounds of the CPPS.

Figure 3-2: Proposed location of Station D at the CPPS

Station D is intended to replace BPL's existing aging generation fleet as baseload generation for the island. This new powerplant is not intended to increase the overall generation level on the island but rather transfer generation from existing inefficient and old assets to newer, more efficient technology. Assuming natural gas is ultimately used as the primary fuel, the substitution of power generation to the new powerplant from BPL's older generation assets is anticipated to lead to net reductions in the emission of particulate matter, CO2 and related greenhouse gases, with corresponding benefits to the local airshed.

If the proposed regasification facilities are not constructed, the supply of diesel and HFO will come from BPL's existing storage tanks in the area. Figure 3-3 below shows a schematic of the proposed layout of the Station D power plant.

Figure 3-3: Proposed layout of Station D



3.2 Alternatives

No alternative sites were considered for construction of Station D. The land is owned by BPL and is already an impacted industrial area.

The 'No Action' alternative would mean that Station D is not constructed. BPL will continue to have to rely on its existing inefficient and old assets that comprise its aging generation fleet. Load shedding will continue for residents of New Providence.

3.3 Capacity and Demand

The Station D site will accommodate 6 reciprocating engines with nameplate generating capacity of 85-102 MW. Together with Station A, the combined complex will allow for approximate installed capacity of 200-220 MW operated on LNG.

Current energy consumption and generation by BPL in New Providence and the Family Islands is detailed in Table 3-1. Current average daily demand for energy in New Providence is 190 – 210 MW

with an average daily peak of 220 MW. Peak demand during the summer is 240 – 250 MW. Current available generation capacity is 298 MW. While Station D is not expected to increase generation capacity, it is expected to improve efficiency and reliability of power production.

3.3 Process Description

The Station D power plant is anticipated to have six tri-fuel engines of approximately 17-18 MW, each capable of running on natural gas, automotive diesel oil (ADO) or heavy fuel oil (HFO) (Figure 3). The tri-fuel engines will initially be powered by either heavy fuel oil or diesel fuel. If the proposed LNG terminal and regasification facilities receive regulatory approval and are constructed, then the current plans call for natural gas to eventually replace HFO and/or diesel as the primary fuel.

Ultimately, it is envisioned that the dominant operating mode will be on natural gas, with the other fuels used as a backup supply should there be any significant damage to the LNG supply infrastructure from storms or other events. However, if the regasification facilities are not constructed, then HFO and diesel will be the primary fuels, as is currently the case at CPPS.

In the event that the regasification facilities are approved and constructed, then within the fence line of the CPPS, the natural gas generated by vaporization of LNG is planned to be delivered by pipeline at a pressure of 7 to 10 bar (100 to 140 psig) and will be combusted in reciprocating engines for the generation of electrical power.

At Station D, a cold mixture of glycol and water will be used to provide jacket cooling of the engines after which it will be returned to the regasification terminal process area for use by the LNG vaporizers. This allows the recovery of heat from the powerplant to regasify the incoming LNG, which is the most energy efficient method. This represents the base case, but alternative vaporizer systems are still possible and will be determined based on detailed engineering.

The engines for the proposed Station D project are the most efficient of their size and technology that are currently available, with a thermal efficiency of 44% on natural gas and emissions that meet World Bank requirements.

The facility is expected to operate 24/7, 365 days a year on a continuous basis supplying power to New Providence. Design life of the Station D power plant is anticipated to be 25 years, with a maximum life of about 40 years.

Table 3-1: BPL Energy consumption and generation (2008-2019)

Consumption by Fuel Type	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
Automotive Diesel Oil (000s bbls)	1,797	1,648	2,175	2,253	1,696	1,857	2,148	2,343	2,513	2,534	2,687	3,183
Heavy Fuel Oil (000s bbls)	1,141	1,081	872	742	960	795	819	733	685	620	626	307
Total (000s bbls)	**2,938**	**2,729**	**3,047**	**2,995**	**2,656**	**2,652**	**2,967**	**3,076**	**3,198**	**3,154**	**3,313**	**3,490**
Generation (GWH)	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
New Providence	1,272	1,395	1,198	1,398	1,386	1,369	1,427	1,421	1,484	1,272	1,335	1,356
Family Island	263	278	238	310	297	295	321	335	286	287	297	312
Total	**1,535**	**1,673**	**1,436**	**1,708**	**1,683**	**1,664**	**1,748**	**1,756**	**1,770**	**1,559**	**1,632**	**1,668**
Number of Customers	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
NP & FI Customers	98,454	100,996	111,282	112,876	106,706	107,765	106,935	108,026	108,127	108,279	109,963	113,438

Where 'bbls' stands for oilfield barrels; one barrel equals 42 US gallons or 0.16 cubic metres.

3.4 Project Execution

The estimated timeframe for the construction phase of the power plant project is 14 months from the date of no objection to the EMP received from the BEST Commission.

3.5 Commercial Arrangements

BPL will develop the Power Plant, and Shell will develop the LNG Plant. The construction of the power plant will be funded by proceeds from the Rate Reduction Bond.

Station D is key to the development of this project, as it represents a new, efficient baseload power plant for New Providence. CPPS has been in operation for decades and is a heavily industrialized site.

The brownfield plot within CPPS is located adjacent to Station A (see Figure 3-2). This land is owned and managed by BPL and is subject, along with the underlying groundwater, to an environmental remediation plan that BPL has been developing in conjunction with the Ministry of Public Works and Ministry of Environment & Housing.

BPL will contract Wärtsilä as the EPC contractor for Station D. Upon completion of the new power plant, Wärtsilä will operate and maintain the plant via an Operation and Maintenance Agreement using a fully trained Bahamian workforce.

4.0 LEGAL AND REGULATORY FRAMEWORK

This chapter summarizes the regulatory regime governing the conduct of this EIA. It outlines the Bahamian regulatory requirements as well as relevant internationally recognized standards and guidelines, such as those provided by the International Finance Corporation (IFC), the World Bank Group (WBG), the United States Environmental Protection Agency (EPA) and the World Health Organization (WHO).

4.1 Pertinent Bahamian Laws and Regulations

4.1.1 The Environmental Impact Assessment Process

The *Environmental Planning and Protection (EPP) Act 2019* provides a legal framework for the protection, enhancement and conservation of the environment. It also provides for the prevention and mitigation of pollution in order to maintain the quality of the environment. It establishes a Department of Environmental Planning and Protection (DEPP) to regulate and oversee the review of Environmental Impact Assessments (EIAs) and Environmental Management Plans (EMPs). Until the Department is formally established, this latter role is being fulfilled by the Bahamas Environment, Science and Technology (BEST) Commission, Ministry of Environment and Housing.

Section 11 of the EPP Act requires all development projects to obtain a Certificate of Environmental Clearance before the project can commence. Section 12 of the EPP Act indicates that an EIA or EMP may be required before a project can be established or begin operation. Section 12 also specifies that regulations can be made under the EPP Act for any aspect of EIAs and EMPs, but to date, these regulations have not been passed.

Since its establishment in 1994, the BEST Commission has been the agency responsible for review of EIAs and EMPs. Until the passage of the EPP Act, the requirement for development projects to submit EIAs and EMPs has largely been based on policy and for a short time, a requirement under the Planning and Subdivisions Act 2010. With the passage of the 2019 EPP Act, an agency now exists with a legal mandate for oversight of EIAs and EMPs. This agency is called the Department of Environmental Protection and Planning (DEPP) and it has been established. The BEST Commission has ceased to exist and DEPP has taken over management of the EIA and EMP process.

4.1.2 Air Quality

Bahamian legislation most relevant for regulation of air quality are the *Environmental Health Services Act 1987* and the *Environmental Protection and Planning Act 2019*.

The *Environmental Health Services Act 1987* provides a general framework for developing environmental regulations in The Bahamas. It promotes the conservation and maintenance of the environment in the interest of public health by regulating, monitoring, and controlling the contamination or pollution of the environment from any source. This regulation requires all projects/developments with associated emissions, depositions, or discharges of any regulated air

contaminant to obtain a permit approval by the Director of the Department of Environmental Health Services (DEHS) prior to initiating discharges to ambient air.

The EPP Act authorizes the DEPP to develop regulations that prevent and control air pollution, such as objectives and quality standards with respect to environmental protection, including bodies of water, air and soil. In particular, the EPP Act authorizes the DEPP to establish ambient air quality standards (Part IX, s65. Regulations)

There are no current Ambient Air Quality Standards (AAQS) for The Bahamas for assessing the potential air quality impacts of the proposed project.

4.1.3 Noise

The statutory provision in The Bahamas that covers the prohibition of airborne noise is the *Penal Code 1927 (Chapter 84),* which lists various nuisances under Title XV – Common Offences Against Public Order, Health and Morality. Specifically, Section 213 of Title XV states:

> *(1) The Minister responsible for Road Traffic may from time to time make rules for the prohibition or restriction in the public places, streets, highways, courts and alleys in New Providence –*
>
> *(a) Of the firing or throwing of fireworks, crackers, and all other explosives whatsoever;*
>
> *(b) Of the sounding or use of horns, trumpets and all instruments of sound other than those used or employed by a duly organized instrumental band.*
>
> *(2) All rules made under this section shall be published in the Gazette and have the force and effect of law.*
>
> *(3) Whoever commits any breach of any rule made under this section shall be liable to a fine of one hundred and fifty dollars.*
>
> *(4) Rules made under this section shall be in addition to the offences prescribed in rules made under the authority of this or any other Act; but so that a person be not punished twice for same offence.*

There are no Acts or regulations in Bahamian law which include any numerical limits or standards that can be used to assess and manage airborne noise. Therefore, in this EIA, airborne noise impacts associated with the Station D Power Plant Project are assessed against internationally-recognized noise guidelines established by IFC/WBG as described in section 4.2.2 below.

4.1.4 Water Quality – Groundwater

The Bahamas *Water and Sewerage Corporation Act 1976* establishes the Water and Sewerage Corporation (WSC) as both a service provider of potable water and a regulator of groundwater resources. Article 5 of the WSC Act (Part II – Establishment of Water and Sewerage Corporation) sets the WSC's role as a service provider:

- Providing "adequate supplies of suitable water for domestic use, for livestock, for irrigation and agricultural purposes, for urban and industrial use" (5(d)); and
- Providing "adequate facilities for drainage the safe disposal of sewage and industrial effluents" (5(e)).

Articles 5 and 6 of the Act (Part II) set the WSC's regulatory responsibilities:

- Controlling and ensuring "the optimum development and use of the water resources of the Commonwealth of The Bahamas" (5(a));
- Ensuring "the co-ordination of all activities which may influence the quality, quantity, distribution or use of water" (5(b));
- Ensuring "the application of appropriate standards and techniques for the investigation, use, control, protection, management and administration of water" (5(c));
- Determining "the allocation of available water between different users or types of use in any area within its jurisdiction" (6(1)(b)); and
- Prescribing and collecting "rates and service fees and deposits in respect of the distribution and supply of water and the disposal of sewerage" (6(1)(h)).

The WSC, with its Water Resources Management Unit (WRMU), has responsibility for optimal development of the country's water resources and the control of water quality. It shares (with DEHS) the responsibility for monitoring water quality, including public pumps for potable water as well as commercial businesses that produce drinking water. WSC is focused on monitoring potable water it produces for sale to communities and piped to homes and businesses. It should be noted that there are many Bahamians in New Providence and on the Family Islands who use private wells for freshwater and either do not pay for water service from WSC or have no infrastructure in their communities for WSC to provide water to them.

Even with its legal mandate, WSC utilizes WHO standards for water quality. WHO standards are described below in section 4.2.3.

WSC is in the process of developing new legislation that would confine its role to that of a provider. Regulation of the water resources sector has been given to the DEPP. Section 6 (Function of Department) of the EPP Act gives one of the functions of the DEPP as "oversee and approve the activities of agencies responsible for water management". It is likely that the DEPP will also now be responsible for monitoring water quality. It is uncertain when the new WSC legislation will be tabled and passed and whether it contains standards for water quality.

Additional functions of the DEPP include developing quality standards with respect to bodies of water, air and soil. These standards do not yet exist, so the adherence to WHO standards will likely continue until the national standards are developed.

The DEPP is also mandated to collaborate with relevant agencies to develop a plan for "the conservation and management of surface waters and wetlands" (6(e)(i)) and "the conservation of ground water resources" (6(e)(ii)). This gives the DEPP the legal mandate to manage all water resources in The Bahamas, including brackish and marine waters, areas that previously were not due to legislative gaps.

Section 13 (Environmental plans) of the EPP Act enables the DEPP Director to develop plans for sustainable use and management of water resources, including surface water and groundwater. Section 56 (Discharge to water resource) of the Act outlines offences and penalties for discharge to water resources and section 65 (Regulations) enables the Minister responsible for the Environment to develop regulations for the "prevention and control of pollution or contamination of the air, water and land".

4.1.5 Soil

The Department of Environmental Health Services (DEHS) is responsible for waste management and sanitation within the islands. Under the *Environmental Health Services Act 1987*, Part IV - Regulations, the DEHS has responsibilities including:

- "*prevention and control of contamination of land and for control and use of land for deposits of contaminant therein*" (17(1)(q)); and
- "*subject to the provisions of Article 27 of the Constitution, the use, regulation and control of beaches and areas of the foreshore both above and below highwater mark, the removal of solid wastes therefrom, and the cleaning and keeping clean, of such beaches and areas as aforesaid, and generally for the preservation of the amenities of the same*" (17(1)(s)).

The National Environmental Management Action Plan (NEMAP) for The Bahamas, prepared by SENES Consultants Limited, dated August 4, 2005, identifies key concerns with respect to soil contamination to be due to:

- land development;
- chemical spills from industrial facilities;
- indiscriminate dumping; and
- leachate from improperly designed landfills, waste dumps and septic systems.

The above action plan called for The Bahamas to establish more formal agencies and methods to address a wide range of environmental concerns. One of the outcomes of the above study was the Planning and Subdivision Act 2010 (amended in 2019 to remove Section 14), which is still applicable today. This document is more directed to residential and tourism development than industrial development.

Through the EPP Act 2019, The Bahamas has developed a regulatory framework for addressing historic soil contamination, controlling new development and minimizing ongoing or new soil contamination. This At addresses soil impacts and many other environmental concerns. Key issues raised concerning soil conditions in the EPP Act include the following:

1. The DEPP has the authority to develop objectives and quality standards for environmental protection including water, air, and soil.
2. The DEPP is to coordinate and implement international environmental policies and obligations.
3. The DEPP is to establish an accredited and standardize environmental laboratory for water, air, and soil testing.

4. No construction work can be carried out without a Certificate of Environmental Clearance approving the environmental assessment for the development site.
5. EMPs must be developed for the site.
6. The DEPP promotes environmental best practices.
7. The property owner must be held liable for historic pollution and may be required to rehabilitate.
8. No person may discharge hazardous substances including chemicals, oil and oil mixtures.
9. Spills and accidental releases must be reported to the Department and a contingency plan developed.
10. The Department can issue site restoration guidelines.
11. The Department is to establish an Environmental Registry.
12. Department Compliance Officers may enter and sample a property of concern.
13. Corporate officers may have a liability regarding environmental violations.
14. The Bahamas adheres to the polluter pays principle.

All of the above issues apply to past, present or future soil contamination as well as surface water and groundwater.

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However, the EPP Act does not specify contaminant concentration standards, criteria or guidelines that must be met for soil or groundwater and no other legislation has been identified to date which addresses this. While it is anticipated that best practices will eventually be adopted once the EPP Act is fully implemented, no standards from other jurisdictions are specifically referenced in the Act. Therefore, international standards on prevention of soil contamination are described below in section 4.2.4.

4.1.6 Socioeconomic Issues

An objective of the EPP Act is "to protect the environment of The Bahamas while providing for development in a way that maintains ecological integrity and the social and economic welfare of local communities" (3(1)(b)).

The First Schedule of the EPP Act details principles of environmental protection which include the principle of integration of economic, social and environmental considerations. It speaks to the requirement for "effective integration of economic, social and environmental considerations in decision making processes with the need to improve community well-being and the benefit of future generations" (1. (2)).

The EPP Act indicates that regulations can be developed for procedures related to EIAs and EMPs. It is likely that in the development of the regulations, procedures and best practices for assessment of socioeconomic impacts will be detailed. Until the regulations are developed and made law, this guidance will come from the DEPP.

Current guidance from the DEPP is that all EIAs must include an assessment of social impacts of development projects. Assessment is done through review of statistical information (e.g. demographics) as well as stakeholder consultations. These must be documented in the EIA.

There is sometimes a requirement for EIAs for specific projects to also go through a public review process. The decision to do so is made by the Cabinet of Ministers of the Government of The Bahamas. EIAs for such projects are made publicly available for at least 30 days and any member of the public can review the document, ask questions and make comments to the DEPP. The developer is expected to respond to these comments and questions, and there may also be a requirement to make revisions to the EIA based on the outcome of this public review process.

There is no other Bahamian legislation related to assessing socioeconomic impacts. International guidance followed is outlined in section 4.2.5 below.

4.1.7 Human Health

The Bahamas does not provide specific guidance or requirements for the Human Health Impact Assessment (HIA) within an EIA framework. As such, guidance from other reputable agencies were followed as described in section 4.2.6 below.

4.1.8 Archaeological and Cultural Resources

National legislation for The Bahamas governing archaeological and cultural resources are the Antiquities, Monuments and Museum Act 1999, Antiquities, Monuments and Museum Regulations 1999, and the Antiquities, Monuments and Museum (Underwater Cultural Heritage) Regulations 2012.

The Antiquities, Monuments and Museum Act 1999 places all monuments, artifacts and antiquities under the ownership of the Government of The Bahamas. The Act also enables the Minister responsible to grant licenses to individuals to search for these resources. The Act established a National Museum as a body corporate, run by a Board of Directors, that will manage activities associated with historical, archaeological and cultural resources. The Antiquities, Monuments and Museum Corporation (AMMC) was formed as a result of this Act to serve as that corporate body.

The Antiquities, Monuments and Museum Regulations 1999 outlines permits that may be granted with respect to archaeological and cultural resources. It also contains the forms for licenses and permits issued with respect to such resources.

The Antiquities, Monuments and Museum (Underwater Cultural Heritage) Regulations 2012 specifically outline the processes for accessing archaeological and cultural resources that may be found underwater, inclusive of shipwrecks. These regulations also outline the licensing process for this type of exploration and recovery.

Any discovery of historical, archaeological or cultural resources are to be reported to AMMC. AMMC will visit the site and provide guidance on managing excavation and/or management of such resources.

4.2 Recognized International standards

While Bahamian laws, regulations, policies and standards will form the basis for assessing this project, there are some areas where standards have not yet been established. As such, relevant recognized international standards and guidelines will be applied, as appropriate. These are discussed further in the subsequent subsections.

- International Finance Corporation/World Bank Group General Environmental, Health, and Safety Guidelines (2007) (IFC/WBG General EHS Guidelines);
- United States Environmental Protection Agency (US EPA) Standards; and
- World Health Organization (WHO) Guidelines.

4.2.1 Air Quality

Given the absence of current AAQS for The Bahamas, the proposed Station D Power Plant Project has been evaluated using relevant internationally recognized standards or guidelines including the IFC/WBG General EHS Guidelines (2007), and the US EPA National Ambient Air Quality Standards (NAAQS).

The IFC/WBG General EHS Guidelines provide air emissions and air quality guidelines to avoid, minimize, and control adverse impacts to human health, safety, and the environment from emissions to air (Section 1.1 – Air Emissions and Ambient Air Quality). The document endorses the World Health Organization (WHO) Air Quality Guidelines presented below in Table 4.1. In addition to the General EHS Guidelines, further industry-specific environmental, health and safety (EHS) guidelines applicable to the Station D Power Plant Project include the IFC/WBG EHS Guidelines for LNG Facilities (2017).

Table 4.1: WHO Ambient Air Quality Guidelines (IFC General EHS Guidelines)

WHO Ambient Air Quality Guidelines[2],[3]		
	Averaging Period	**Guideline Value in µg/m³**
Sulfur dioxide (SO_2)	24-hour	125 (Interim target-1)
		50 (Interim target-2)
		20 (guideline)
	10-minute	500 (guideline)
Nitrogen dioxide (NO_2)	1-year	40 (guideline)
	1-hour	200 (guideline)

[2] World Health Organization (WHO). Air Quality Guidelines Global Update 2005. PM 24-hour value is the 99th percentile.

[3] Interim targets are provided in recognition of the need for a staged approach to achieving the recommended guidelines.

Particulate Matter PM_{10}	1-year	70 (Interim target-1)
		50 (Interim target-2)
		30 (Interim target-3)
		20 (guideline)
	24-hour	150 (Interim target-1)
		100 (Interim target-2)
		75 (Interim target-3)
		50 (guideline)
Particulate Matter $PM_{2.5}$	1-year	35 (Interim target-1)
		25 (Interim target-2)
		15 (Interim target-3)
		10 (guideline)
	24-hour	75 (Interim target-1)
		50 (Interim target-2)
		37.5 (Interim target-3)
		25 (guideline)
Ozone	8-hour daily	160 (Interim target-1)
		100 (guideline)

Source: IFC/WBG General EHS Guidelines. 2007. (Data also available at WHO http://www.who.int/en)

The WBG's *Pollution Prevention and Abatement Handbook 1998: Toward Cleaner Production* (World Bank Group, 1999) summarizes reference guidelines of the WHO (WHO 1979), the European Union (EU 1992), and the US EPA.

The US EPA NAAQS for six principal pollutants (i.e. "criteria" air pollutants) are shown in Table 4.2.

Table 4.2: US EPA National Ambient Air Quality Standards

Pollutant (links to historical tables of NAAQS reviews)	**Primary / Secondary**	**Average Time**	**Level**	**Form**
Carbon Monoxide	Primary	8 hours	9 ppm	Not to be exceeded more than once per year
		1 hour	35 ppm	
Lead (Pb)[4]	Primary and secondary	Rolling 3-month average	0.15 µg/m^3	Not to be exceeded

[4] In areas designated nonattainment for the Pb standards prior to the promulgation of the current (2008) standards, and for which implementation plans to attain or maintain the current (2008) standards have not been submitted and approved, the previous standards (1.5 µg/m^3 as a calendar quarter average) also remain in effect.

Nitrogen Dioxide (NO_2)		Primary	1 hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		Primary and secondary	1 year	53 ppb[5]	Annual Mean
Ozone (O_3)[6]		Primary and secondary	8 hours	0.070 ppm	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
Particle Pollution (PM)	$PM_{2.5}$	Primary	1 year	12.0 µg/m³	Annual mean, averaged over 3 years
		Secondary	1 year	15.0 µg/m³	Annual mean, averaged over 3 years
		Primary and secondary	24 hours	35 µg/m³	98th percentile, averaged over 3 years
	PM_{10}	Primary and secondary	24 hours	150 µg/m³	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide (SO_2)		Primary	1 hour	75 ppb[7]	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		Secondary	3 hours	0.5 ppm	Not to be exceeded more than once per year

Source: US EPA, 2016.

Comparison of the above-mentioned air quality standards shows, for example, that the WHO Guideline has more stringent standards for NO_2 than the US EPA NAAQS. In the case of SO_2 the most stringent 1-hour criterion is the US EPA NAAQS, while the 24-hour standard from the WHO Guideline is more stringent. In the case of PM10 and PM2.5, it is recommended that the IFC/WHO criteria are applied in the ESHIA/EIA, as these are more stringent. For this EIA, the air quality standards in Table 4. 3 are being used because they are the most stringent and therefore provide the highest level of environmental protection.

[5] The level of the annual NO_2 standard is 0.053 ppm. It is shown here in terms of ppb for the purposes of clearer comparison to the 1-hour standard level.

[6] Final rule signed October 1, 2015, and effective December 28, 2015. The previous (2008) O_3 standards additionally remain in effect in some areas. Revocation of the previous (2008) O_3 standards and transitioning to the current (2015) standards will be addressed in the implementation rule for the current standards.

[7] The previous SO_2 standards (0.14 ppm 24-hour and 0.03 ppm annual) will additionally remain in effect in certain areas: (1) any area for which it is not yet 1 year since the effective date of designation under the current (2010) standards, and (2)any area for which an implementation plan providing for attainment of the current (2010) standard has not been submitted and approved and which is designated nonattainment under the previous SO_2 standards or is not meeting the requirements of a SIP call under the previous SO_2 standards (40 CFR 50.4(3)). A SIP call is an EPA action requiring a state to resubmit all or part of its State Implementation Plan to demonstrate attainment of the required NAAQS.

Table 4.3: Ambient Air Quality Standards for the EIA

Pollutant	Averaging Period	Concentrations (ug/m^3)	Source
Nitrogen dioxide (NO_2)	1-hour	200	IFC/WHO guideline
	1-year	40	WHO guideline
Sulfur dioxide (SO_2)	10-min	500	IFC/WHO guideline
	1-hour[8]	196	US EPA NAAQS
	24-hour	125	IFC/WHO Interim target-1
		50	IFC/WHO Interim target-2
		20	IFC/WHO guideline
Particulate Matter PM_{10}	1-year	70	IFC/WHO Interim target-1
		50	IFC/WHO Interim target-2
		30	IFC/WHO Interim target-3
		20	IFC/WHO guideline
	24-hour[9]	150	IFC/WHO Interim target-1
		100	IFC/WHO Interim target-2
		75	IFC/WHO Interim target-3
		50	IFC/WHO guideline
Particulate Matter $PM_{2.5}$	1-year	35	IFC/WHO Interim target-1
		25	IFC/WHO Interim target-2
		15	IFC/WHO Interim target-3
		10	IFC/WHO guideline
	24-hour	75	IFC/WHO Interim target-1
		50	IFC/WHO Interim target-2
		37.5	IFC/WHO Interim target-3
		25	IFC/WHO guideline
Carbon dioxide (CO)	1-hour	10305	US EPA NAAQS
	8-hour	40076	US EPA NAAQS

4.2.2 Noise

The IFC/WBG General EHS Guidelines (Section 1.7 - Noise) is an internationally-recognized guideline document that provides day and night airborne noise guidelines for different receptor categories (residential, institutional, educational, industrial, and commercial). Table 4.4 presents the IFC/WBG airborne noise guidelines that should not be exceeded at the nearest offsite receptor locations. In addition to the absolute values provide in Table 4.4, the IFC/WBG also requires that airborne noise increase above existing (background) levels should not exceed 3 decibels (dB). It is generally accepted that an increase in 3 dB is the threshold of human detection for two different noise sources.

[8] 99th percentile of 1-hour daily maximum concentrations averaged over 3 years.

[9] PM 24-hour value is the 99th percentile.

Table 4.4: IFC/WBG Airborne Noise Level Guidelines

Organization	One Hour LAeq (dB(A))	
	Daytime (07:00 – 22:00)	Nighttime (22:00 – 07:00)
Residential, institutional, educational	55	45
Industrial, commercial	70	70

LAeq = A-weighted equivalent sound levels over a measurement period, dB(A) = A-weighted decibel

4.2.3 Water Quality – Groundwater

An example of WHO standards for drinking water quality includes the standard for reference pathogens as outlined in Table 4.5.

Table 4.5: Sample WHO Standard for Drinking Water Quality Reference Pathogens

	Units	Cryptosporidium	Campylobacter	Rotavirus
Drinking water quality	Organisms per litre	1 per 79,000 litres	1 per 9,500 litres	1 per 90,000 litres

Source: WHO (2017)

In accordance with WHO standards, the bacterium *E.coli* can be used as an indicator of faecal contamination and total coliforms can be used as an indicator for cleanliness and integrity of distribution systems.

With respect to naturally occurring chemicals, WHO guideline values are outlined in Table 4.6.

Table 4.6: WHO Guideline Values for Naturally Occurring Chemicals in Drinking Water

Chemical	Guideline Value		Remarks
	µg/l	mg/l	
Inorganic			
Arsenic	10 (A, T)	0.01 (A, T)	-
Barium	1300	1.3	-
Boron	2400	2.4	-
Chromium	50 (P)	0.05 (P)	For total chromium
Fluoride	1500	1.5	Volume of water consumed and intake from other sources should be considered when setting national standards
Selenium	40 (P)	0.04 (P)	-
Uranium	30 (P)	0.03 (P)	Only chemical aspects of uranium addressed
Organic			

Microcystin-LR	1 (P)	0.001 (P)	For total microcystin-LR (free plus cell-bound)

Source: WHO (2017)

Where A – provisional guidance value because calculated guideline value is below the achievable quantification level;
P – provisional guidance value because of uncertainties in the health database;
T – provisional guidance value because calculated guideline value is below the level that can be achieved through practical treatment methods, source protection, etc.

4.2.4 Soil

In the absence of specific soil remediation chemical standards under the EPP Act, applicable standards from other jurisdictions could be used. The US EPA has developed Regional Screening Level (RSL) generic tables, most recently updated in November 2019, for a very broad range of soil contaminants. The Province of Ontario in Canada, under Ontario Regulation 153/04 (Records of Site Condition), as amended, provides a range of generic standards including those for industrial properties located adjacent to waterbodies. Other useful standards are available in Canada, the US or internationally. The sensitive coastal ecological conditions are of particular concern in selection of appropriate soil and groundwater quality standards.

Applicable standards may also be developed if required. It is noted that the Institute of Risk Assessment Science, Utrecht University, The Netherlands completed an Environmental Health Risk Assessment for Pinder's Point, Lewis Yard and Surrounding Areas in December 2017 for impacted sites on Grand Bahamas Island. The WHO and PAHO were involved. This suggests risk assessment approaches may be used if necessary. The Province of Ontario in Canada offers the use of a simplified risk assessment methodology which is applicable for some sites.

4.2.5 Socioeconomic Issues

Best practices for assessing socioeconomic impacts from the IFC, World Bank and US EPA are described in Table 4.7. These practices have been drawn on as necessary in conducting this EIA.

Table 4.7: Best Practices for Assessing Socioeconomic Impacts

Organization	Best Practices for Socioeconomic Assessments
International Finance Corporation (IFC)	Identification and assessment of positive and negative impacts. Identification and assessment of opportunities for enhancing the socioeconomic well-being of the people who live and work in the project's area of influence. Development of a social impacts monitoring program. For projects with significant adverse impacts, developers are can consider interventions that provide sustainable benefits as well as creation of a Community Development Plan.
World Bank	Assessment of human impacts, involuntary resettlement, gender impacts, vulnerable ethnic minorities, violence, child labour, community cohesions, cultural property, employment and income generation.

	Involvement of civil society in the scoping phase of an ESIA. Systematic stakeholder analysis to ensure all groups and interests have an opportunity to participate in the ESIA process.
United States Environmental Protection Agency (US EPA)	Opportunity for public involvement from the earliest stages of project development. General public participation requirements – notification, consultation, disclosure, public written comment, public hearings, consideration of public comments and allocation of costs. Socioeconomic conditions to include crime rates, literacy rates, community organizations and information on public health and safety (e.g. existing electromagnetic fields, local perceptions of the project). Social impact assessment tools can include family-level surveys, focus group discussions and key informant interviews.

4.2.6 Human Health

The Gothenburg Consensus Paper (WHO, 1999) outlines an international standard for completing HIAs at all levels (international, national and local). Since that time, other jurisdictions have built on the concepts and standards provided by the WHO. In 2013, the Pan American Health Organization (PAHO) together with the WHO published a guidance document entitled "Health Impact Assessment: Concepts and Guidelines for the Americas" and in 2009 the IFC/WBG published a document entitled "Introduction to Health Impact Assessment". Both of these documents outline best practices and procedures for completing HIA assessments.

The HIA for this current project has been completed following the general guidance provided by IFC World Bank, PAHO and WHO.

4.3 Permitting and Licensing

Table 4.8 below outlines the various permits and licenses that will need to be obtained by BPL prior to construction commencing on the power plant.

Table 4.8: Permitting and Licensing

Permit or License	**Agency Responsible**
EIA No Objection	Department of Environmental Planning and Protection (DEPP)
EMP No Objection	DEPP
Certificate of Environmental Clearance	DEPP
Land use permit	Ministry of Public Works (who directs it to Department of Physical Planning)
Construction permit	Ministry of Public Works
Work permits	For any workers who are foreign nationals without the right to work in The Bahamas

5.0 BASELINE DESCRIPTION OF THE SITE AND SURROUNDINGS

5.1 Physical Aspects

5.1.1 Climate, including major events

The project area has a sub-tropical climate, with two distinct seasons: a tropical wet summer season (May to October) and a warm temperate dry winter season (November to April) . The climate is influenced by the warm waters of the Gulf Stream, which has the effect of slightly lowering temperatures in the summer and contributing to mild winters. Baseline climatic conditions at the project area are characterized by the NOAA Global Historical Climatology Network (GHCN) data and the NCDC Global Surface Summary of Day (GSSOD) data observed at the climate station at Nassau Lynden Pindling International Airport for the period from 1973 to 2019. The Lynden Pindling International Airport (LPIA) station, located 8 km north-east from the study area, has a long-term record of general meteorological conditions and is considered well representative of the climatic conditions at the site. Meteorological parameters of interest include temperature, precipitation and wind observations.

Monthly mean, maximum and minimum temperature data are summarized in Table 5-1. The long-term climatology of the area is characterized by mean daily temperature of 25.4°C. The hottest months are June, July and August, while December, January, and February are typically the coolest months in the project area. Monthly maximum temperature is 33.6°C (in July), while monthly minimum temperature is 14.0°C (in December). The lowest recorded temperature was 7°C on January 20th, 1981, while the hottest temperature on record was 36.5°C recorded in June 1998.

The monthly distribution of precipitation data is shown in Table 2. There is a rainfall observed all the year round. The greatest rainfall occurs during the summer months. The annual average precipitation is about 1,348 mm (or 53.1 inches) and 72% of it falls from May through October. June, August and September tend to be the wettest months with an annual average of 201 mm, 193 mm and 180 mm (or 7.9, 7.6 and 7.1 inches), respectively. Maximum monthly rainfall within the period from 1973 to 2019 was 546 mm, recorded in June. On average there are 133.3 days of precipitation in a year, with the most precipitation occurring in August with 17.4 days and the least precipitation occurring in February with 6.0 days.

The climate in the area is influenced by trade winds. Trade winds blow in a predominately easterly direction with consistent wind speed, blowing from the tropical high-pressure belts to the low-pressure zone at the equator. The prevailing wind is from the east and northeast, but wind direction ranges from southeast to northeast throughout the year. Monthly distribution of average wind speed, maximum sustained wind speed and maximum wind gust is shown in Table 3. Average observed wind speed is 13.3 km/h (or 8.3 mph), with the highest average winds experienced in March. Monthly maximum wind speed recorded is 69 km/h (or 22 mph). Maximum sustained wind speed in average is 24 km/h (or 15 mph), with highest recorded of 98 km/h (or 37.3 mph). Maximum wind gust of 166 km/h (or 53 mph) was recorded in August.

Table 5-1: Monthly temperature distribution for LPIA Station (1973 – 2019)

TEMPERATURE	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Mean temperature (°C)	21.9	22.1	22.9	24.3	26.1	27.7	28.6	28.6	28.1	26.7	24.6	22.9	25.4
Maximum temperature (°C)	27.2	28.1	28.4	30.4	31.6	33.5	**33.6**	33.4	32.7	31.8	28.6	28	33.6
Minimum temperature (°C)	15.6	16.1	16.7	18.9	20.9	23.1	23.5	23.8	23.3	22.3	18.9	**14.0**	14.0

Note: Bolded value presents extreme value Source:
ftp://ftp.ncdc.noaa.gov/pub/data/ghcn/v3/csv/

Table 5-2: Monthly rainfall distribution for LPIA Station (1973 – 2019)

PRECIPITATION	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Average rainfall (mm)	65	48	60	63	119	**201**	145	193	180	136	78	60	1348
Maximum rainfall (mm)	361	272	256	207	317	**546**	290	434	449	366	244	510	546

Note: Bolded value presents extreme value Source:
ftp://ftp.ncdc.noaa.gov/pub/data/ghcn/daily

Table 5-3: Monthly wind data distribution for LPIA Station (1973 – 2019)

WIND	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Average of wind speed (km/h)	13.9	14.4	**15.3**	15.0	13.6	11.9	11.8	11.4	11.1	13.3	14.6	14.0	13.3
Maximum of wind speed (km/h)	42.0	36.9	39.8	36.1	32.0	34.3	34.4	46.7	**68.9**	48.3	51.9	37.0	68.9
Average of MXSPD (km/h)	24.8	25.6	**26.0**	25.4	23.5	22.5	22.8	22.7	22.0	23.6	24.9	24.5	24.0
Maximum sustained wind speed (km/h)	88.9	94.3	**97.8**	83.2	96.1	75.9	70.2	74.1	94.3	96.1	94.3	87.0	97.8
Maximum of GUST (km/h)	103.5	94.3	96.1	84.8	77.8	77.8	77.8	**166.1**	140.8	137.0	140.8	75.9	166.1

Note: Bolded value presents extreme value Source:

https://www7.ncdc.noaa.gov/CDO/cdoselect.cmd?datasetabbv=GSOD&resolution=40

It should be noted that the Lynden Pindling International Airport (LPIA) is located on the north side of the island and northerly winds might be overrepresented in the above data. The site is in the lee of New Providence island and is more vulnerable to southerly or southeasterly winds, especially in summer.

On average, there is more than seven hours of bright sunshine per day in Nassau with periods of a day or two of cloudy weather at any time of year. The duration of daylight varies from 10 hours 35 minutes in late-December to 13 hours 41 minutes in late-June.

The average annual relative humidity is 78.8%, ranging from 77% in April to 82% in September. Diurnal distribution of relative humidity ranges from about 90 % in the early morning hours to 55% in the afternoon (Bahamas Meteorology Department).

Climate variability and change is expected to greatly influence the existing weather and environment of The Bahamas. Problems that may be exacerbated in response to climate variability and change are the frequency and intensity of hurricanes and the potential of rising sea levels. Changes in the position and the distribution of fresh, brackish and saline groundwater is anticipated due to any rising sea level; combined with possible reductions in groundwater recharge from changes in rainfall distribution.

It appears that the sea has been rising at a rate in the order of 6 to 10 inches (152 to 254-mm) per 100-years in The Bahamas, not taking account of possible differences in the rates of uplift or subsidence at these sites. The observations are consistent with the model predictions, and it is generally agreed that the rate of sea level rise in the next century will be 2 to 5 times that in the last 100-years.

In The Bahamas, rising sea levels will lead to considerably less fresh groundwater resources, accelerated erosion of coastal shorelines, and the deeper penetration of sea surges inland.

TROPICAL STORMS AND HURRICANES

The Bahamas are quite vulnerable to hurricanes and tropical storms that occasionally hit this area. Hurricanes and tropical storms are a regular occurrence during the Atlantic hurricane season that extends from June to November. Hurricanes are cyclones that develop over the warm tropical oceans and have sustained winds in excess of 64 knots. Low-lying islands and cays of The Bahamas are susceptible to high winds, rains, sea level rise and storm surges and flooding caused by this severe weather conditions that can result in significant damage.

Data on the number of tropical storms and hurricanes whose center passed within 100 mi (160 km) of The Bahamas from 1886 to 2000 (115 seasons) are summarized in Table 5-4 (The Second National Communication of The Bahamas, UNFCCC[10], 2014). Hurricanes most frequently occur in the months of September, October, August and November respectively. October is a month when tropical storms

[10] United Nation Framework Convention on Climate Change

occur most frequently. In the period from 1871 to 2000 total of 186 hurricanes and 86 tropical storms passed within 160 km of Bahamas.

Table 5-4 – Hurricanes and Tropical Storms Between 1886-2000[11]

Number of hurricanes over the period 1886-2000 (115 hurricane seasons) by months								
Hurricanes	May	June	July	August	September	October	November	Total
Number per month	3	5	11	43	52	50	22	186
Probability per month*	0.02	0.04	0.09	0.33	0.4	0.39	0.17	n/a
Number of tropical storms over the period 1886-1999 (114 hurricane seasons) by months								
Tropical storms	May	June	July	August	September	October	November	Total
Number per month	2	4	7	14	19	28	12	86
Probability per month*	0.02	0.04	0.06	0.12	0.17	0.25	0.11	n/a

*Probability is calculated as the number recorded for any one month divided by the number of Atlantic hurricane seasons.

The most recent data from the NOAA National Hurricane Center on hurricanes and tropical storms passing in the surrounding of The Bahamas over the past 19 seasons are summarized in Table 5-5. Total of 44 hurricanes, tropical storms and tropical depressions affected The Bahamas in the last 19-year period, and six of them were category 5 hurricanes (in strength on the Saffir-Simpson Scale[12]). Figure 5-1 shows the frequency of occurrence per category/type of the extreme events between 2001 and 2019 based on Table 5-5.

[11] https://unfccc.int/sites/default/files/resource/bhsnc2.pdf

[12] The Saffir-Simpson Hurricane Wind Scale is a 1 to 5 rating based on a hurricane's sustained wind speed (https://www.weather.gov/mfl/saffirsimpson)

Table 5-5: NOAA National Hurricane Center Data on Hurricanes and Tropical Storms That Affected The Bahamas between 2001-2019

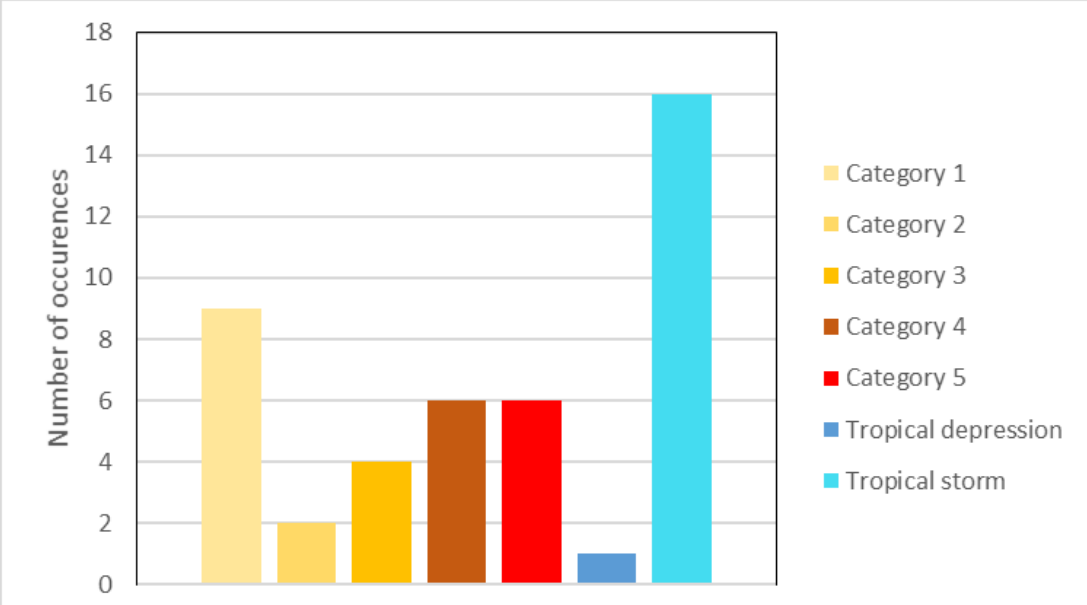
Storm Name	Dates active	Storm category at peak intensity	Max 1-min wind mph (km/h)	Min. press. mbar	Areas affected	Damage in USD	Deaths
Michelle	October 29 – November 5, 2001	Category 4 hurricane	140 (220)	933	Central America, Jamaica, Cuba, Bahamas	$2.35 billion	17
Olga	November 24 – December 4, 2001	Category 1 hurricane	90 (150)	973	Bermuda, Bahamas	None	None
Mindy	October 10-14, 2003	Tropical storm	45 (75)	1002	Dominican Republic, Bahamas	$46,000	None
Frances	August 24–September 10, 2004	Category 4 hurricane	145 (230)	935	The Bahamas, Southern United States, Midwestern United States, Mid-Atlantic states, New England, Atlantic Canada	$10.1 billion	7(42)
Jeanne	September 13 – September 28, 2004	Category 3 hurricane	120 (195)	950	Leeward Islands (Guadeloupe), Greater Antilles (Puerto Rico, Dominican Republic), (The Bahamas), Southeastern United States (Florida), Mid-Atlantic states, New England, Atlantic Canada	$7.94 billion	3,042
Franklin	July 21–29, 2005	Tropical storm	70 (110)	997	Bahamas, Bermuda, Newfoundland	None	None
Katrina	August 23–30, 2005	Category 5 hurricane	175 (280)	902	Bahamas, South Florida, Cuba, Southeastern US, Eastern US	$125 billion	1,836
Ophelia	September 6–17, 2005	Category 1 hurricane	85 (140)	976	Bahamas, Florida, The Carolinas, East Coast of the US, Atlantic Canada, Europe	$70 million	3
Rita	September 18–26, 2005	Category 5 hurricane	180 (285)	895	Hispaniola, Bahamas, Cuba, Florida, Gulf Coast of the United States, Midwestern United States	$18.5 billion	120
Tammy	October 5–6, 2005	Tropical storm	50 (85)	1001	Bahamas, Southeastern US	Minor	10
Wilma	October 15–26, 2005	Category 5 hurricane	185 (295)	882	Bahamas, Jamaica, Central America, Yucatan Peninsula, Cuba, South Florida, Bahamas, Atlantic Canada	$20.2 billion	48
Alpha	October 22–24, 2005	Tropical storm	50 (85)	998	Hispaniola, Bahamas	Unknown	26
Chris	August 1 – 4, 2006	Tropical storm	65 (100)	1001	Leeward Islands, Puerto Rico, Turks & Caicos Islands, Hispaniola, Bahamas, Eastern Cuba	Minimal	None
Andrea	May 9 – 11, 2007	Subtropical storm	60 (95)	1000	Virginia, North Carolina, South Carolina, Georgia, Florida, The Bahamas	Unknown	0 (6)

Noel	October 28 – November 2, 2007	Category 1 hurricane	80 (140)	980	Leeward Islands, Puerto Rico, Hispaniola, Jamaica, Cuba, Turks and Caicos Islands, Bahamas, Florida, East Coast of the United States, Atlantic Canada, Greenland	$580 million	222
Hanna	August 28 – September 7, 2008	Category 1 hurricane	85 (140)	977	Puerto Rico, Turks and Caicos Islands, Bahamas, Hispaniola, East Coast of the United States, Atlantic Canada	$160 million	533
Paloma	November 5–10, 2008	Category 4 hurricane	145 (230)	944	Nicaragua, Honduras, Cayman Islands, Jamaica, Cuba, The Bahamas, Florida	$454.5 million	1
	September 1–14, 2008	Category 4 hurricane	145 (230)	935	Hispaniola, Turks and Caicos Islands, The Bahamas, Cuba, Gulf Coast of the United States, Midwestern United States, Eastern Canada, Iceland	$38 billion	192
Ana	August 11 – 16, 2009	Tropical storm	40 (65)	1003	Lesser Antilles, Puerto Rico, Hispaniola, Cuba, The Bahamas	Minimal	None
Bonnie	July 22 – 24, 2010	Tropical storm	45 (75)	1005	Puerto Rico, Hispaniola, Turks and Caicos, Bahamas, Florida	$1.36 million	1
Earl	August 25 – September 4, 2010	Category 4 hurricane	145 (230)	927	Leeward Islands, Puerto Rico, Bahamas, Eastern United States, Atlantic Canada, Quebec	$45 million	5 (3
Paula	October 11 – 15, 2010	Category 2 hurricane	105 (165)	981	Nicaragua, Honduras, Mexico, Cuba, Bahamas, Florida	Unknown	1
Bret	July 17–22, 2011	Tropical storm	70 (110)	995	Bahamas, Bermuda, East Coast of the United States	None	0
Emily	August 2–7, 2011	Tropical storm	50 (85)	1003	Antilles, Florida, Bahamas	$5 million	4 (1)
Irene	August 21–28, 2011	Category 3 hurricane	120(95)	942	Antilles (US Virgin Islands, Puerto Rico), Lucayan Archipelago (Bahamas), Eastern United States (North Caroloina, New Jersey, New York), Eastern Canada	$14.2 billion	49 (9)
Beryl	May 26 – May 30, 2012	Tropical storm	70 (110)	992	Cuba, The Bahamas, Southeastern United States (Florida)	$148,000	1 (2)
ISaac	August 21 – September 1, 2012	Category 1 hurricane	80 (130)	965	Leeward Islands, Puerto Rico, Hispaniola (Haiti), Cuba, The Bahamas, Southeastern United States (Louisiana), Midwestern United States, Kentucky	$3.11 billion	34 (7)
Patty	October 11 –13, 2012	Tropical storm	45 (75)	1005	The Bahamas	None	None
Sandy	October 22 – 29, 2012	Category 3 hurricane	115 (185)	940	Greater Antilles (Jamaica, Cuba), The Bahamas, East Coast of the United States (New Jersey), Bermuda, Atlantic Canada	$68.7 billion	148 (138)
Dorian	July 23 – August 3, 2013	Tropical storm	60 (95)	1002	The Bahamas, Florida	None	None
Arthur	July 1–5, 2014	Category 2 hurricane	100 (155)	973	The Bahamas, East Coast of the United States (North	≥ $28.6 million	0 (1)

					Carolina), Atlantic Canada (Nova Scotia)		
Joaquin	September 28 – October 8, 2015	Category 4 hurricane	155 (250)	931	Turks and Caicos Islands, The Bahamas, Cuba, Haiti, Southeastern United States, Bermuda, Azores, Iberian Peninsula	$200 million	34
Kate	November 8 – 11, 2015	Category 1 hurricane	85 (140)	980	The Bahamas, United Kingdom, Ireland	Minimal	None
Alex	January 12 – 15, 2016	Category 1 hurricane	85 (140)	981	The Bahamas, Bermuda, Azores, southern Greenland	Minimal	-1
Bonnie	May 27 – June 4, 2016	Tropical storm	45 (75)	1006	The Bahamas, Southeastern United States	$640,000	2
Hermine	August 28 – September 3, 2016	Category 1 hurricane	80 (130)	981	Dominican Republic, Cuba, Florida, The Bahamas, East Coast of the United States, Atlantic Canada	$550 million	4 (1)
Irmaa	August 30 – September 12, 2017	Category 5 hurricane	180 (285)	914	Cape Verde, Leeward Islands (Barbuda, Saint Martin, Saint Barthelemy, U.S. Virgin Islands), Puerto Rico, Hispaniola, Turks and Caicos Islands, The Bahamas, Cuba, Southeastern United States (Florida and Georgia), Northeastern United States	$77.16 billion	52 (82)
Maria	September 16 – 30 2017	Category 5 hurricane	175 (280)	908	Lesser Antilles (British Virgin Islands, Dominica, Guadeloupe, Martinique, Saint Croix), Puerto Rico, Hispaniola, Turks and Caicos Islands, The Bahamas, Southeastern United States, Mid-Atlantic States, United Kingdom, Ireland, France, Spain	$91.61 billion	3,059
Beryl	July 4 – 15, 2018	Category 1 hurricane	80 (130)	991	Lesser Antilles, Hispaniola, Puerto Rico, Cuba, The Bahamas, Bermuda, Atlantic Canada	Minimal	None
Gordon	September 3 – 6, 2018	Tropical storm	70 (130)	996	Greater Antilles, The Bahamas, Florida, Gulf Coast of the United States, Eastern United States, Ontario	$200 million	3 (1)
Three	July 22 – 23, 2019	Tropical depression	35 (55)	1013	The Bahamas, Florida	None	None
Erin	August 26 – 29, 2019	Tropical storm	40 (65)	1002	Cuba, The Bahamas, East Coast of the United States, Atlantic Canada	Minimal	None
Dorian	August 24 – September 7, 2019	Category 5 hurricane	185 (295)	910	Windward Islands, Leeward Islands, Puerto Rico, The Northwestern Bahamas, East Coast of the United States, Eastern Canada	>$4.68 billion	77 (7)
Humberto	September 13 – 19, 2019	Category 3 hurricane	125(205)	950	Hispaniola, Cuba, Bahamas, Southeastern United States, Bermuda, Atlantic Canada, Ireland, United Kingdom	>$25 million	2

Note: Category 5 hurricanes are shaded in red

Figure 5-1: Frequency of Occurrence of Hurricanes, Tropical Storms and Tropical Depressions That Affected The Bahamas between 2001-2019



Hurricane Dorian was the strongest hurricane on record to have hit The Bahamas — and one of the strongest Atlantic hurricanes on record. According to the *Tropical Cyclone Report: Hurricane Dorian*[13] in September 2019 this Category 5 hurricane, with estimated winds of 160 kt (or 296 km/h) and a minimum central pressure of 910 mb, resulted in a storm-total rainfall of 22.84 inches at Hope Town in The Bahamas and caused catastrophic storm surge flooding and damage, mainly in Abaco and eastern Grand Bahama Islands. Water levels reached 6–7 ft above ground level on the western end of Grand Bahama Island and higher water levels occurred farther east on Grand Bahama Island and on the Abaco Islands, reaching more than 20 ft above ground level. The Bahamas Weather Service estimated the total at 74 people lost their lives in Dorian. The Inter-American Development Bank (IDB) stated that the hurricane left 29,500 people homeless and/or jobless. The island of Abaco was hardest hit, suffering 87 percent of the damage. More than 75 percent of all homes on the island were damaged. Total damage was estimated at $3.4 billion (USD).

5.1.2 Topography

Topographically, the islands of The Bahamas are typically flat with elevations of less than 32 feet (10 metres). A higher coastal ridge may occur, usually located along the exposed side of most islands. Islands of the southeast and central Bahamas are generally of higher elevation than in the northern

[13] *Lixion A. Avila; Stacy R. Stewart; Robbie Berg; Andrew B. Hagen (April 20, 2020). Tropical Cyclone Report: Hurricane Dorian (PDF) (Report). Miami, Florida: National Hurricane Center. Retrieved April 27, 2020*

Bahamas. The islands are usually long and narrow oriented from northwest to southeast with central ridges extending to a maximum height of 200 ft (60 m).

The topography of the Clifton area is dominated by a ridge that runs northeast to southwest along western New Providence. Clifton Pier is located at the southern end of that ridge and gently slopes down in elevation toward the coastline. The BPL site is well above sea level with coastal elevations of approximately 6.7 m (22 ft). Heading north from the coast and upward towards the ridge, elevations range from 6.7 m to 19.8 m (22 to 65 ft). The highest parts of the ridge reach an elevation of approximately 22.8 m (75 ft).

The land at Clifton Pier Power Station is primarily developed with impervious surfaces, buildings, and storage facilities covering most of the site. The remaining undeveloped land has been cleared or disturbed in some way or another, with areas that have exposed soil and rocky surface, disturbed fill mounds, and some vegetation.

The Clifton Pier/Bay sea cliff exposure and marine environment is to the south of the CPPS

Figure 5-2: Elevations at CPPS

Note: Larger digital and hard copy versions are attached at Appendix B

5.1.3 Hydrology/hydrogeology, water resources, surface waters, drainage, flood-prone areas

In The Bahamas, the physical geology, hydrogeology, water resources, and coastal zone are diametrically linked, as there are no true rivers in The Bahamas. The sole natural means of recharge/existence for the underlying 'freshwater resources' is via rainfall.

The groundwater resources of The Bahamas comprise the fresh, brackish, saline and hyper-saline waters found in the subsurface and in the lakes and ponds that intercept the land surface. There is a direct connection of the landform to the marine/coastal environment, separated by a typical mangrove vegetation buffer on the protected coastal flats.

GEOLOGICAL SETTING

The Commonwealth of The Bahamas consists of an archipelago of islands atop the Bahama Platform. The platform is comprised of a series of thick, shallow carbonate banks horizontally aligned that have built up along the subsiding continental margin of North America. Geophysical data indicate that the shallow marine carbonates and evaporates beneath the banks is between 3.2 miles (5.4 kilometres) and 6 miles (10 km) thick depending on the location across the Bank. The banks are separated by a series of deep-water channels upon which the islands of the Commonwealth occur unevenly usually on the margins of the larger and in the center of the shallower banks.

In The Bahamas, "from sea level down to a depth of about 5 miles (8 km), the geology is dominated by limestone and dolomite, with anhydride, salt and gypsum appearing at deeper horizons." (Cant, 1992)

HYDROGEOLOGICAL SETTING

The upper portions of the land area have been exposed several times in the geologic past as a result of sea-level fluctuations of the Pleistocene age. The rocks in which the easily exploitable groundwater resources occur extend down to approximately 130 ft (39.6 m) in the zones of the Pleistocene and Holocene limestone and lime-sands. These rocks formed as a result of wave action, the chemical precipitation of calcium carbonate and the deposition of oolitic and skeletal sands of marine origin. Pleistocene limestone in the form of shallow marine deposits, coral and wind-blown deposits dominate the surface geology. These deposits have been cemented by the solution of calcium carbonate in fresh rainwater during low sea level, followed by the re-precipitation within the inter-grain pores.

WATER RESOURCES

The freshwater resources occur as three-dimensional lens-shaped bodies, which overlie brackish and saline water. All freshwater in The Bahamas is as a result of rainwater that penetrates the ground surface.

Generally, there is nowhere on the islands that groundwater cannot be met in holes that penetrate 10 ft (3 m) below sea level. Water typically met in the range 0 to 3 ft (0 to 0.9 m) above sea level. Tidal action induces an up and down movement to the entire groundwater table ranging from

negligible amounts to about 3 ft (0.9 m). The effect of tides decreases inland on the whole, but may be substantial inland if an established cavern or other large opening directly connects the area to the sea. In many places inland, rise and fall of the water table is less than 1 ft (0.3 m).

The typical normal water table elevations are estimated at 3 to 5 ft (0.9 to 1.5 m) below ground level. Seasonal high-water table elevations can range from 1 to 3 ft (0.3 to 0.9 m) below ground level. During certain storm periods, the water table elevation can be above ground for a period ("perennial wetland areas") but dissipates following the storm period.

The main freshwater aquifer in The Bahamas occurs in the 'Pleistocene Age' formations named the Lucayan Limestone from approximately 3 to 130 ft (1 to 40 m) below ground level (BGL). Younger Holocene deposits can contain freshwater, but freshwater is not present in older deposits beyond 150 ft (45 m) BGL (Cant & Weech, 1986).

SURFACE WATER, DRAINAGE, & FLOOD PRONE AREAS at CPPS

The rapid infiltration of surface water results in the absence of surface streams and other permanent erosional features like channels. However, the typical karst geologic features (blue hole, caves, depressions, and solution features) all assist with the subsurface transit of flows.

Elevations at the project site (Station-D) are greater than +25 ft (+7.62 m) mean sea level (MSL), and shall be confirmed by the necessary site surveys for the proposed project works. Placement of all critical infrastructure above +30 ft (+9.14 m) MSL is generically suggested toward the integration of climate resilience measures for built structures in the Caribbean Region.

MARINE & COASTAL SURVEYS

Per the 2004 USACE Report, "both hurricanes and waves from the Atlantic Ocean, generally during high tide combined with storm surge, generate extreme wave conditions. Flooding and erosion typically occur during these wave conditions. The waves erode protective beaches and dunes and cause surge and flood damage to the adjacent lands, buildings, infrastructure, and groundwater especially significant since eighty percent of the country's land mass is only 5 feet (1.52 m) above mean sea level and more than 90% of the freshwater resources are within 5 feet (1.52 m) of the surface."

In the general vicinity of the island of New Providence, the tides are semi-diurnal with an average range of 2.46 ft (0.75 m) and a tidal period of approximately 12.4 hours. The anticipated Mean High Water Spring (MHWS) Tide is +1.30 ft (+0.40 m), Mean Sea Level is +0.00 ft (+0.00 m), and Mean Low Water Spring (MLWS) Tide is -1.64 ft (-0.50 m).

IPCC sea level rise projections for The Bahamas are as high as 3.6 ft (1.1 m) by 2100.

Per the National Hurricane Center (NHC), the Central Bahamas is ranked highly to receive hurricanes with 157+ mile/hour (mph) winds. Of specific concern to New Providence are storms greater than Category 2 entering the Central Bahamas directly from the south (north projected path between

Eleuthera and Andros) - on similar paths as Hurricane Matthew (2016) - with resulting projected surge. The CPPS site experienced the force of 74+ mph hurricane force winds from October 5-6, 2016 due to Hurricane Matthew.

5.1.4 Air Quality

The existing air quality in The Bahamas is affected by strong easterly trade winds for the most part of the year and in general windy conditions during the year that tend to transport emissions from sources located on the Islands out over water, rather than allowing them to accumulate and concentrate in ambient air over areas of population (SENES, 2005).

The existing air quality within the project area needs to be characterized in order to estimate total potential air quality impact of the proposed power plant and to demonstrate (evaluate) compliance of the Project with ambient air quality standards. Background air quality levels values are added to modeled pollutant concentrations to obtain cumulative impacts, which are then compared to applicable ambient air quality standards. Background air quality (or "baseline" levels) accounts for pollutant concentrations that are not associated with any of the sources explicitly included in the modeling analysis for the Project.

Methodology recommended to determine (characterize) the general background air quality in the area is to use historical ambient air quality monitoring data that are representative of the study area. There are no established ambient air quality monitoring stations to collect data on pollutants levels on New Providence Island (or elsewhere in The Bahamas) that might be used to estimate the existing air quality.

An ambient air quality network was historically operated by Golder Associates (on behalf of Bahamas Electricity Corporation) which comprised of three continuous monitoring stations. The three monitoring stations were located at Clifton Pier, Lyford Cay and Blue Hills. Data from Clifton Pier and Lyford Cay air quality monitoring stations were preferable to use in the Project existing air quality description due to the stations' proximity to proposed project site. Ambient air monitoring data from these stations are only available for certain time periods (from 2000 to 2006 and from 2011 to 2013) and for certain contaminants of interest such as SO_2, NO_2 and PM_{10}.

Ambient air quality monitoring data on NO_2 and SO_2 collected at these two stations are summarized in Table 5-6. Table 5-7 presents a summary of PM_{10} air quality monitoring data collected at Clifton Pier and Lyford Cay. Relevant statistics such as percentiles, maximums and annual averages were extracted from the data sets for the relevant averaging periods. It should be noted that monitored data can only be considered as representative if the annual data collection efficiency is greater than 75%.

Table 5-6: Monitored NO2 and SO2 Concentrations (ug/m3)

Pollutant	Location	Averaging Period	2000	2001	2002	2003	2004	2005	2006	2011	2012	2013
NO_2	Clifton Pier	Maximum 1-Hour Average	54	116	115	126	77	88	114	38	47	94
		Annual Average	5	8	9	7	5	8	7	3	2	3
		90th percentile	12	22	23	19	12	21	19	9	6	8
		% Data Capture	52	55	77	95	76	17	24	67	67	17
	Lyford Cay	Maximum 1-Hour Average	67	77	68	105	118	126	90	27	50	28
		Annual Average	4	3	3	3	2	3	3	2	2	1
		90th percentile	8	7	7	8	4	7	7	4	5	4
		% Data Capture	76	91	94	95	83	45	43	55	37	55
SO_2	Clifton Pier	Maximum 1-Hour Average	406	179	84	122	65	241	423	237	62	40
		Annual Average	4	4	3	3	3	3	4	3	2	3
		99th percentile	53	61	28	32	10	22	17	42	16	17
		90th percentile	7	10	7	7	6	6	7	7	3	9
		% Data Capture	75	85	85	95	69	60	47	76	75	28
	Lyford Cay	Maximum 1-Hour Average	174	156	81	90	130	445	152	77	48	13
		Annual Average	1	1	1	1	1	2	1	1	1	1
		99th percentile	20	8	5	9	45	17	9	6	3	1
		90th percentile	2	1	2	1	2	2	2	1	1	1

		% Data Capture	79	91	94	91	83	70	49	74	60	75

Table 5-7: Monitored PM_{10} Concentrations (ug/m^3)

Pollutant	Location	Averaging Period	2000	2001	2002	2003	2004	2005	2006	2011	2012	2013
PM_{10}	**Clifton Pier**	Maximum 24-Hour Average	70	72	58	58	67	79	52	35	68	81
		99th percentile	66	67	58	55	55	73	50	28	61	78
		90th percentile	42	37	28	37	33	33	36	19	41	41
		Annual Average	27	24	21	21	23	23	22	17	27	25
		% Data Capture	85	98	85	98	87	89	56	97	80	84
	Lyford Cay	Maximum 24-Hour Average	212	54	93	53	58	56	44	36	53	98
		99th percentile	193	45	66	51	44	54	44	36	45	87
		90th percentile	80	27	18	33	24	22	27	25	27	22
		Annual Average	35	17	14	18	16	16	17	18	18	18
		% Data Capture	85	100	67	98	92	75	59	95	13	77

The background concentrations of SO_2 is based on the 3-year average of the 99th percentile of daily maximum 1-h values. The background concentrations of 1-hour NO_2 is conservatively based on the maximum recorded concentration. Annual NO2 concentrations monitored at the Clifton Pier monitoring location are higher than those recorded at Lyford Cay and have been selected as background concentrations as a more conservative approach. It is noted that PM_{10} levels recorded at Clifton Pier are in general higher than at Lyford Cay, except for the year 2000 (not taken into calculation due to much higher levels of PM_{10} concentrations at Lyford Cay in comparison to other years as well as other levels at Clifton Pier). The background concentrations of PM_{10} are selected as the maximum recorded 99th percentile at the Clifton Pier monitoring location.

In the absence of the established Ambient Air Quality Standards (AAQS) in The Bahamas, the background air quality levels are compared to the relevant internationally recognized standards/guidelines: WHO Air Quality Guidelines (enforced by the IFC EHS General Guideline) and the US EPA national ambient air quality standards (NAAQS), as presented in Section 4.2.1. Ambient air quality monitoring collected at the two locations show that no exceedances of the WHO and US EPA standards have been recorded for NO_2. Monitoring SO_2 data for the average period of 1-h comply with the US EPA NAAQS, while 24-hour average SO_2 concentrations are below WHO Interim target level-2 and exceed the WHO Interim target-1 and WHO guideline. Ambient air quality monitoring data on PM_{10} show a compliance with the US EPA standards and WHO Interim target-1 and 2, while exceed the WHO Interim target level-3 and guideline. Annual PM_{10} levels at Clifton Pier exceed the guideline, while are below interim target level-3.

The background concentrations of NO_2, SO_2 and PM10 selected for use in the air quality assessment for the EIA are presented in Table 4-3 in the previous chapter.

5.1.5 Noise Pollution

The terms ‘sound’ and ‘noise’ tend to be used interchangeably, but noise can be defined as unwanted sound, whereas sound is a normal and desirable part of life. However, when noise is imposed on people, it can lead to disturbance, annoyance and other undesirable effects. Noise is measured and quantified using decibels (dB). The decibel scale is logarithmic, which means that sound levels do not add up or change according to simple linear arithmetic. For example, adding two equal sound sources results in a doubling of sound energy, which gives a combined sound level that is 3 dB higher than the individual levels. Because the human ear is less sensitive to low and high frequencies than mid-frequencies, decibels on the A-weighted frequency scale (dBA) were devised to correspond to the sensitivity of the human ear. The letter ‘A’ denotes that ‘A’-weighting has been used and the ‘eq’ indicates that an equivalent level has been calculated.

The human ear’s threshold of perception for sound change is considered to be about 3 dB. A 5 dB difference is generally noticeable to the human ear, and a 10 dB increase is perceived as a doubling of sound. Noise levels and subjective loudness of common noise sources are presented for reference in Table 5.8.

Table 5.8: Noise Levels and Subjective Loudness of Common Sound Sources

Common Noise Source	Noise Levels dBA	Typical Subjective Loudness
Moon launch at 100 m; artillery fire, gunner's position	140	Intolerable
Ship's engine room; rock concert, in front and close to speakers	120	Intolerable
Textile mill; press room with presses running; punch press and wood planers, at operator's position	100	Very noisy
Next to busy highway, shouting	80	Noisy
Department store, restaurant, speech levels	60	Noisy
Quiet residential neighborhood, ambient level	40	Quiet
Recording studio, ambient level	20	Very quiet
Threshold of hearing for normal young people	0	Very quiet

Source: Bies, Hansen and Howard, 2018

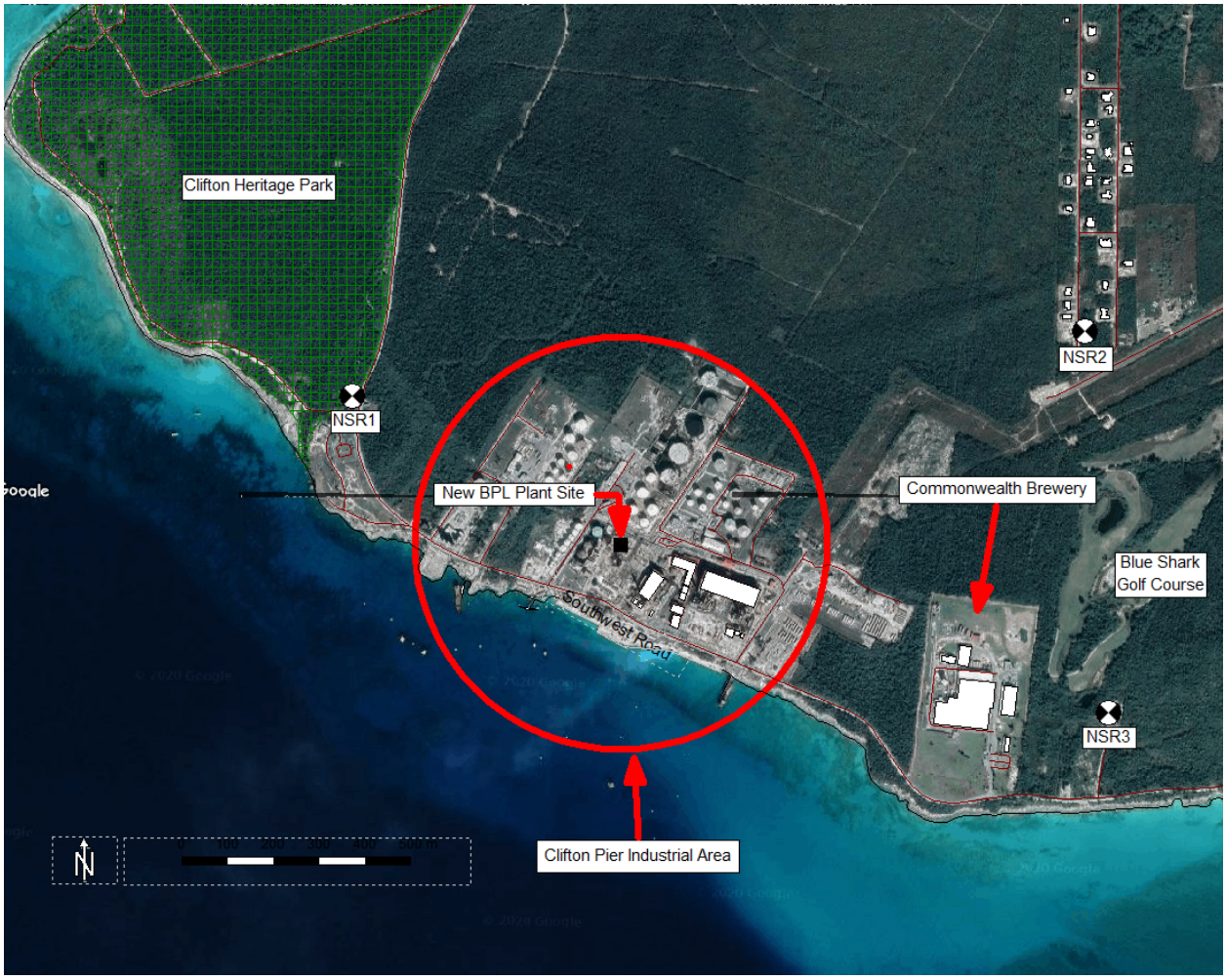
The sound environment at the BPL power plant site and its immediate surroundings is characterized by onshore and offshore industrial activities, ocean waves, and light to moderate roadway traffic. The new power plant is bounded by:

- Liquid fuels and bunkering facilities to the north,
- BPL's upgraded Station A power plant and an LPG storage and road transport facility to the east,
- Multiple marine facilities to the south, and
- A jet fuel storage facility to the west.

The Commonwealth Brewery is located further east of the Clifton Pier. Southwest Road is located directly to the south of the site. A scaled area location plan depicting the site and the surrounding area is provided in Figure 5.3.

Noise sensitive receptors (NSRs) were selected that are representative of the nearest sensitive points of reception around the new plant site. For the purpose of this assessment, three locations have been selected to represent the NSRs, labelled as NSR1 through NSR3 in Figure 5.3. The nearest NSR is a Clifton Heritage National Park, a recreational and cultural heritage site located approximately 2,165 ft or 0.4 mi (660 m) west of the center of the new BPL plant site. Other NSRs include a cluster of residences 3,625 ft or 0.7 mi (1,105 m) northeast and an isolated residence 3,674.5 ft or 0.7 (1,120 m) southeast of the center of the new BPL plant site. The Blue Shark Golf Course to the east is currently not in operation and as such, not considered an NSR.

Figure 5-3: Noise Sensitive Receptors at CPPS



5.1.6 Water quality

Salinity levels of water are expressed in parts per million (ppm) or milligrams per litre (mg/l) of the chloride content in the water, which is a constituent of the total dissolved solids.

For the purposes of this particular site and the proposed water use, the ranges of salinity follow:

Water Description	**Dissolved Solids**
Fresh	Less than 1,500 mg/l
Brackish	1,500 – 3,000 mg/l
Salt	More than 3,000 mg/l
Saline	More than 30,000 mg/l

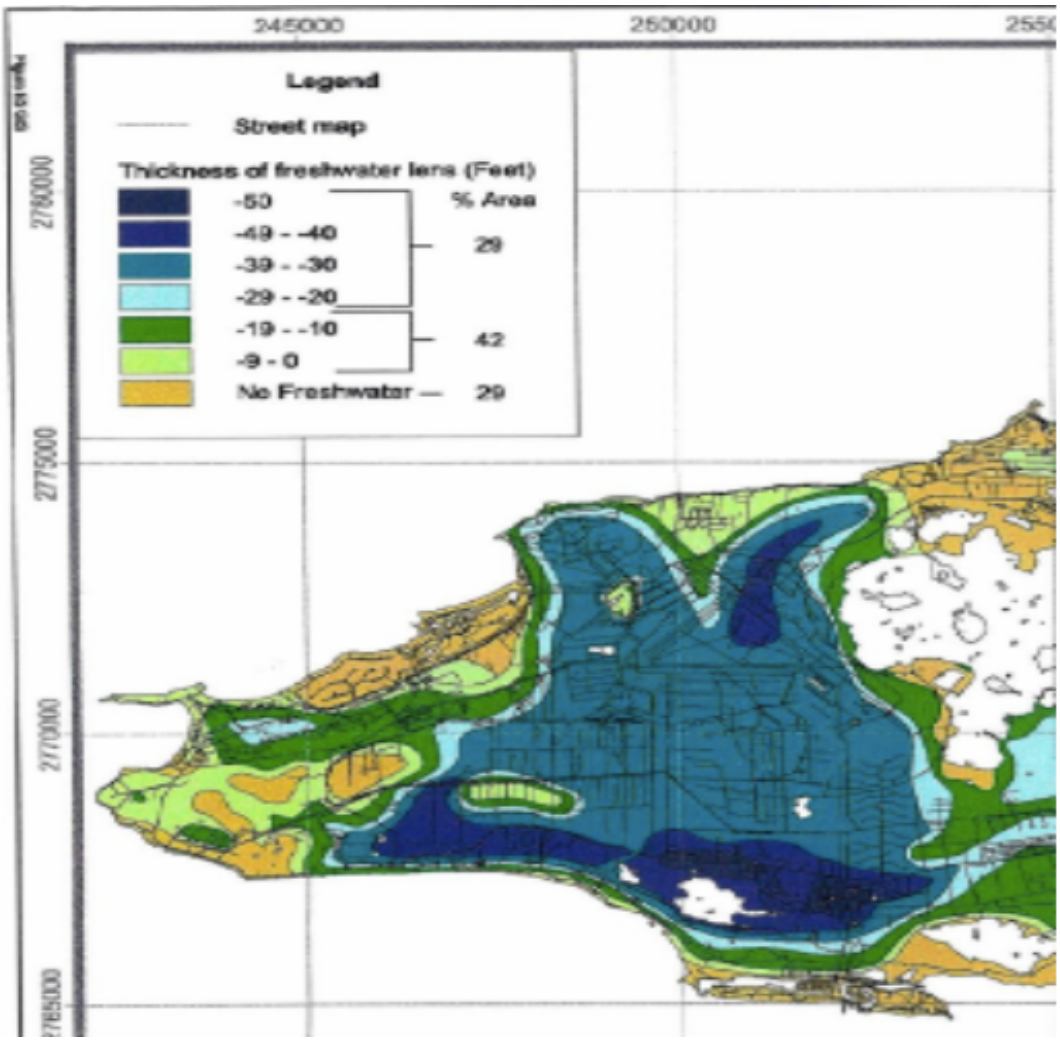
Climate variability and change is expected to greatly influence the existing weather and environment of The Bahamas. Problems that may be exacerbated in response to climate variability and change are:

1. The frequency and intensity of hurricanes; and
2. The potential of rising sea levels.

Changes in the position and the distribution of fresh, brackish and saline groundwater is anticipated due to any rising sea level, combined with a possible reduction in groundwater recharge from changes in the rainfall distribution.

The upper groundwater is brackish water (salinity of 1,500 to 3,000 mg/l), encountered at approximately 20 ft (6.09 m) below ground level (bgl). Groundwater conditions at site further indicate a limited availability of freshwater resources in the vicinity of the project area. Any available freshwater resources (Salinity < 1,500 mg/l) would be north of the project site and less than 20 ft (6.09 m) in thickness.

Figure 5-4: Freshwater Lens – Western New Providence



5.1.7 Potential existing contamination of soil and groundwater

The groundwater resources at the project site have been impacted by hydrocarbon contamination. This contamination is documented in reports by CH2M Hill in 2016 and Geosyntec in 2020. The complete Geosyntec report is attached at Appendix G1. Text from the Geosyntec report indicates the following:

Environmental conditions in 2016 were documented in the Preliminary Activities Summary Report (CH2M, 2016). The CH2M Hill report indicates that several areas of shoreline LNAPL[14] discharge have been observed. Environmental assessment work by CH2M Hill indicated the presence of multiple sources of petroleum products on the western side of the CPPS, including drain lines, piping trenches, disposal wells, waste-oil storage tanks, and spillage in and around operations. Measured thicknesses of LNAPL ranged from 0.11 to 94.70 feet and organics were detected in shoreline surface water samples. Chemical fingerprint analysis indicated that the LNAPL closely resembled fuels used onsite or a mixture of those fuels that have undergone varying degrees of weathering. Variability in the colour and viscosity of some of the LNAPL was also noted. These data infer mixing of multiple fuels over multiple release events.

Geosyntec collected 19 surficial soil samples at the site as well as ten (10) soil borings and three (3) deep soil borings. Geosyntec also collected soil vapor (SV) samples and head space samples from four (4) soil boring locations and above-ground ambient air monitoring at four (4) locations. The Geosyntec report detailing the results of their 2020 analysis can be found at Appendix G1. To supplement works already initiated by BPL, which includes installation of a barrier wall to prevent LNAPL entering the marine environment, Geosyntec has recommended remediation at CPPS based on the results of its analysis as follows:

- soil remediation;
- construction air monitoring;
- long-term ambient air monitoring; and
- vapour intrusion remediation.

These remediation measures are detailed in the Geosyntec report (see Appendix G1).

[14] LNAPL - light non-aqueous phase liquid

Figure 5-5: Contamination at CPPS
(most impacted areas of the site outlined in red)

5.2 Biological Aspects

5.2.1 Terrestrial habitats

All trees positively identified were listed and classified as Native (NA), Nonnative (NN), or Invasive (IN) based on information in Currie et al. (2019) and the Global Invasive Species Database (www.iucngisd.org).

The trees on the property are primarily nonnative and invasive plants with a few non-invasive ornamental plants and fruit trees. Native plants located on the site are relatively abundant in the surrounding area and are not currently of high conservation concern.

The Bahamas list of protected plant species is currently under review and is expected to be updated within the year to include the majority of native and endemic forest tree species. Therefore, all species within the Native category should be assumed to be afforded some measure of protection via the Forestry Act, its pending update and the Conservation and Protection of the Physical Landscape of The Bahamas Act. The Nonnative species found on the property include decorative horticultural species and fruit trees. These species are not protected or expected to gain protection under the

updated laws and appear to be maintained for aesthetic purposes or employee use. They do not pose an ecological threat to the neighboring biodiversity.

Four (4) key invasive plant species are found on the Station D site. All of the listed invasive species have significant impact on native biodiversity when allowed to proliferate. In general, they do not provide meaningful benefit to native birds or other wildlife and should be removed and destroyed where possible and feasible.

Within the boundaries of the Station D site, no trees encountered are listed in the Schedule of Protected Trees under the Conservation and Protection of the Physical Landscape of the Bahamas Act, 1997.

Table 5-9: Plant Species observed at Station D

Common Name	Scientific Name	Category	Location
Alexander Palm	*Archontophoenix alexandrae*	NN	Eastern fence boundary of Station D
Assorted Grasses	Various species	NA	Along roadsides and in south west corner
Banana	*Musa sp.*	NN	In south west corner of property
Brazilian Pepper	*Schinus terebinthifolius*	IN	Along northern fence boundaries
Casuarina (Australian Pine)	*Casuarina sp.*	IN	North west holding tanks
Coconut	*Cocos nucifora*	NN	
Florida Strangler Fig	*Ficus aurea*	NN	East of entrance
Gum Elemi	*Bursera simaruba*	NA	Along northern fence boundary
Juju	*Ziziphus jujuba*	NN	
Poison Wood	*Metopium toxiferum*	NA	Along northern fence boundary
Hawaiian Scaevola	*Scaevola Taccata*	IN	In south west corner of property
Shepherd Needle	*Bidens pilosa*	NA	Along parking lot boundaries
West Indian Almond	*Terminalia catappa*	IN	
Willow Bustic	*Sideroxylon salicifolium*	NA	North west corner of site

Figure 5-6: Brazilian Pepper

Figure 5-7: Hawaiian Scaevola

Figure 5-8: Florida Strangler Fig

5.2.2 Biodiversity, including protected species of animals, birds and plants

All species of birds detected during the surveys are protected under the Wild Birds Protection Act and as such it is illegal to kill or capture them without permission during the closed season. For most species detected that closed season is the entire year. Only the White-Crowned Pigeon found on the site has a shorter closed season. The Minister can exempt any portion of The Bahamas from the Act and thereby allow the legal removal of birds and their nests from the property.

Avian surveys were conducted on April 2, 2020 to identify the presence, abundance and habitat utilization of avian species within the boundaries of the Station D site and its environs. Morning and afternoon surveys were conducted between 7:00 AM and 3:00 PM. The number of individuals birds counted was combined and species names and numbers of detected individuals were recorded in the abundance categories, Single (1), Few (2-10) and Many (11-100). Taxonomy is based on the Clements Checklist of Birds of the World (August 2019 edition). Status is based on the International Union for Conservation of Nature (IUCN). These results are based on a small sample size and do not represent the total expected diversity at the site.

Table 5-10: Avifauna survey abbreviations

TABLE KEY:		
RANGE	**STATUS**	**OBSERVATIONS**
PRB = Permanent Resident Breeding	**LC =** Least Concern (Conservation - IUCN)	**S =** Single (1)
RNB = Resident Non-Breeding	**NT =** Near Threatened (Conservation – IUCN)	**F =** Few (2-10)
WR = Winter Resident	**VU =** Vulnerable (Conservation – IUCN)	**M =** Many (>10)
E = Endemic (Distribution)		

A total of thirteen (13) species were recorded during the surveys (Table 5-11).

Table 5-11: Bird species observed at Station D

Common name	**Scientific Name**	**Range**	**Status**	**Observations**
Laughing Gull	*Leucophaeus atricilla*	PRB	LC	F
Osprey	*Pandion haliaetus*	PRB	LC	S
House Sparrow	*Passer domesticus*	PRB	LC	F
Common Ground-dove	*Columbina passerine*	PRB	LC	F
Northern Mockingbird	*Mimus polyglottos*	PRB	LC	F
Palm Warbler	*Setophaga palmarum*	WR	LC	F
Yellow-rumped Warbler	*Setophaga coronata*	WR	LC	S
Smooth-billed Ani	*Crotophaga ani*	PRB	LC	F
Cattle Egret	*Bubulcus ibis*	PRB	LC	S
White-crowned Pigeon	*Patagioenas leucocephala*	PRB	NT	S
Thick-billed Vireo	*Vireo crassirostris*	PRB-E	LC	S
Prairie Warbler	*Setophaga discolor*	WR	LC	S
Western Spindalis	*Spindalis zena*	PRB-E	LC	F

Figure 5-9: Western Spindalis (*Spindalis zena*) female

Figure 5-10: Western Spindalis (*Spindalis zena*) male

Figure 5-11: Laughing Gull (*Leucophaeus atricilla*)

Figure 5-12: Osprey (*Pandion haliaetus*)

RANGE

The range of a species is the geographic areas where the birds can be consistently found e.g. migrant birds have seasonal ranges while restricted range species remain on the same island or in the same region year-round. To support development and conservation decisions, the birds detected were classified into range categories. Range categories include: Permanent Resident Breeding (PRB) birds which live in the Bahamas throughout the year and also reproduce in the country; Resident Non-Breeding (RNB) birds live in the Bahamas for most of the year, but leave to breed in other locations; Winter Resident (WR) birds migrate through the Bahamas or remain here throughout the winter months typically October through May; Endemic birds (E) occur only within the Bahamas or Caribbean.

PERMANENT RESIDENT BREEDING

Permanent Resident Breeding species refers to the resident species that live and breed year-round in the Bahama Islands. A total of ten (10) species were found in this category during the survey. The species detected are fairly common throughout the island and with the exception of the Northern Mockingbird and House Sparrow, they were not engaged in breeding or nesting behavior.

The Northern Mockingbirds were defending territories on the property and may nest in the large fig tree at the entrance to the property. House Sparrows are a common invasive species and were

gathering in the Banyan tree but could not be counted and no nests were visible though it is highly likely. There was a House Sparrow nesting in an abandoned structure on the western part of the property.

SUMMER RESIDENT BREEDING

Summer Resident Breeding refers to migrant species that breed in The Bahamas during summer months from April to October and spend the rest of the year in other regions. No species were found in this category during the surveys. However, it is possible that species such as the Antillean Nighthawk would use the open areas throughout the property for nesting.

WINTER RESIDENT NON-BREEDING

Winter Resident Non-breeding species refers to the annual non-breeding fall/winter migrants which pass through the Bahama Islands from North America en route to southern regions or which remain in the Bahamas. Three (3) species in this category were recorded within the study area. Those species include the Yellow-rumped Warbler, the Palm Warbler and the Prairie Warbler. All three of these birds are protected internationally via the Migratory Bird Treaty.

RESIDENT NON-BREEDING

Resident non-breeding birds spend most of their lives in the Bahamas but leave to breed in another location. None of the species encountered during the surveys were in this group.

ENDEMIC SPECIES

Endemic species are found only in a restricted geographic area. Endemism must be described at scale. Some species are only found in a small area, on a particular island, or within a region like the Caribbean. The Thick-billed Vireo found at the site is a regional endemic that lives year-round in the Bahamas and Turks and Caicos, but may migrate to the north coast of Cuba. The Western Spindalis was detected in the forest nearby but not on the property and is an endemic to the Bahamas archipelago including the Turks and Caicos Islands and Cuba.

CONSERVATION STATUS – PROTECTED

All of the species observed are protected under the Wild Birds Protection Act (Statute Law of The Bahamas, Chapter 249). In addition to the local laws, all migratory birds listed above are protected under international treaties and conventions such as the Migratory Bird Treaty Act of the United States.

CONSERVATION STATUS – SPECIES OF CONCERN

"Near Threatened" (NT) by the IUCN classifies a species that may be considered threatened with extinction in the near future, although it does not currently qualify for the threatened status.

White-crowned Pigeons (*Patagioenas leucocephala*), are designated a Near-threatened species by IUCN and are managed as a hunted species in The Bahamas. Hunting is allowed with a permit and limits and regulations are determined by the Government of The Bahamas.

HABITAT UTILIZATION BY BIRD SPECIES

The site surveyed included:

- The industrial site for Station D within the larger BPL Clifton Pier compound;
- Rocky coastal cliffs and Blackland coppice areas along the roadside both east and west of the Station D site; and
- The secondary growth area west of the Station D site.

No permanent or ephemeral wetlands were found in the study area, though the ocean borders the property to the South. Various native fruit were present nearby, along with insects that serve as food resources for the birds. The birds detected were primarily in transition through the property and are not expected to make significant use of the property for feeding, foraging or nesting with the exception of the aforementioned House Sparrows, Northern Mockingbirds and Common Ground Doves. The House Sparrow was the only species seen at an active nest.

5.2.3 National parks, protected areas, and marine reserves within the area of influence

The protected areas within the area of influence of the project are:

1. Clifton Heritage National Park
2. Southwest New Providence Marine Management Area

Clifton Heritage National Park (CHNP) comprises 208 acres and is managed by the Clifton Heritage Authority. The park was established in June 2004 to protect and preserve this historic area for the use and benefit of the Bahamian people. The Park encompasses what was once a booming plantation and the home to three unique cultures spanning centuries - The Lucayans, The Loyalists and The Africans. The Clifton plantation has the distinction of being the only complete remaining plantation on the island of New Providence. It includes:

- Remnants of the slave walls which acted as dividers for the crops harvested here,
- The Great House (The Master's Quarters),
- The Slave Village (The Slave Quarters), and
- The Johnston ruins (Former quarters of Lewis Johnston).

There is also an underwater sculpture garden as a part of CHNP which was installed in 2014.

Figure 5.13: Clifton Heritage National Park

Source: Bahamas Ministry of Tourism

The Southwest New Providence Marine Management Area is a 73.84 sq km managed marine area (MMA) established by the Government of The Bahamas in 2015. While the MMA does not have a marine management plan as yet, the intent is that it will be a multi-use site with zones for permitted activities.

Figure 5-14: Southwest New Providence Marine Managed Area boundaries

Source: protectedplanet.net

5.3 Socioeconomic Aspects

5.3.1 Adjacent communities, demography and economic base and status

Approximately 351,000 make up the population of The Bahamas and over 70% reside on New Providence. Between the 2000 and 2010 Census, the population has grown by almost 16%, the lowest increase since the 1950's. At just 80 square miles and 3,070 persons per square mile, New Providence is the most densely populated island in the archipelago (Dept of Statistics, 2010).

Clifton is widely recognized as the southwestern-most community on New Providence. The constituency is described in the 2010 Census Report for New Providence as "Bounded on the North by the Sea; on the East by an imaginary line that extends to West Bay Street, an Unnamed Road, Westridge Drive, Atlantic Drive, an Unnamed Road, John F Kennedy Drive, International Airport Road, Coral Harbour Road Adelaide Road, Carmichael Road and Coral Harbour Road; on the South by the Sea; on the West by the Sea (Clifton Bluff, Lyford Cay)" (2010 Census, 2012). Clifton has a population of 9,323 and 2,868 households. Over a third of dwellings are vacant. There are ten residential areas within two miles of Clifton Pier. They are;

- Adelaide (historic settlement)
- Albany (gated community)
- Blue Shark Golf Club (gated community)
- South Ocean
- South Ocean Estates
- South Ocean Beach
- South Ocean Condos
- Country Club Estates
- Lyford Cay (gated community)

- Mount Pleasant

Three of these communities are within one mile of Clifton Pier - South Ocean Estates, Blue Shark Golf Club, and South Ocean Condos. South Ocean is the largest non-gated community within the one-mile radius. The latter is no longer occupied.

Enrollment in school is mandatory in The Bahamas for youth between the age of 5 and 16. Approximately 75,120 students are enrolled at the preschool school to secondary school levels and between 8-9,000 enrolled at the tertiary level. There are two schools located approximately three miles away from Clifton Pier: Lyford Cay International School and Windsor School, Albany Campus. Lyford Cay International School is located within the gated Lyford Cay community and has a school population of 385 students. Windsor School at Albany has a student population of over 400.

Compared to other countries in the Western Hemisphere, The Bahamas has the third highest per-capita gross domestic product (GDP). However, the majority of the GDP is dependent on the tourism industry. The epicenter of the economy emerges from New Providence, the only island offering employment in every sector listed in the 2010 Census.

5.3.2 Existing opportunities for employment

Tourism is the number one industry in The Bahamas, accounting for a large portion of the labour force, and contributing 60% of the GDP. Financial services sector is the second major industry in The Bahamas and includes commercial and private banking institutions. Employment in agriculture, forestry, and fishing make up 1.45% of the total industries that employ Bahamians. Other related industries that employ Bahamians are list in Table 5-12.

Table 5-12: Employment statistics for The Bahamas – Smaller Industries

INDUSTRY	**# OF PERSONS EMPLOYED**
Fishing	1,597
Manufacturing of beverages	756
Manufacturing of refined petroleum products	29
Electricity Power Generation Transmission and Distribution	1,386
Manufacture of Gas; Distribution of Gaseous Fuels Through Mains	27
Transport Via Pipeline	6
Sea and Coastal Water Transport	945

Employment in the areas adjacent to Clifton Pier, is predominantly in the tourism industry. Primary employment comes from the Clifton Heritage Park, Lyford Cay Development, Stuart Cove's Dive Bahamas, Albany Development, various restaurants, and several other small businesses in the Mount Pleasant Community.

There are several businesses and industries open to the public that generate economic activity in the areas surrounding Clifton Pier, attracting local and international clients and customers. They include:

- Banking
- Building and Trade Vendors
- Clifton Heritage Site
- Educational Services
- Governmental Offices
- Legal Services
- Merchant and Domestic services
- Primeval Forest National Park
- Stores, restaurants, and other commodities
- Tour Operators,
- Transportation Services
- Warehousing and Storage Facilities

High-end residential areas that provide employment and contribute to the local economy include Lyford Cay (the oldest gated community on New Providence), Old Fort Bay, and Albany (most recently established). Lyford Cay and Albany both feature private 18-hole golf courses, clubhouses, and marinas.

5.3.3 Present and planned land and marine use (e.g., transport, fishing, sport, tourism)

The Clifton community is located in the Southwest corner of New Providence. It includes Clifton Pier, an area zoned for industrial activities. It is home to several industrial operations including Bahamas Power and Light (BPL), Sun Oil Limited (SOL) Bahamas (north and west), Rubis Bahamas Limited (to the west), and Shell. Other industrial companies adjacent to the power and oil companies are Caribbean Gas Company and Commonwealth Brewery.

Historically, large quantities of heavy fuel oil (HFO or Bunker C) for power generation have been stored at Clifton Pier. At the BPL tank farm to the north automotive diesel fuel (ADO), lubricating oil, and HFO or Bunker C. Outside of the BPL storage facility, gasoline, aviation fuel, and jet fuel are being stored by other facilities.

There are several key uses of the area surrounding the industrial properties at Clifton Pier Power Station. Marine traffic is by far the largest category of use in the Clifton Pier area. This includes shipping traffic related to BPL, Rubis, SOL, and Caribbean Gas. Other vessels are typically engaged in leisure, recreational, snorkeling, scuba diving, sightseeing or fishing (subsistence and commercial).
The shoreline area at Clifton has been modified over the years to accommodate industry. There are several outfalls, sheet pilings, and other related structures. There is also a cave on the shoreline adjacent to the BPL Oil Recovery Storage Area. The marine environment at Clifton extends from the shallow waters of the shoreline and beaches out to the marine shelf (40-60 ft) and plunges down in excess of 1,000 meters.

Coral reef, fish, and other marine species attract a broad group of uses. Fishermen frequent the southwest New Providence area primarily via boat as fishing from shore is very limited in recent times. Subsistence fishing is most popular during mutton fish spawning seasons. Local vessels can be observed along the marine shelf where aggregations form and can be harvested.

Within two (2) miles of Clifton Pier there are:

- 10 Residential Communities
- 2 Schools
- 2 Wild Bird Reserves
- 20 Dive Sites
- Clifton Heritage Site
- Primeval Forest National Park
- Underwater Sculptures Park
- South Ocean Beach

Clifton Heritage Park is a terrestrial protected area that stretches from Clifton Point west to Lyford Cay. Its 208 acres is primarily undeveloped with several archaeological and cultural sites. It boasts several interpretive trails, signage, and restored historical and cultural structures. Remnants of the movie set for "Flipper" is located at this park, with a rustic boat ramp (condemned) and poles where the dolphin pens were installed for the movie. There is no boat access to this park and vehicular access is limited to tour buses and park vehicles only.

The Primeval Forest National Park is a terrestrial protected area, 7.5 acres in size and is located less than a mile off of South Ocean Road (north of Frank Watson Blvd). It is a designated category III IUCN protected area. This park has a guest center, several trails, boardwalks, bridges, and parking facility.

Scuba diving, snorkeling, recreational swimming and other leisure and sightseeing activities occur daily in the area surrounding Clifton Pier. There are numerous dive sites sprawled in the waters less than a quarter mile from Clifton Point stretching all the way to Golding Cay. These sites fall within and outside the Southwest New Providence Marine Managed Area and are used for scuba diving, snorkeling, and swimming. Dive operators including Stuart Cove's Bahamas, Bahama Divers, and other private vessels offer trips to areas near and around Clifton. Several feature films have been recorded on land and in the waters around Clifton, including Thunderball (1965), Never Say Never (1983), Jaws: The Revenge (1987), Flipper (1992), After the Sunset (2004), and Into the Blue (2005).

The first underwater sculpture garden in The Bahamas is a popular attraction for visitors to New Providence. It is located in the shallow waters of Clifton, near the Clifton Heritage Site, and includes 65 reef balls and 3 sculptures. It attracts swimmers (from Clifton Heritage Site), snorkelers and scuba divers who access. All either access the site by boat or from shore. Birdwatching also occurs at the nearby Clifton Heritage Park, Primaeval Forest National Park, Goulding Cay Wild Bird Reserve, and Adelaide Creek Wild Bird Reserve.

Private vessels that utilize marinas and dock facilities around New Providence and primarily at Albany and Lyford Cay are known to traverse and recreate in the areas surrounding Clifton. Guests travel primarily by bus, taxi or private rental car to the various tourist sites.

Sportfishing by local and visiting vessels is also common in the Clifton Pier area. Commercial fishing is known to occur in the area, but the extent of this activity cannot be established through existing literature at this time. The consultants will engage the Department of Marine Resources for more information once the Emergency Orders have been lifted.

5.3.4 Land tenure

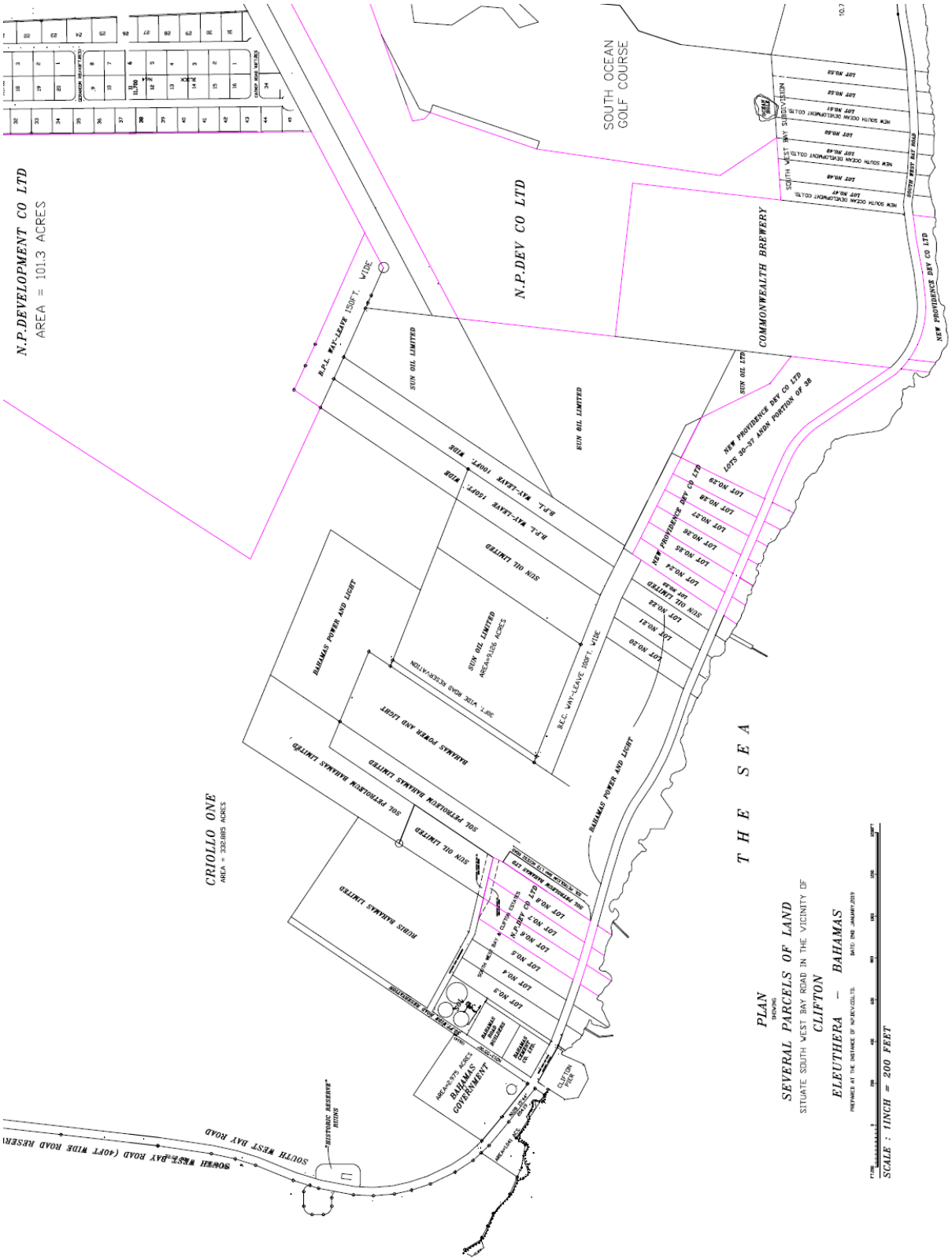
Land tenure in the Clifton area is shown in Map 5-1.

5.3.5 Transportation, including docks, roads, airports, and improvements needed

New Providence offers the full spectrum of transportation offered throughout the archipelago, with air, land, and sea options barring none. Regular domestic and international air transportation is available from the Lynden Pindling International Airport (LPIA), approximately seven (7) miles from Clifton Pier. LPIA provides routine direct flights to North America, the Caribbean, and Europe. There are domestic flights to every major island in The Bahamas. Private domestic and international flights are facilitated at two Fixed Base Operator (FBO) facilities (Million Air and the Jet Center), at LPIA.

Transportation on land is facilitated via a complex network of roads. These roads on New Providence are primarily two-lane, with major thoroughfares having four lanes. These include Prince Charles Drive, Tonique-Darling Highway, and John F. Kennedy Drive. Heading west from LPIA the main road is Windsor Field Road, a two-lane road which transitions to the Western Road and ends at the roundabout at Lyford Cay. Further west, the road meanders into Southwest Road, which leads to Clifton Pier. Southwest Road is the only road access to and from Clifton Pier, running west to Clifton Heritage Site and Lyford Cay east to South Ocean and Albany.

Map 5-1: Land tenure for Clifton area



Transportation and storage of bulk fuel via large vessels occurs at Clifton Pier. Outside of Clifton Pier, boat transportation activity primarily occurs on the north side of New Providence. At Potters Cay, fishing, cargo, and mailboats dock; servicing interisland marine transport and shipment of goods. West of Potters Cay, cruise ships dock at the secured Prince George Wharf. Further west, the Arawak Port Development is home to the Nassau Container Port and Gladstone Freight Terminal, which facilitates international commercial shipping and houses the Bahamas Customs Department. These areas represent the hub of economic activity and transportation in The Bahamas. Numerous marinas on New Providence, both private and public, facilitating hundreds of private yachts and marine vessels. These include:

- Albany Marina
- Atlantis Marina Village
- Bay Street Marina
- Coral Harbour
- Harbour Bay Marina
- Harbour Central
- John Alfred Wharf
- Lyford Cay Marina
- Nassau Yacht Club
- Old Fort Bay Marina
- Palm Cay
- Port New Providence
- Sea Breeze Estates
- TPA Marina
- Venice Bay
- Woodes Rodgers Wharf

5.3.6 Infrastructure and public services

New Providence offers a wide variety of services to its population including education (at all levels), medical, banking, insurance, and transportation. Power generation for New Providence is by oil-powered generators and is provided by Bahamas Power and Light, located at Clifton Pier. There are three telecommunications companies on the island; Bahamas Telecommunications Company, ALIV, and Cable Bahamas.

Potable water and centralized sewerage collection are managed by the Water and Sewerage Corporation. Sewerage service is limited to about one fifth of the island through the WSC sewerage system and systems set up by housing subdivisions. All other locations use on-plot disposal devices including septic tanks. Major hotels and resorts use their own treatment facilities. Waste is generally treated to primary or secondary levels then disposed of through deep well injection systems.

Clifton is the primary point of importation of oil, gas, and other fuel into the island. The pier and its associated network of lines and storage containers is home to Bahamas Power and Light, Rubis Ltd., SOL Bahamas Limited, Sun Oil Limited, Commonwealth Brewery, and a cement storage facility.

5.4 Cultural Aspects

5.4.1 Archaeological and historic resources - location, description and significance

The historical resources within the project area of influence are protected at the Clifton Heritage national Park. There are no archaeological and historic resources at the proposed BPL power plant site.

5.4.2 Paleontological resources (fossils) - location, description and significance

There are no paleontological resources at the proposed BPL power plant site.

5.4.3 Tourist and recreational areas, use and access

There is no direct tourist or recreational use of the project site. Tourist and recreational uses of the general Clifton area include:

- swimming
- wading
- snorkeling
- scuba diving
- boating
- birdwatching
- paddleboarding
- photography
- sightseeing
- sportfishing
- subsistence fishing (from the rocks and dock)
- subsistence fishing (from boat)
- walking
- jogging
- jet skiing

5.4.4 Community organizations, including non-profits and civil society organizations

Non-profits and civil society organizations active on the island of New Providence are detailed below.

Bahamas National Trust (BNT)

The BNT was established by an Act of Parliament in 1959, which makes it unique in the NGO community. It represents a unique collaboration of governmental, private sector and scientific interests dedicated to the conservation of the natural and historic resources of The Bahamas for the enjoyment and benefit of the Bahamian people. The major mandate of the Trust is management of the National Parks System of The Bahamas.

Bahamas Reef Environment Educational Foundation (BREEF)

BREEF is concerned primarily with coral reef education and fund-raising for the protection of marine resources of The Bahamas through education. Its mission is to strengthen the symbiosis between the Bahamian people and the reefs, which protect, nourish, and enrich us, by focusing Bahamian and allied minds on this relationship. The Foundation's raison d'etre is the restoration of the reefs of The Bahamas to their former glory and abundance.

Save the Bays

Save the Bays was established in 2013 with an initial effort to preserve and protect Clifton Bay and other marine environments surrounding New Providence. They were involved in the establishment of the Southwest New Providence Marine Managed Area. They are now a member of the Waterkeepers Alliance and have projects on other islands of The Bahamas including Grand Bahama.

reEarth

Established in 1990, reEarth is a non-profit, community based environmental watch group dedicated to increasing public awareness and understanding of environmental issues.

5.5 Health Aspects

The first step of the human health assessment stage is to create a baseline health profile that describes the current health conditions of the community. The baseline health assessment establishes the current health status of people within New Providence, if available, and the Bahamas in general and compares this with statistics within the Non-Latin Caribbean countries. This assessment allows for the evaluation of vulnerable groups within the community. Indicators of health are markers of health status and are used to diagnose the health status of a population to help plan, monitor and evaluate activities related to disease control and health care delivery (World Health Organization (WHO), 2001).

5.5.1 Health Demographics

Birth rates in The Bahamas have decreased from 17.1 per 1,000 live births in 2010 to 16.7 in 2015 (PAHO, 2020). The population dynamics are changing, with a decreasing birth rate and an increasing life expectancy; the population is aging, where the age group 65 years old and older has increased 25%, while the age group 45 to 54 has increased by 32% (PAHO, 2020). The population of the Bahamas is 85% African, 12% European, 3% Asian and 3% Latin Americans (World Population Review, 2020). Life expectancy for males and females in 2016 was 73 and 79 years, respectively.
PAHO (2020) reports the gross national income per capital as US $21,570 and the gross domestic product (US $25,100), generated mainly by tourism (60%). Total expenditure on health per capita is $1,819 and as a percent of GDP (2014) is 7.7%.

Non-Latin Caribbean countries, including Jamaica, Trinidad and Tobago, Guyana, Suriname, Barbados, Curacao, Saint Lucia, Aruba, Virgin Islands (US), Saint Vincent and the Grenadines, Grenada, Antigua and Barbuda, Dominica, Saint Kitts and Nevis, Cayman Islands, Sint Maarten (Dutch), Virgin Islands (UK), Turks and Caicos Islands, Anguilla and Montserrat were used for regional comparisons of indicators (Table 5-13).

Table 5-13: Demographic Statistics Comparing the Bahamas to Non-Latin Caribbean

Statistic	New Providence (MOH, 2013)	Bahamas (PAHO, 2019)	Non-Latin Caribbean (PAHO, 2019)
Total Population (thousands)	246.1	389	7,607
Urban Population (%)	-	83	60
Life Expectancy at Birth (years) Female	76.8	76.1	76.5
Life Expectancy at Birth (years) Male	70.6	71.7	72
Life Expectancy at birth (years) total	N/A	73.9	74.2
Median age (years)	N/A	32	32
Adolescent fertility rate (births/1000 women aged 15-19)	N/A	29.2	47.1
Population less than 15 years (%) total	N/A	22	23
Population aged 65+ (%) total	N/A	7	10
Births (thousands)	N/A	5.4	114.7
Deaths (thousands)	N/A	2.7	59.2
Total fertility Rate (children/woman)	N/A	1.7	1.9
Annual Population Growth Rate	N/A	1.0	0.5

All data from PAHO (2019) or Ministry Of Health (MOH) (2013).

Live birth rates are generally decreasing over time in both New Providence and Bahamas. The total number of live births and the change from the previous year is summarized in Table 5-14 below.

Table 5-14: Live Births for New Providence and the Bahamas

Statistic	Total Live Births 2014 (% Change from Previous Year)	Total Live Births 2015 (% Change from Previous Year)	Total Live Births 2016 (% Change from Previous Year)
New Providence	3932 (7.8)	3789 (-3.6)	3635 (-4.1)
Bahamas	4682 (5.4)	4561(-2.6)	4363 (-4.3)

Information sourced from MOH, 2018a.

Adolescent birth rate is an indicator of reproductive health which is a state of physical and mental well-being (World Bank Group, 2020). If adolescent fertility rate is high, then many young women face an elevated risk of maternal death and disability. In addition, newborns and infants of adolescent mothers are at higher risk of low birth weight and mortality (Measure Evaluation, 2020). The adolescent birth rates (aged 15-19 years old) for the Bahamas are compared with that of Non-Latin Caribbean for the year 2019. The adolescent fertility rate for the Bahamas (births per 1,000 women

aged 15-19) was 29.2 compared with Non-Latin Caribbean of 47.1. For context, the 2019 adolescent fertility rate for Canada and the United States was 8.0 and 18.6, respectively (PAHO, 2019).

There were three, seven, five and zero maternal mortalities related to pregnancy or childbirth reported in the Bahamas in 2008, 2009, 2010 and 2011, respectively (MOH, 2013). Five maternal deaths were reported in 2019 in the Bahamas (PAHO, 2019). Maternal deaths in 2019 reported for the Non-Latin Caribbean were 81 (PAHO, 2019).

Stillbirth, or third trimester fetal deaths, is an indicator of reproductive health and often reflects inadequacies in antenatal care coverage or intrapartum care (WHO, 2015). Stillbirths and the percent change from the previous year are presented in Table 5-15 for New Providence and the Bahamas.

Table 5-15: Stillbirths

Statistic	Total Stillbirths 2014 (% Change from Previous Year)	Total Stillbirths 2015 (% Change from Previous Year)	Total Still births 2016 (% Change from Previous Year)
New Providence	46 (-2.1)	31 (-32.6)	51(64.5)
Bahamas	57 (-6.6)	39 (-31.6)	58(48.7)

Information sourced from MOH, 2018b.

Infant mortality (under 1 year) is an indicator of overall physical health of a community. A high infant mortality rate is generally indicative of unmet human health needs in sanitation, medical care, nutrition and education. Table 5-16 Summarizes the information available for New Providence and for the Bahamas for infant mortality.

Table 5-16: Infant (Under 1 year) Mortality

Statistic	Infant Mortality 2014 (% Change from Previous Year)	Infant Mortality 2015 (% Change from Previous Year)	Infant Mortality 2016 (% Change from Previous Year)
New Providence	88 (-10.2)	92 (-6.1)	66 (-25)
Bahamas	91 (-9.9)	94 (-6.9)	70 (-23.1)

Information sourced from MOH, 2018c.

In 2016, there were 70 infant deaths reported in the Bahamas, corresponding to an infant mortality rate (mortality/1,000 live births) of 16.0. In Non-Latin Caribbean, there were 1,651 infant deaths reported corresponding to an infant mortality rate of 17.1.

The general age adjusted mortality rate (1,000 population) of the Bahamas in 2016 was reported as 5.7, with a mortality rate for males of 7.3 and for females of 4.4. This is compared with a general age adjusted mortality rate (1,000 population) of 7.0, with a mortality rate of males of 8.4 and of females of 5.7 for the same time period for the Non-Latin Caribbean. The communicable diseases mortality

rate, noncommunicable disease mortality rate and external causes mortality rate for the Bahamas and Non-Latin Caribbean are summarized in Table 5-17 for the year 2016. Noncommunicable diseases, or chronic diseases tend to be of a long duration and are a result of a combination of genetic, physiological, environmental and behavioural factors. Examples of noncommunicable diseases include cardiovascular diseases, cancers, chronic respiratory disease (e.g., asthma) and diabetes. Noncommunicable diseases are responsible for almost 70% of deaths worldwide. The risk of noncommunicable diseases is often attributed to four major risk factors tobacco use, physical inactivity, harmful use of alcohol and unhealthy diets (WHO, 2020b).

Table 5-17: Communicable and Noncommunicable Disease and External Causes Mortality Rate for The Bahamas and non-Latin Caribbean

Statistic	Communicable Diseases Mortality Rate (100,000 pop) 2016			Noncommunicable Diseases Mortality Rate (100,000 pop) 2016			External Causes Mortality Rate (100,000 pop) 2016		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
The Bahamas	97.6	132.7	65.2	418.4	511.0	351.8	53.1	87.4	20.7
Non-Latin Caribbean	92.2	111.8	73.9	536.5	621.2	469.3	69.0	109.7	29.4

Information sourced from PAHO (2019)

The ten leading causes of death in the Bahamas (both sexes combined) in 2014 with the percent of defined cause and the rate per 100,000 persons is summarized in Table 5-18 as are the top ten leading causes based on sex.

Table 5-18: Top Ten Leading Causes of Death in Bahamas (2014), sexes combined and in male and females.

Cause of Death – Ranked	% of Defined Causes	Rate Per 100,000 persons
All Ages Both Sexes		
1. Ischemic Heart Disease	8.6	50.3
2. Hypertensive Disease	8.6	50.0
3. Cerebrovascular Disease	6.6	38.3
4. Assault (homicide)	6.0	34.7
5. Diabetes	5.1	29.5
6. HIV Disease	4.6	27.1
7. Septicaemia	2.7	15.9
8. Malignant neoplasm of female breast (C50 in women)	2.6	29.6

9. Influenza and pneumonia	2.5	14.5
10. Heart failure and complications and ill-defined heart disease	2.4	14.2
Ten Leading Causes of Death Among Males		
1. Assault (homicide)	9.9	66.2
2. Ischemic heart disease	8.9	59.4
3. Hypertensive disease	7.5	50.3
4. Cerebrovascular diseases	5.2	34.5
5. HIV Disease	4.7	31.7
6. Diabetes	4.6	30.5
7. Malignant neoplasm of the prostate	3.9	26.0
8. Land transport accidents	3.6	23.8
9. Septicaemia	2.6	17.5
10. Heart Failure and complications, ill-defined heart disease	2.5	16.4
The Ten Leading Causes of Death Among Females		
1. Hypertensive diseases	9.9	49.7
2. Ischemic heart diseases	8.3	41.8
3. Cerebrovascular diseases	8.3	41.8
4. Malignant neoplasm of female breast (C50 in women)	5.9	29.6
5. Diabetes	5.7	28.6
6. HIV Disease	4.5	22.7
7. Malignant neoplasm of uterus	3.7	18.5
8. Septicaemia	2.8	14.3
9. Influenza and pneumonia	2.6	13.2
10. Diseases of the urinary system	2.6	13.2

All information sourced from MOH, 2017.

5.5.2 Health Status and Wellness

The health care system accessibility is a useful indicator of the capacity and suitability of primary health care system. According to PAHO (2019), 3.2% of the gross domestic product (GDP) for Bahamas was spent on the health care system (public and private) in 2016, compared with 3.4 and 2.4% for the Non-Latin Caribbean for Public and Private, respectively. According to 2010 census, approximately 49% and 47.2% of the population have medical insurances in New Providence and in Bahamas as a whole, respectively. In August 2016, the parliament approved the National Health Insurance Act which will provide covered primary care benefits for all Bahamians and legal residents that are enrolled in the system. The primary care package comprises medical services, medications, and imaging and laboratory services. The public health care facilities are located on the main occupied islands and include 28 health centers, 33 main clinics, and 35 satellite clinics.

There are three public and two private hospitals which provide secondary and tertiary care in Bahamas. Of these there are two public and two private health care facilities in New Providence: the Princess Margaret Hospital (public), the Sandilands Rehabilitation Centre (public), the Doctors Hospital (private) and the Lyford Cay Medical Facility (private). The psychiatric, geriatric, and substance abuse services are provided in the Sandilands Rehabilitation Centre which is the main national provider for these services.

Table 5-19 summarizes the Ratio of Health Professionals per 10,000 Population in the Bahamas (2018) compared with Non-Latin Caribbean (2018).

Table 5-19: The Ratio of Health Professionals per 10,000 Population in Bahamas compared with Non-Latin Caribbean (2018)

Health Resource Category	Bahamas (2017)	Non-Latin Caribbean (2018)
Physicians	19.4	14.6
Dentists	2.6	1.8
Nurses	31.4	22.7

Source: PAHO, 2019

The ratios of health professionals have decreased over the years. In 2008, the ratios were 28 physicians per 10,000 population, 27 registered nurses per 10,000 and 14 clinical nurses (PAHO, 2020).

The evaluation of human resources for health care system revealed a deficiency in the distribution, skills mix, and human resource management practices. It was concluded that there is a shortage of health professionals in the public health clinics, in the Family Islands, and in some associated health professions (PAHO, 2020).

5.5.3 Health Trends and Population Groups

A summary of health situation and selected trends among several population groups are presented below (PAHO, 2020):

- Maternal and Reproductive Health: There are few maternal deaths in the Bahamas, given the low number of pregnancies. Maternal death rates varied between 0.0 to 13.1 per 1,000 live births from 2008 to 2013, with an average of 3.5 deaths per year. In 2014, 52.9% of pregnant woman received antenatal care in the first 16 weeks of gestation (PAHO, 2020).
- Child Health: Infant mortality increased from 17.6 per 1,000 live births in 2007 to 22.7 in 2013 with the leading causes of mortality being perinatal respiratory disorders, congenital pneumonia, and perinatal pulmonary hemorrhage. Factors influencing infant mortality include late antenatal care, the rate of premature delivery and multiparity. Low birth weight rates also increased from 10.9% in 2006 to 13.8% in 2014, with 66.2% of infant deaths occurring among low birthweight babies.
- Health of Adolescents: According to 2013 Global School-based Student Health Survey: 44.7% of youth aged 13 to 15 years-old were overweight while 21% were considered obese. It was reported that for the week prior to the survey, 29.6 % of youth did not participate in physical activities, 83.4% had consumed fewer than five fruits and/or vegetables; 28.6% had consumed alcohol in the month prior to the survey; 13.7% were current smokers; 15.1% had used drugs, 19.3% had thought about suicide and 13.6% had attempted suicide. Males consumed more alcohol than females, and they were more susceptible to road traffic injuries or intentional injuries. In 2011, 18.4% of deaths in males were due to injuries. In 2013, it was reported that a total of 12.6% of adolescents used tobacco, with 16.1% of males and 8.4% females (PAHO, 2019). This is compared to 14.4% for Non-Latin Caribbean with 16.6% males and 12.1% females.
- A large proportion of the population are vaccinated, and there have been no reported vaccine-preventable diseases since 2013. In 2015, 94% of the population was immunized for measles (PAHO, 2020).
- As of June 15, 2020, there were 104 confirmed cases of COVID 19, with 11 deaths and 72 recovered cases. Two cases are currently hospitalized and there are 21 active cases in the Bahamas. Of the 104 confirmed cases, 82 were from New Providence (MOH, 2020).
- Health of the Elderly: the population of people over 65 years is growing rapidly. The chronic noncommunicable disease (NCDs), social isolation and mental health disorders such as Alzheimer's and depression are common among this group. Prostate cancer results in 4.4% of deaths among males.
- Health of the Disabled: according to 2010 statistics, 2.8% of the population was disabled. The Government of Bahamas has approved legislation to protect the disabled from discrimination and ensure their right to amenities that the abled currently enjoy, such as accessible transportation, employment etc.

PREVALENCE OF COMMUNICABLE DISEASES

Vector borne diseases, such as malaria, dengue, chikungunya and Zika viruses are found within the Bahamas. In 2018, there were 10 reported cases of dengue fever in The Bahamas, compared with 2,337 in the Non-Latin Caribbean (PAHO, 2019). There were no cases of malaria reported in the

Bahamas in that same year. In 2014 the chikungunya virus was introduced to the country and up to early 2017, there were 10 cases of Zika virus infections recorded (PAHO, 2020). There are sporadic outbreaks of malaria and dengue and nationwide efforts to reduce the mosquito host populations through community cleanup campaigns and the use of mosquito adulticides continue.

The number of new cases of AIDS ranges from 329 to 105 new cases per year from 2004 to 2011 (MOH, 2013). In 2017, there were 151 new cases of HIV/AIDs reported with 60% of them being male. This corresponds to a New HIV diagnoses rate (per 100,000 of population) of 39.6 compared with a new diagnoses rate for the Non-Latin Caribbean of 51.1 (PAHO, 2019). New Providence had the highest number of diagnoses with 122 of the 151 cases, with the majority of cases (70%) being of Bahamian nationality (MOH, 2018d). Of the 151 new cases in 2017, there were 14 (9%) fatalities. There is an average of 117 deaths per year between 2008 and 2017 from HIV related deaths. Although yearly fluctuations are common, new HIV diagnoses have decreased among all demographic groups between 2008 and 2017 (MOH, 2018d).

In 2014, there were 45 new cases of tuberculosis (TB) recorded, resulting in an incidence rate of 17 cases per 100,000 population. In 2017, the incidence rate was reported at 15 compared with an incidence rate of 18.0 in Non-Latin Caribbean (PAHO, 2019). There is a relatively high prevalence of TB in the population affected by HIV/AIDS (PAHO, 2020).

Food and waterborne illnesses are a concern for public health and have prompted education systems to improve food hygiene and safety and to reduce the risk of food-borne illnesses (PAHO, 2019). Ciguatera poisoning, shigellosis, salmonellosis and gastroenteritis are all food- and waterborne illnesses that have been reported.

PREVALENCE OF NON-COMMUNICABLE DISEASES

Between 2009 and 2013, the leading causes of death from malignant neoplasms were digestive system cancers (24.9% of all cancer deaths) and breast cancer (15.2% of all cancer deaths). The breast cancer mortality rate (per 100,000 population) in 2016 was 31.5 for the Bahamas compared with 23.8 for the Non-Latin Caribbean (PAHO, 2019).

Ischemic heart disease is also prevalent in the Bahamas, with 8.7% of all deaths attributed to it between 2009 and 2013 (PAHO, 2020). Hypertension and cerebrovascular diseases also accounted for 9.1% and 6.9% of deaths, respectively, during this same time period (PAHO, 2020). Collectively, cardiovascular diseases from hypertension, cerebrovascular disease and ischemic heart disease caused about 24.7% of all deaths during 2009-2013 (PAHO, 2013). This parallels a 79.2% prevalence of overweight and obese people (PAHO, 2020). In 2013, 44.7% of children aged 13-15 were overweight and 21% were obese (PAHO, 2020).

MENTAL HEALTH AND SUBSTANCE ABUSE

In The Bahamas, 7.7% of adults are considered daily smokers, compared to 11.4% for Non-Latin Caribbean (PAHO, 2019). 17.4% of Bahamians are exposed to smoke one or more days a week in the workplace and 12.1% are exposed one or more days a week in their home (MOH, 2019).

Alcohol consumption in the Bahamas in 2018 was 4.2 L per person per year compared to 6.1 L per person per year for Non-Latin Caribbean (PAHO, 2019). In 2019, 49.6% of people in the Bahamas were considered drinkers (they drank alcohol within the last 30 days), and 17.6% were considered heavy drinkers (MOH, 2019).

Mental illness and substance abuse are a major cause of death in the Bahamas. Statistics on discharges from the Sandilands Rehabilitation Centre indicate that between the years 2010 and 2014 schizophrenia and schizotypal disorders accounted for 35%, mood affective disorders for 12.3% and drug and alcohol abuse for 27% (PAHO, 2017).

ENVIRONMENTAL FACTORS INFLUENCING HEALTH

There are streams and bodies of brackish water in The Bahamas, but no freshwater rivers. Freshwater for human consumption is obtained from monitoring wells for groundwater or by desalination. Improvements to drinking water sources and improved sanitation have occurred since 1990 to 2015, with coverage increasing from 96% to 98% for drinking water-source and from 88% to 92% for improved sanitation coverage.

The Bahamas is susceptible to tropical storms and hurricanes and frequently sustains damage to infrastructure.

Threats of deforestation and air pollution are resulting from the use of native trees as a fuel source, especially in poor neighborhoods. Poor neighborhoods also have increased risk of contamination the water supply with sanitation because of poorly installed wells and infrastructure.

More than 90% of the food is imported, and agriculture contributes very little to the food supply (PAHO, 2019). As a result, there is a high cost to food, with foods higher in sugar, salt and trans-fat being less expensive than healthier options. This could contribute to the poor diet choices and obesity of the population (PAHO, 2019).

The Bahamian population is dependent on the ocean for food, transportation, recreation and income (tourism), and therefore it is sensitive to environmental shifts. Climate change can have direct and indirect effects to health and a 1 m rise in sea level could eliminate 80% of the country's land (PAHO, 2019).

5.5.4 Local Environmental Conditions

Baseline environmental conditions were characterized in 2020 through a Pre-Construction Environmental Survey where soil, soil vapour and ambient air were characterized (Geosyntec, 2020) and through the analysis of historical ambient air quality data. A summary of the findings of the Pre-Construction Environmental Survey and historical ambient air monitoring data as they pertain to human health of workers and people in the vicinity of the site is provided herein.

The BPL site is a known brownfield site with impacts to soil and groundwater resulting from historical, current, and surrounding operations (Geosyntec 2020). An Environmental Remediation Plan has been developed in conjunction with the Ministry of Public Works and the Ministry of Environment and Housing to support the development of the Project. It is expected with the implementation of this program, that baseline environmental conditions should improve.

Environmental conditions were previously documented in the Preliminary Activities Summary Report (CH2M, 2016) where several areas of shoreline adjacent to the site were observed to have discharges of light non-aqueous phase liquid (LNAPL). Measured thickness of LNAPL on site ranged from 0.11 to 94.70 feet with a chemical fingerprint analysis resembling fuels used on the BPL site or a mixture of those fuels that have undergone various degrees of weathering (CH2M, 2016). The data suggest the mixing of multiple fuel types over multiple release events (CH2M, 2016).

Surficial soil, shallow soil and deep soil sampling were completed across the site. Geosyntec (2020) compared soil quality results to Florida Department of Environmental Protection (FLDEP) Direct Contact for Industrial (DCI) standards from Chapter 62-777 Contaminant Cleanup Target Levels (Florida Department of State, 2010) in the absence of Bahamian soil guidelines or standards. Arsenic exceeded the applicable standards in one surficial soil (concentration of 32 mg/kg) and one shallow soil sample (concentration of 13 mg/kg). All other parameters tested met the applicable standards. It should be noted that Geosyntec did not sample soil for petroleum hydrocarbons (PHC) and the sampling methodology used for volatile organic compounds (VOCs) may have resulted in an underestimation of VOC concentrations. Visible PHC impacts in soil have been observed by Arcadis, SEV and others across the site. Based on the arsenic impacts and the visible PHC impacts, baseline soil conditions could result in adverse health effects to human receptors at the site.

Soil vapour was sampled by Geosyntec (2020) on March 18 and 19, 2020 at four soil boring locations. At three locations, soil vapour was sampled using a soil vapour probe and the fourth location was sampled from the headspace of a monitoring well where LNAPL was observed. Analytical results were compared with the United States Environmental Protection Agency (USEPA) Vapour Intrusion Screening Levels (VISLs) for near-source soil gas with a non-residential exposure scenario. Based on the sampling results, the following parameters were detected in soil vapour above the applicable screening levels in one or more locations: 1,1-dichloroethane, 1,2,4-trimethylbenzene, benzene, bromodichloromethane, ethylbenzene, vinyl chloride, xylene(s), and naphthalene. Given the limited sampling locations (four) and the magnitude of impacts observed, it is likely that vapour intrusion of these volatile parameters would be a concern at the site given baseline conditions. Consideration for existing and proposed buildings for vapour intrusion should be given at the site. It should be noted that PHCs were not analyzed for in soil vapour, despite the wide-spread impacts observed.

Based on the soil vapour concentrations, any subsurface work that is to be completed on the site in a trench where air exchanges may be reduced relative to ambient air, a worker health and safety plan should be implemented to protect workers from vapour accumulation in confined spaces.

The recommended methodology to characterize baseline air quality was through the use of historical ambient air quality monitoring data. There are three continuous air quality monitoring stations, historically operated by Golder Associates on behalf of the Bahamas Electricity Corporation, at Clifton Pier, Lyford Cay and Blue Hills. Data from Clifton Pier and Lyford Cay are located within close proximity to the site and therefore could be used to assess baseline conditions. Data is only available from 2000 to 2006 and 2011 to 2013 for SO_2, NO_2 and PM_{10}.

As per the TOR, comparison of the air quality monitoring data to internationally recognized standards (WHO Air Quality Guidelines) (WHO, 2005) and the US EPA National Ambient Air Quality Standards (NAAQS) (US EPA, 2016b) was completed to assess baseline conditions. The baseline air quality data were below the US EPA NAAQS for all measured parameters (NO_2, SO_2, and PM_{10}). The WHO presents interim targets, which are proposed as incremental steps to the reduction of air pollution to achieve the air quality guideline. The Interim Target-2 guideline for SO_2 is an intermediate goal based on controlling emissions from motor vehicles, industrial emissions and/or power production. The Interim Guideline Target 3 (24-hour mean) represents about a 1.2% increase in short-term mortality over the ambient quality guideline. The baseline data exceeded the WHO guideline and Interim Target-2 guideline for 24-hour SO_2 and exceeded the 1-year averaging WHO guideline for PM10, and exceeded the WHO Interim Guideline Target 3 and the WHO Guideline for 24-hour PM10 exposure.

Geosyntec also completed limited air quality monitoring during the Pre-Construction Environmental Survey (2020). They compared the air concentrations a construction worker would be exposed to, to minimal risk levels (MRLs) from the Agency for Toxic Substances and Disease Registry (ATSDR) for acute and sub-chronic exposures, where available and where not available they compared with California Division of Occupational Safety and Health (Cal/OSHA) 8-hour Time Weighted Average (TWA) Permissible Effect Levels (PEL). Parameters were not compared with chronic MRLs which would represent an operational worker's exposure during the operation phase of the proposed project or with ambient air quality guidelines developed by other jurisdictions. Based on Geosyntec's assessment of the single grab sample, the following was noted:

- Cadmium was detected at a concentration greater than the acute MRL;
- Toluene was detected at a concentration less than the acute MRL; and
- Trichloroethylene was detected at a concentration greater than the intermediate MRL.
- Barium, copper, benzene, chlorobenzene, methyl ethyl ketone, and xylenes were detected but are without MRLs derived (except for benzene, as discussed further below), these were compared with the Cal/OSHA PELs and were all below the PEL limits.
- Benzene was erroneously reported to not have MRLs derived, when in fact ATSDR does have acute, sub-chronic and chronic MRLs for benzene. The concentrations detected in ambient air at the site exceeded the three available benzene ATSDR MRLs.

Chronic MRLs were not considered by Geosyntec in their assessment, however, chronic MRLs would be appropriate for comparison to for workers and local residents (within a 1-mile radius of the site) during the operation phase of the proposed project. Chronic toxicity endpoints are more sensitive

than acute, therefore given that air concentrations at the site are in excess of acute MRLs for some parameters, then chronic health effects would also be expected.

PM10 values were measured continuously by Geosyntec (2020) and the ranges of PM10 detections at each sampling location were provided. Comparison of data to ambient air quality standards for 24 hour or annual averaging periods were not performed and the baseline data was not interpreted by Geosyntec (2020). Based on the historical ambient air quality data from Clifton Pier and Lyford Cay, PM10 values at baseline are predicted to be above the 24-hour and annual ambient air quality guidelines derived by WHO (WHO, 2005).

Based on the limited data available, it appears that there are some baseline air quality issues, namely chemical impacts, vapour and PM, present at the site and surrounding area prior to the commencement of the project that could impact human health. Measures to improve air quality at the site should be integral to the design and operation of the proposed project to protect the health of all at the site and in the vicinity of the site. It is also recommended that additional air monitoring be completed to gain a more comprehensive understanding of typical air quality conditions at the Site.

Baseline noise in the area of the Project site is characterized by onshore and offshore industrial activities, ocean waves and light to moderate roadway traffic. Three noise sensitive receptors (NSR) were selected to represent characterize the potential impacts of noise resulting from the Project. These NSR are described in Section 5.1.5 Noise Pollution of the report. Baseline noise measurements were not available for these receptors.

5.6 Use of Services

5.6.1 Emergency services (fire, police, medical)

Emergency services available on the island of New Providence are outlined below.

Emergency Agencies

Fire Department	911
Ambulance Department	919
Police Department	911

Administrative Agencies (which may also need to be contacted for emergencies)

Bahamas Power and Light	302-1000 or 323-5561 thru 4
DEPP	322-4546
DEHS	322-8037 or 322-2295
Department of Meteorology	356-3734 or 356-3736
Hurricane Forecast Section	377-7178 or 377-7040
Royal Bahamas Police Force	919 or 911
Water and Sewerage Corporation	302-5599

Medical Services

Lyford Cay Hospital (closest to project site)	362-4400
Princess Margaret Hospital	322-2861
Doctor's Hospital	302-4600

5.6.2 Potable water

The Clifton Pier Power Station (CPPS) is an industrial property complex, located in the Western District of New Providence, on the Southwest Road. Operational electrical production and fuel storage facilities presently exist at the CPPS site.

The surrounding groundwater environment / water resources within the general vicinity of the CPPS have been compromised by previous fuel/oil spills. Alternative potable water supplies are present at the project site.

A total of two (2) potable water companies operate in the general vicinity of the CPPS site - Water & Sewerage Corporation (WSC) and New Providence Development Company (NPDCo).

WSC has a 16-inch (406.4-mm) ductile iron water main along the northside of the Southwest Road that presently provides a metered water service to the CPPS site. This main should be approximately 15 ft (4.57 m) above the groundwater lens, but also equipped with necessary oil/fuel resistant gaskets at each length of pipe connection, to prevent possible intake of contaminants into the potable supply.

Figure 5-15: CPPS Potable Water Connection
(at Stations A/B/C)

5.6.3 Sewerage and wastewater

At present, there is not a centralized sewer or wastewater collection system in the proximity of the CPPS site.

All sewerage and wastewater collection is per the Ministry of Works (MOW) approved septic tank typical requirements with recommended oil-water separation prior to the septic tanks (per MOW standard).

5.6.4 Electricity

BPL will be the provider of electricity to enable operation of the new Station D power plant. Expected electricity needs of the plant are 1.6 MW.

5.6.5 Roads

The Southwest Road is the only access road to the Station D power plant site. It is a public road and traffic flow is not expected to be interrupted for any period during construction of the plant.

6.0 ENVIRONMENTAL, SOCIAL AND HEALTH IMPACTS

6.1 Methodology for the Impact Assessment

6.1.1 Screening and scoping process to identify and assess potential impacts

The screening and scoping process for identifying and assessing potential impacts was completed using a number of tools:

- Field visits to the project site and neighbouring areas to determine existing conditions with respect to physical, biological and social features;
- Review of existing data and reports, including past reports of the area provided by BPL (a list of these reports is provided in Appendix G);
- Stakeholder consultations on the draft EIA to document any concerns of neighbouring residents, organizations and businesses; and
- Modeling using baseline air quality data to determine potential air quality impacts.

6.1.2 Impact identification and assessment methodology

The severity of an environmental impact is a measure of the magnitude of impact an event has on the environment. Severity is measured by such factors as toxicity to humans, the negative effect on flora and fauna, impact on wildlife habitat, the reduction of natural resources, contamination of air and water, the potential for reversible versus irreversible environmental damage, and short-term versus long-term recovery of the environment. Other factors such as noise, heat, odour, and visuals are also used to determine severity.

Severity is given a numerical rating of 1 for low impact, 3 for medium impact and 5 for high impact:

1. Low Impact (score 1) - There is little or no impact on the environment.
2. Medium Impact (score 3) - There is impact on the environment that falls within regulatory guidelines. The impact is considered short-term and reversible.
3. High Impact (score 5) – There is high and lasting impact on the environment.

6.1.3 Identification and assessment of potential impacts

Table 6-1 below summarizes the environmental impacts that can result from the BPL power plant project.

The most significant environmental impacts from the project are related to avifauna, invasive species, occupational health and safety, and human health (see Table 1-1).

Table 6-1: Summary of Environmental Impacts

	Severity of Impact	**Environmental Impacts**
Materials	3	Construction materials can potentially be toxic or hazardous to the environment and human health if not managed properly.

		Removal of old equipment from the project site can also be potentially hazardous to the environment and human health if not safely handled or disposed of properly.
Air quality and dust	3	From the air quality modeling, the use of HFO shows the highest impacts with all the assessed contaminants above the applicable thresholds. However, with the transition to LNG, NOx and the PM are the only two contaminants exceeding the applicable thresholds. It should also be noted that the emissions from Station A are the primary contributor to the predicted maximum impacts as seen in the modelling analysis. Illegal construction activities, such as burning of waste, can negatively impact air quality. Poorly maintained construction equipment can also impair air quality, such as diesel fumes emissions. Construction activities can generate significant quantities of dust that impair air quality and negatively impact human health if proper management techniques are not employed.
Waste management	3	Wooden spools, plastic and metal packaging on and around the property in various states of decomposition may cause hazards to wildlife and harbor pests. Plastic and metal debris pose choking, strangulation and entrapment hazards for wildlife. These are easily mitigated, but also require long term management strategies.
Landscape and visual	1	There are very few trees on the project site and most of them are invasive as the site is already being used for industrial activities. The landscape impact is therefore expected to be minimal in terms of removal of trees. There is potential for damage to trees along the transport route for equipment during construction from Arawak Cay Port to CPPS if trees are not properly trimmed. The visual impact from construction activities is expected to be minor and short-term.

Water resources	1	While the groundwater resources at the project site have already been impacted by past activities at the site, the current project is not expected to impact groundwater resources.
Ecology	1	Introduction of infrastructure and associated waste will also encourage pest species, like rats, which can damage local ecosystems.
Avifauna	5	Fumes, dust and noise from development and operations activities will disrupt bird behavior beyond the physical boundaries of the site. The onsite avifauna diversity impacts are permanent.
Invasive species	5	The site harbors invasive plants, birds and rodents. When allowed to proliferate within the site, they then spread to surrounding natural areas, damaging the ecosystems and killing native wildlife.
Traffic and transport	3	Southwest Road is the only road that provides access to Clifton Pier. It is a two-lane public road that is used by essentially all types of vehicles. Heavy equipment entering and exiting the site during construction and the transport of wastes through nearby communities will likely impact traffic along Southwest Road.
Contaminated land	3	During remediation of the site and construction, there is the potential to contaminate land from improper handling and disposal of hazardous materials or waste. There is also potential for contamination during transport of fuel (ADO and HFO) to the power station if there is a breach of the pipeline during operation.
Human health		Please see tables 6-12 and 6-13 for summary of all health impacts
Occupational health and safety	5	Workers can be put at risk during construction phase through failure to wear protective personal equipment (PPE), improper handling of equipment and materials, and not adhering to standard safety procedures. These failures can result in loss of life or permanent physical damage. COVID-19 virus poses a health risk to workers if they are in close proximity to each other.

Impacts on neighboring communities	3	This project will have short- to long-term impacts on neighbouring communities. These are related to the construction activities and day-to-day operations once construction is complete and may include disruption of traffic, increased noise levels, impairment of air quality, and contamination of land and groundwater. Depending on the severity of impacts, such as noise, air pollution and groundwater contamination, health of residents can be impacted over the long term.

6.1.4 Public/community participation in any activities conducted to determine impacts

Due to COVID-19 Emergency Orders, the usual methods of public participation in the impact assessment process had to be modified. Three virtual meetings were held to enable stakeholders from the groupings outlined below to learn about the proposed project design, identified impacts and proposed mitigation measures:

1. Government agencies
2. Environmental non-Governmental organizations
3. The general public

During the virtual meetings, the presentation at Appendix H was given for 20 minutes and stakeholders were given 40 minutes to ask questions and provide comments. A summary of their concerns is provided below. These concerns have been addressed in the sections on impacts as well as mitigation measures. For example, the risk of spills at different phases in fuel transport to Station D have been noted and appropriate mitigation measures identified.

Table 6-2: Summary of stakeholder comments

Grouping	**Comments**
Government agencies	Questions and comments related to: • Ensuring project design does not prevent road widening in the future. • Prevention of unnecessary tree clearing or any damage during transport of equipment between Arawak Cay and CPPS during construction; recommendations included using a skilled arborist. • Options for minimizing traffic impacts. • Surface drainage design.
Environmental NGOs	Questions and comments related to: • Ensuring seasonality of bird population was considered. • Consideration for carbon offsetting.

	• Addressing potential for contaminated runoff into the marine environment. • Partnering with local environmental NGOs and National Oil Spill Committee on water quality monitoring and public education on energy sources and uses. • Increasing penetration of renewable energy in New Providence. • Concerns about continued use of fossil fuels for energy generation in New Providence. • Ensuring impacts are considered for all aspects of fuel transport to CPPS. • Consideration for hurricane impacts to avoid resulting environmental damage if plant is hit.
General public	Questions and comments related to: • Funding for construction of Station D (e.g. Rate Reduction Bond). • Costs associated with construction of Station D. • Design of Station D and related efficiency and output of the plant. • Status of negotiations with Shell North America. • Status of remediation at CPPS.

6.2 Impacts to the Physical Environment

6.2.1 Erosion, sedimentation impacts

While the project is not expected to cause erosion on the Station D site, there is the potential for minimal sedimentation with construction activities that generate dust. Construction will be occurring directly across from the shoreline and therefore, the risk of sedimentation exists.

6.2.2 Hydrologic impacts

At the CPPS, there are no specific natural surface water concerns, but natural drainage and surface runoffs are concerns to be addressed. Regarding potential flooding at CPPS: the site is elevated, so flooding is not particularly a concern.

The present high-flow discharges from the CPPS cooling water system at Stations A/B/C to the marine resources is a concern, with an associated impact of moderate to major over the long term. Heated water flowing into the marine environment can negatively impact seagrasses and corals which are temperature-sensitive. There are small coral heads offshore of CPPS, mainly mustard hill corals (*Porites astreoides*).

The seasonal exposure of the project's construction activities is a concern. It is encouraged that all efforts to minimize or mitigate the anticipated effects of storm surge be explored. Typical

construction protective measures shall be required to minimize any potential upland flows at CPPS, toward the coastal and marine environment. The effects of storm surge to the projects activities at Station D are considered minor to moderate in the short term - pertaining to groundwater, water resources, hydrology, and water quality.

6.2.3 Water quality impacts

The current impact to the water quality at CPPS is moderate to major over the long term if no remediation of contamination occurs. The proposed project is not expected to have any direct negative impacts to groundwater, but construction and operation can result in movement of the contamination plume already on the site.

The proposed 'BPL Groundwater Treatment System Project' along with monthly water quality checks (preliminary for hydrocarbon) must commence prior to the proposed construction of Station D. Water quality checks done prior to construction will establish the baseline for the site and enable confirmation that treatment is working.

6.2.4 Air quality impacts

The objective of the air quality impact assessment is to conservatively predict the highest levels of criteria air contaminants (CACs), namely Nitrogen Oxides (NOx), Sulphur Dioxide (SO2) and Particulate Matter (PM) that are likely to result from the proposed LNG terminal operations at the CPPS. These CACs are common pollutants released into the air by activities such as the combustion of fossil fuels. As the proposed Station D will initially be powered by heavy fuel oil (HFO) during the construction of the proposed LNG terminal and regasification facilities and then powered by liquefied natural gas (LNG) replacing the HFO as the primary fuel, there are two operating scenarios to consider for this air quality impact assessment.

In order to estimate total potential air quality impacts of the proposed LNG terminal and to demonstrate (evaluate) compliance of the proposed project with ambient air quality standards background air quality levels values must be added to modelled pollutant concentrations to obtain cumulative impacts, which then compared to applicable air quality criteria and guideline. It should be noted that background air quality (or "baseline" levels) accounts for pollutant concentrations that are not associated with any of the sources explicitly included in the modeling analysis for the proposed project. Existing air quality in the area surrounding the CPPS, is a combination of emissions from sources in the area (other industrial operations and traffic) plus a component that flows into the area from other areas within and surrounding the island.

As noted above, when a modelling assessment is completed these other "background" sources must be accounted for in order to get an accurate representation of the air quality after the proposed LNG terminal and power stations are in operation. Hence, the historical background concentrations for NOx, SO2 and PM10 were added to model-predicted concentrations to capture the upwind portions of background.

Consequently, the concentrations presented in this report include potential effects from the background emission sources surrounding the CPPS as well as other upwind sources.

The potential impact of the emissions on air quality in the vicinity of the operation was evaluated using dispersion modelling using a variable spaced receptor grid to determine maximum predicted ambient air concentrations of NOx, SO2 and inhalable particulate matter (PM_{10}), and respirable particulate matter ($PM_{2.5}$). The receptor grid covered the western half of the Nassau island out to an extent of approximately 13 kilometers out from the CPPS.

As part of the predictive modelling of the pollutant concentrations, detailed background reviews were conducted of the CPPS operations, layout both in the interim and in the long run, equipment manufacturer's specification data of the existing and proposed Wartsila engines, associated emission statements and finally, the stack parameters. Emission inventories were created for NOx, SO2 and PM10/PM2.5 emissions for both operating scenarios i.e. in the interim with HFO as the primary fuel and LNG as the replacement fuel expected to be used for the long-term operations at CPPS.

The U.S. EPA AERMOD (v19191) regulatory air dispersion model was used with the projected emissions to predict ambient concentrations in the area surrounding the CPPS. AERMOD is a steady-state plume model that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, including treatment of both surface and elevated sources, and both simple and complex terrain. It is a highly capable modelling system, preferred by the international regulators for modelling emissions originating from various simple to complex operations including power plants similar to this project. There are two (2) input data processors that are regulatory components of the AERMOD modeling system: AERMET, a meteorological data preprocessor that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, and AERMAP, a terrain data preprocessor that incorporates complex terrain.

(a) Meteorology

The AERMOD model accepts hourly meteorological data records to define the conditions for plume rise, transport and dispersion. The model estimates the concentration or deposition value for each source-receptor combination, for each hour of input meteorology, and calculates short-term averages, such as one-hour, eight-hour and 24-hour averages. The hourly averages can also be combined into longer averages (1-month, seasonal, annual or period).

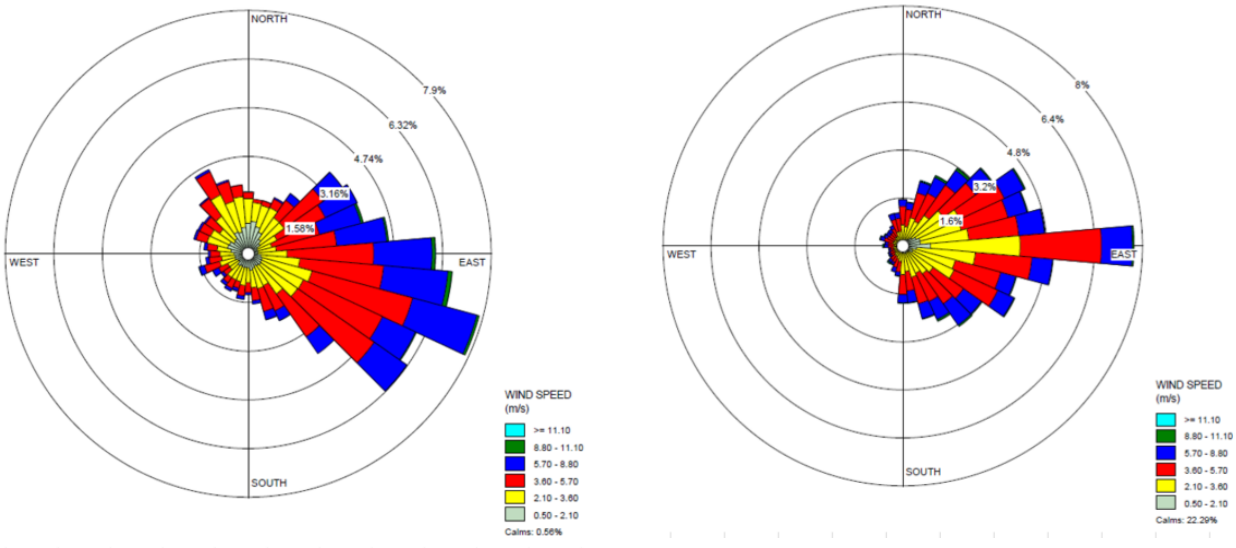
A review of available meteorological data was conducted. Data from nearby Nassau International Airport (Lynden Pindling Airport) was found to have large data gaps and thus did not meet completeness requirements to be considered as acceptable meteorological dataset for AERMOD. A wind rose was developed from the available data and used to determine an alternate data source. Therefore in this assessment, AERMOD was run using five (5) years of meteorological data set from 2015 to 2019 (obtained from https://floridadep.gov/air/air-business-planning/content/aermet-datasets-map) for three (3) alternative meteorological stations - Miami, Florida Keys-Marathon, and Key West that showed prevailing wind representative of the northern Caribbean area. All the three data set were measured at ASOS sites and preprocessed using AERMET v19191 by Florida DEP. After

reviewing the initial predicted impacts over the range of applicable pollutant's averaging periods, the Miami meteorological dataset resulted in the most conservative impacts for most averaging periods and therefore was chosen for the analysis.

Wind is the primary driver that carries air pollutants away from a source towards a receptor. The direction and speed of the wind dictates the location and distance from the source that a pollutant may travel, and the receptors that may be impacted. Higher wind speeds disperse gases and particulates throughout the atmosphere more effectively and as a result, concentrations generally decrease with increasing wind speed due to dilution. On the contrary, low wind speeds or no winds can lead to very high pollutant concentrations at ground level. Wind speed also induces mechanical turbulence (which affects dispersion) as a result of flows around obstacles on the surface (topography, buildings, etc.). The amount of mechanical turbulence created depends on the roughness of the surface and the wind speed.

Figure 6-1 presents the wind rose from Miami, Florida and Nassau that show the frequency of the direction that winds blow from for the 5 years of hourly meteorological data used in this assessment. It shows the predominant wind directions are from the southeast to northwest

Figure 6-1: Miami (L) and Nassau (R) Wind Roses 2015-2019



(b) Modelling Terrain

The AERMOD model can utilize terrain information through applying elevation heights to all receptors and sources. National Elevation Dataset (NED), Digital Elevation Model (DEM) or equivalent terrain datasets were not readily available for the island for preprocessing using AERMAP. Due to lack of a consistent dataset and given the fact that topographically, the island predominantly exhibits a flat terrain, it has been assumed that the terrain for the modelling is also flat. This information was also verified using a survey plan prepared for the proposed CPPS, by Donald E. Thompson & Associates, dated August 5, 2019.

(c) Receptor Grid

The AERMOD model calculates predicted ambient concentrations at a series of receptors set up in the model inputs. A variable spaced grid with grid spacing increasing with distance from CPPS was used in the assessment as generally adopted in the industry. The grid spacing from CPPS is as follows:

- Fenceline receptors were set at 25-meter spacing interval;
- Fine grid receptors were placed at 25-meter spaced interval out to approximately 300 meters from the proposed Station D stack;
- 100-meter spaced receptor interval to cover southwest tip of the island (Please note: distance varies due to the geographical setting of the coastline: 1,200 m to the east, 1,800 m to the north and 1,600 m to the northwest);
- 250-meter spaced receptor interval (varies) extends out to approximately 3,500 meters to east and approximately 3000 meters to the north; and
- 500-meter spaced receptor interval out to approximately 13 km to the east of the CPPS.

All of the variable spaced receptors that fell within the Station D proposed property boundary and overwater were removed from the grid. Figure 6-2 presents the receptors used in the modeling analysis.

Figure 6-2: Air Dispersion Modelling Receptors

(d) EMISSION ESTIMATIONS

In order to be conservative, a maximum emission scenario was developed to capture expected worst-case maximum daily CAC emissions from the proposed Station D power plant and existing Station A. Emissions rates were estimated in a combination using data contained in emission statements provided by Warstila, the engine manufacturer and published emission factor values provided in US EPA AP-42 (Compilation of Air Emission Factors). The modelling assumed that CPPS operates all six (6) engines in Station D and all seven (7) engines in Station A for 24 hours per day, 365 days a year simultaneously. These assumptions highlight the conservative nature of the assessment, as the power plant is unlikely to experience maximum levels of operation on a continuous basis. It was assumed that the provided potential short-term emission rates for NO2/NOx were in term of NOx. Therefore, the ambient ratio method (ARM2) option to convert NOX to NO2 was chosen in AERMOD.

(e) MODELLING RESULTS

A total of sixteen (16) air dispersion modelling runs were conducted to predict maximum 1-hour, 24-hour and annual ground-level concentrations at gridded receptor locations – eight (8) runs for HFO Scenario and the remaining eight (8) runs for LNG Scenario. Results are presented graphically as concentration isopleths over entire modelling domain and in tabular format at nearby model receptors presented in figures below. It should be noted that for the 24-hour average concentrations, these are the maximum modelled concentrations that occur only once in the 5 years (1,825 days) of meteorological data used. For the tabular results, all point of impingement (POI) values that are over the applicable criteria are shown in bolded text.

Table 6-3 shows the modelling results for the long-term LNG scenario, where both the Station A & D are operating simultaneously using LNG as the primary fuel

Table 6-3: Modelling results for long-term LNG scenario

Pollutant	Averaging Period	Meteolorogical Dataset Year(s)	AAQS ug/m^3	Combined Station D and A		
				Impact ug/m^3	UTM Coordinates Easting	UTM Coordinates Northing
NO_2	**1-hr**[2]	2015-2019	200	**1862**	243,412.5	2,767,888
	Annual[1]	2018	40	**41.8**	243,150.0	2,767,950
SO_2	1-hr	2015-2019	196	**2805**	243,412.5	2,767,888
	Annual	2018	20	**58.2**	243,150.0	2,767,950
PM_{10}	24-hr	2015-2019	50	**86.8**	243,262.5	2,767,888
	Annual	2018	20	4.41	243,150.0	2,767,950
$PM_{2.5}$	24-hr	2015-2019	25	**35.1**	243,312.5	2,767,888
	Annual	2018	10	3.98	243,150.0	2,768,150

Figure 6-3 shows a concentration isopleth for NOx based on the maximum modelled concentration for HFO scenario that occurs once in the 5 years of meteorological data used in the model.

Figure 6-3: Concentration isopleth for NOx (HFO scenario)

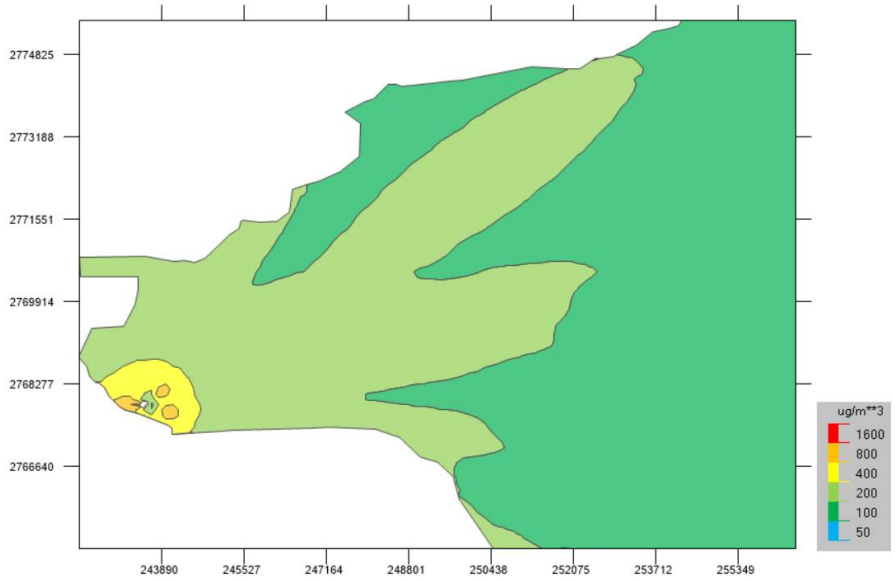


Table 6-4 shows the modelling results for the anticipated long-term LNG operational scenario, where both the Station A & D are operating simultaneously using LNG as the primary fuel

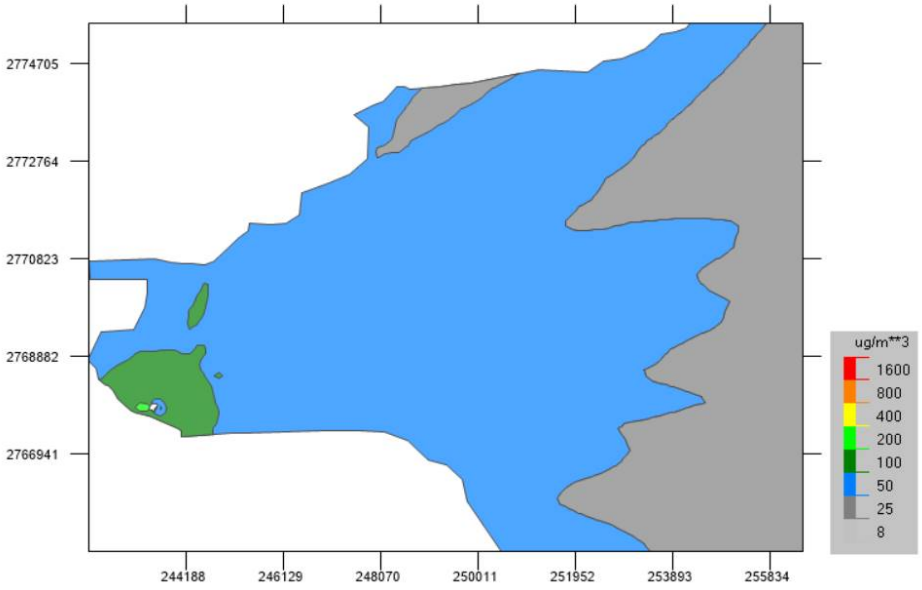
Table 6-4: Modelling results for long-term LNG operational scenario

Pollutant	Averaging Period	Meteorological Dataset Years	AAQS	Combined Station D and A		
				Impact	UTM Coordinates	UTM Coordinates
NO_2	1-hr	2015-2019	200	**310.5**	243,412.5	2,767,888
	Annual[1]	2018	40	11.2	243,150.0	2,768,050
SO_2	1-hr	2015-2019	196	0.48	243,412.5	2,767,888
	Annual	2018	20	0.01	243,150.0	2,767,950

PM_{10}	24-hr	2015-2019	50	2.19	243,387.5	2,767,888
	Annual	2018	20	0.169	243,150.0	2,767,950
$PM_{2.5}$	24-hr	2015-2019	25	2.19	243,387.5	2,767,888
	Annual	2018	10	0.152	243,150.0	2,768,150

To demonstrate the spatial distribution maximum concentrations, several isopleths were prepared. Figure 6-4 for NOx shows isopleths based on the maximum modelled concentrations for LNG scenario that occurs once in the 5 years of meteorological data used in the model.

Figure 6-4: Concentration isopleth for NOx (LNG scenario)



(f) Background Air Quality Conditions

The existing background air quality conditions in the study area can be characterized generally with historical air quality monitoring data. As stated in Section 5.1.4, there are no established ambient air quality monitoring stations to collect data on pollutants levels on New Providence Island (or elsewhere in The Bahamas) that might be used to estimate the current existing air quality. An ambient air quality network was historically operated by Golder Associates (on behalf of Bahamas Electricity Corporation) which comprised of three continuous monitoring stations. The three monitoring stations were located at Clifton Pier, Lyford Cay and Blue Hills. Stations that are or were located geographically close to the proposed project site in recent years and that are or were reasonably representative of the project site were selected and utilized to determine existing air quality conditions.

Of the three stations, Clifton Pier air quality monitoring station is used for the assessment of the air quality impacts. Ambient air monitoring data from the station are only available for certain time periods (from 2000 to 2006 and from 2011 to 2013) and for certain contaminants of interest such as SO2, NO2 and PM10. The two tables, Table 5-6 and Table 5-7 presented in Section 5.1.4 of the EIA provide a summary of air quality monitoring data for the three contaminants. The following table provides a summary of the background data that will be added to the maximum modelled concentration for the credible worst-case analysis. The concentrations shown in Table 6-5 were derived from an average calculated for each of the various contaminants based on the 10 years of data available.

Table 6-5: Summary of Ambient Air Measurements

Contaminant	Averaging Period	Adopted Background Value	AAQS	% of AAQS
NO2	1-hour	86.9	200	43%
	Annual	5.7	40	14%
SO2	1-hour	185.9	196	95%
	Annual	3.2	20	16%
PM10	24-hour	64	50	128%
	Annual	23	20	115%

(g) Assessment of Credible Worst-Case Analysis

Table 6-6 summarizes the maximum concentrations (maximum modelled concentration plus the maximum 1-hour or 24 hour or annual average background concentration) at the most impacted receptor for the HFO scenario.

Table 6-6: Summary of Credible Worst-Case Analysis for HFO Scenario

Pollutant	Averaging Period	Background Concentration ug/m³	Modelled Impact ug/m³	Combined Station A and D			AAQS ug/m³	% of AAQS
				Cumulative Impact ug/m³	UTM Coordinates Easting	UTM Coordinates Northing		
NO_2	1-hr	86.9	**1862**	**1949.2**	243,412.50	2,767,888	200	974.60
	Annual[1]	5.7	**42**	**47.46**	243,150.00	2,768,050	40	118.65
SO_2	1-hr	185.9	**2805**	**2990.5**	243,412.50	2,767,888	196	1525.77
	Annual	3.2	**58**	**61.43**	243,150.00	2,767,950	20	307.15
PM_{10}	24-hr	64	**87**	**150.78**	243,387.50	2,767,888	50	301.56
	Annual	23	**4**	**27.41**	243,150.00	2,767,950	20	137.05
$PM_{2.5}$	24-hr	N/A(1)	**35**	N/A	243,387.50	2,767,888	25	N/A
	Annual	N/A(1)	**4**	N/A	243,150.00	2,768,150	10	N/A

Note: 1) There were no PM2.5 background monitoring data available for the area, hence a comprehensive assessment could not be completed as part of the AQIA.

Similarly, Table 6-7 summarizes the maximum concentrations (maximum modelled concentration plus the maximum 1-hour or 24 hour or annual average background concentration) at the most impacted receptor for the LNG scenario.

Table 6-7: Summary of Credible Worst-Case Analysis for LNG Scenario

Pollutant	Averaging Period	Background Concentration Year(s)	Modelled Impact ug/m³	Combined Station D and A			AAQS ug/m³	% of AAQS
				Cumulative Impact ug/m³	UTM Coordinates Easting	UTM Coordinates Northing		
NO_2	1-hr	86.9	**310.5**	**397.4**	243,412.50	2,767,888	200	198.70
	Annual[1]	5.7	11.2	16.9	243,150.00	2,768,050	40	42.25
SO_2	1-hr	185.9	0.48	186.38	243,412.50	2,767,888	196	95.09
	Annual	3.2	0.01	3.21	243,150.00	2,767,950	20	16.05
PM_{10}	24-hr	64	2.19	**66.19**	243,387.50	2,767,888	50	132.38
	Annual	23	0.169	**23.169**	243,150.00	2,767,950	20	115.85
$PM_{2.5}$	24-hr	N/A(1)	2.19	N/A	243,387.50	2,767,888	25	N/A
	Annual	N/A(1)	0.152	N/A	243,150.00	2,768,150	10	N/A

Note: 1) There were no PM2.5 background monitoring data available for the area, hence a comprehensive assessment could not be completed as part of the AQIA.

Table 6-8 presented below shows the relative change in cumulative impacts between the two scenarios from interim HFO to long-term LNG.

Table 6-8: Relative Change in the Worst-Case Concentrations between Scenarios

	Averaging Period	Cumulative Impact for HFO Scenario ug/m³	Cumulative Impact for LNG Scenario ug/m³	% Change of Long-Term LNG Scenario Relative to Interim HFO Scenario
NO_2	1-hr	1949.2	397.40	-79.61%
	Annual[1]	47.46	16.90	-64.39%
SO_2	1-hr	2990.5	186.38	-93.77%
	Annual	61.43	3.21	-94.77%

	Averaging Period	Cumulative Impact for HFO Scenario ug/m³	Cumulative Impact for LNG Scenario ug/m³	% Change of Long-Term LNG Scenario Relative to Interim HFO Scenario
PM_{10}	24-hr	150.78	66.19	-56.10%
	Annual	27.41	23.17	-15.47%
$PM_{2.5}$	24-hr	N/A	N/A	N/A
	Annual	N/A	N/A	N/A

In the above-noted tables, Tables 6-6 and 6-7 show the predicted maximum concentrations for both the HFO and LNG scenarios.

Of the two scenarios, the HFO scenario shows the highest impacts with all the assessed contaminants above the applicable thresholds. However, with the LNG scenario, NOx and the PM are the only two contaminants exceeding the applicable thresholds. It should also be noted that the emissions from Station A are the primary contributor to the predicted maximum impacts as seen in the modelling analysis.

It should be noted that the historical background concentrations (prior to 2014) for PM were already above the threshold without any additional contribution from the modelled impacts. For NOx, the maximum predicted concentrations from the modelling showed significant contributions above the applicable threshold primarily due to the existing Station A.

However, it should be noted that when relative comparisons are made between the two scenarios, a significant reduction in the predicted emissions levels are noted for all the contaminants. Table 6-8 shows that all pollutants are predicted to decrease between the interim HFO scenario and the long-term operation on strictly LNG as the primary fuel. This is due to expected use of LNG, which is a cleaner fuel and expected to combust more efficiently than HFO resulting into lower emissions overall.

The fact that the CPPS is located with an industrial complex, there are significant other operations surrounding the proposed operations that has significant contributions to the background air quality in the area. The ambient concentrations for NOx, SO2 and PM10 (1-hour maximum averaged) were already approaching to the applicable threshold levels, ranging from 43% to 128% of the applicable thresholds.

(h) Conclusion

For all the assessed contaminants, the interim use of HFO at the proposed operations will have the most direct impact on air quality in the area. However, with the switch out to the planned use of LNG in the long run from HFO, once the LNG terminal and regasification plant is commissioned, the burden on the air quality will significantly decrease.

The temporary emissions associated with the construction of the proposed project were not predicted, due to the unpredictable nature of the construction activities. For an in-depth analysis, a detailed description, types and planned duration of construction activities and equipment inventory (including equipment specifications and fuel type) need to be further reviewed. Any modeling to represent construction activities will require extensive emission development and include any proposed best management practices to minimize emissions during the construction period. It is recommended that construction-related emissions be handled by development of a management plan and implementation of best management practices to minimize exhaust emission are well as wind-blown dust, in order to minimize the emissions to the best extent that can reasonably be achieved.

6.2.5 Climate change including the potential project impact on the national development goals (30% reduction of GHG by 2030)

The impact of climate change to the water resources is moderate to major over the long term. Climate change includes the potential project impact on the national development goals as outlined in the National Energy Policy, i.e. 30% reduction of greenhouse gases by 2030.

Climate change is expected to greatly influence the existing weather and environment of The Bahamas, and to exacerbate the response to climate variability and change for the water resources. Due to the frequency and intensity of hurricanes along with the potential of rising sea levels, the impact to the position and the distribution of fresh, brackish and saline groundwater is anticipated. A possible reduction in groundwater recharge from any changes in the rainfall distribution is additionally expected.

Changes to species diversity and functional groups will have a multilevel impact on ecology in the area.

Impacts from petroleum-based power generation are directly related to climate change and the national development goal of GHG reduction. Use of ADO and HFO will not aid in achieving GHG reduction.

6.2.6 Noise impacts

There has been no analysis of noise impacts by SEV or Arcadis. Noise data was provided by Wartsila, but no inferences could be made from this data. The Wartsila document entitled “Noise Impact Study BPL Plant Extension 6xW 18V50DF” dated 23 April 2020 can be found in Appendix G2.

6.2.7 Solid, liquid and hazardous waste impacts

Construction of Station D will generate solid waste. If not stored, handled or disposed of properly, such waste can attract pests which are disease vectors or end up in the marine environment where they pose risk to marine life.

The impact to the water resources due to the solid, liquid and hazardous waste impacts for construction of Station D is assessed as minor over the short term. The risk to the water resources is minimal for the related solid, liquid and hazardous waste, per the proposed operations for Station D.

Removal of existing equipment and buildings on the proposed project site has the potential to generate hazardous waste that can negatively impact groundwater and soil at the project site as well as the site where these wastes are disposed of. It will be important that remediation entails proper planning for handling and disposal of these materials.

Construction can involve use of hazardous materials, such as chemicals, insulation and paints. If spilled or disposed of improperly, these materials can become hazardous wastes.

Operation can result in spills of different forms of waste. Spill of fuels is particularly of concern and can happen at various phases of operation including transport of fuels into the Station.

6.2.8 Fire and hurricane risks

Hurricane force winds may transport unsecured debris from the site and into the surrounding habitat. Contents or parts of derelict buildings and storage tanks are also sources of flying debris risk to wildlife, human property and infrastructure in the event of a hurricane.

6.2.9 Accidents and malfunctions

Any project can experience accidents from activities, such as movement of vehicles or falls of workers. Safety induction and training will be key in preventing accidents on the site. Operation of industrial facilities can result in malfunctions for any number of reasons, such as equipment failure, fires, and natural disasters. Planning for these types of risks are important to reduce incidences of malfunctions.

6.3 Biological Impacts

6.3.1 Habitat loss and degradation impacts

Invasive plant species, birds and rodents, allowed to proliferate, on the project site easily invade the surrounding natural habitat. This reduces local diversity and ecosystem function.

Plants, such as Casuarina and Brazilian Pepper, replace food species and are not suitable nesting trees for most resident birds. Rats kill native birds and reptiles and compete with birds for food resources by eating the fruits of native trees. Similarly, invasive bird species, such as Rock Pigeons and House Sparrows, proliferate in unused buildings and difficult-to-reach areas of buildings. They then forage in nearby habitat and compete with native birds.

6.3.2 Biodiversity impacts, especially on rare or protected species

Native Bahamian forest tree species, including, but not limited to those identified in the study area are protected by Bahamian law. Removing these species during development has negative effects on biodiversity, directly by the removal of the plants and indirectly by reducing the available food and shelter for species such as birds, butterflies and native reptiles or amphibians. Insects, such as butterflies, moths and other pollinators will be negatively affected by the removal of flowers and trees for the laying of eggs and the growth and development of their larvae.

Rare and endangered migratory songbirds, such as Kirtland's Warblers (*Setophaga kirtlandii*), have been found on New Providence and in similar coastal habitats, but the study period did not include their typical migratory season. All North American migratory birds are protected under the United States Migratory Bird Treaty Act. All wild birds are protected by Bahamian Law.

6.3.3 Impacts on special features, such as caves and blue holes

No caves or blue holes were identified on the project site.

6.4 Socioeconomic Impacts

6.4.1 Land use impacts

The Clifton Pier Power Station is an area zoned for industrial activities and is home to several industrial operations including BPL. The project will be implemented on BPL land that is within, or immediately adjacent to, the existing power facilities. The land at BPL is private property and has been the footprint of power generation activities since the inception of BPL. Land use by BPL is exclusively for power generation. Access to the land or use of the land by the public has never been allowed. Use of this area will remain limited to BPL activities and the site will remain off limits to the general public.

The area for the proposed project is currently used as a staging area, with a temporary building at the entrance and abandoned infrastructure throughout. Within the scope of this project, the land will be put to better use with the construction of a new power plant within the area west of Station A footprint.

No physical, or economic displacement, are expected as a result of the project.

Construction activities will be immediately felt by nearby industrial facilities due to the proximity of these operations to the project site. Negative impacts would be generally the same as what is currently experienced at the site and what would be considered typical of impacts that occur at construction sites. These impacts may include reduced air and noise quality or reduced soil and water quality as described in sections 6.1 through 6.3. Some impacts, including noise, soil erosion, runoff, or emissions, may be increased during various phases of construction at the site.

The surrounding groundwater environment and water resources within the general vicinity of the CPPS have been compromised in the past by previous fuel/oil spills. This may have an impact on soil and water quality during construction as construction activities can result in movement of the plume

of contamination. The two (2) potable water companies operating in the general vicinity of the CPPS site, Water & Sewerage Corporation (WSC) and New Providence Development Company (NPDCo), would likely be impacted the most by this occurrence.

6.4.2 Impacts on neighboring communities (such as imported labor including foreign workers)

The construction of the new power plant will have positive impacts on the community, including the creation of employment opportunities for the unemployed and underemployed. It will require an increase in personnel, both local and foreign. These new opportunities may be beneficial for Bahamians and residents currently seeking employment in communities near Clifton Pier and across The Bahamas.

This would be particularly impactful as the country is still experiencing the impact of Hurricane Dorian and the current global pandemic. Hiring of construction workers will likely include individuals that live in adjacent communities and also beyond the Clifton area. Given the nature of the project, imported labour will likely be necessary in order to meet the technical capacity required for construction of the new facility.

Available employment opportunities can potentially attract both local and foreign workers. Increased employment in the Clifton area may also result in more persons moving to nearby neighbourhoods in order to live closer to work. This would increase the residential occupancy rates, population sizes, and demand for public services.

Additionally, upgrading to a newer, more efficient power generating plant will likely lead to net reductions in emissions and minimize other issues related to older and less efficient facilities. This would benefit the adjacent communities surrounding Clifton Pier.

Another significant benefit of this project will be the production of more reliable and stable energy production. This will have an impact on society in the adjacent communities and across the entire island of New Providence.

Health and safety impacts during the construction and operation of a power plant are common. Negative impacts to the nearby communities may include reduced air and noise quality or reduced soil and water quality as described in sections 6.1 through 6.3. Health and safety impacts can be found in Section 6.6.

An increase in the number of employees at Clifton will likely result in increased road traffic passing near and through communities during peak hours.

Impacts related to the biophysical environment can be found in Section 6.1 through 6.3 and the social and economic environment can be found in Section 6.4.4. Specific impacts related to health and safety can be found in Section 6.6.

6.4.3 Traffic impacts, including marine and air impacts

The road known as Southwest Road is a two-lane public road which serves as the only corridor connecting the south and west areas of New Providence. It runs the extent of southwest New Providence beginning at Coral Harbour (in the south) and ending at Clifton (in the west). It borders communities including Coral Harbour, Adelaide, Albany, and South Ocean, providing access to and from those communities.

The Southwest Road is the only access road to the Clifton Pier Power Station (CPPS) and its Station D power plant site, where the road runs east to west. Past the CPPS, the road winds north along the Clifton Heritage Site and transitions into the Western Road which borders Lyford Cay and Old Fort bay. This corridor facilitates the full range of motor transportation available on the island.

The population of the Clifton district is 9,323 spread mainly across ten residential communities that are within a two-mile radius of Clifton Pier Power Station. Construction at Clifton may increase vehicular traffic resulting in some delays during peak hours.

Heavy equipment entering and exiting the site during construction will likely impact traffic in the immediate area. Use of the immediate roadway may be interrupted or slowed for other industries operating at Clifton Pier, where access to the site occurs.

Construction vehicles and movement of heavy equipment along Southwest Road toward neighboring communities may also impact traffic flow. However, it is anticipated that the impact on traffic will lessen as the distance increases from the construction activities centered at the BPL site.

An increase in employment in the area could also lead to an increase in the demand for transportation, resulting in more vehicular traffic on the road.

Impacts to air transportation may include reduced visibility for aircrafts and/or ground control at the Lynden Pindling International Airport. Access to Lynden Pindling International Airport via Southwest Road during construction may be impacted by construction activities and the movement of heavy equipment to and from the site.

There are several key uses of the area surrounding the industrial properties at Clifton Pier Power Station. Marine traffic is by far the largest category of use in the Clifton Pier area. This includes shipping traffic related to BPL, Rubis, SOL, and Caribbean Gas. Other vessels are typically engaged in leisure, recreational, snorkeling, scuba diving, sightseeing or fishing (subsistence and commercial). No increase or interruption in marine traffic is expected as a result of the construction of the new power plant.

6.4.4 Economic impacts

The construction of the new power plant will have positive impacts on the community, including the creation of employment opportunities for the unemployed and underemployed. It will require an increase in personnel, both local and foreign. These new opportunities may be beneficial for

Bahamians and residents currently seeking employment in communities near Clifton Pier and across The Bahamas.

This would be particularly impactful as the country is still experiencing the impact of Hurricane Dorian and the current global pandemic. Hiring of workers will likely include individuals that live in adjacent communities and also beyond the Clifton area. Given the nature of the project, imported labour will likely be necessary in order to meet the technical capacity required for construction of the new facility.

Available employment opportunities can potentially attract both local and foreign workers. One negative impact of hiring foreign workers during periods of high unemployment is the perception (real or imagined) that the preference is to employ foreigners rather than locals.

Overall, the hiring of workers will likely include individuals that live in adjacent communities and beyond the Clifton area. Increased employment in the Clifton area may also result in more persons moving to nearby neighbourhoods in order to live closer to work. This would increase the residential occupancy rates, population sizes, and demand for public services.

Another significant benefit of this project will be the production of more reliable and stable energy production. This will have a positive impact on the quality of life in the adjacent communities and across the entire island of New Providence.

6.4.5 Aesthetic and visual impacts

Construction of the power plant may result in unwanted visual impacts, both by its physical presence and profile against the surrounding area. Southwest Road runs adjacent to the coast, which is on the southside of the road. Clifton Pier and its industrial properties are located on the northside of the Southwest Road, but are visible from the road and by the sea. Visual impacts as a result of the construction of the building, storage of materials and waste, and staging areas, may be unappealing and reduce the aesthetic profile of the area. Dust and exhaust emissions may also reduce visibility in the immediate area.

6.4.6 Infrastructure and public services impacts

Clifton is the primary point of importation of oil, gas, and other fuel into the island. The pier and its associated network of lines and storage containers is home to Bahamas Power and Light, Rubis Ltd., SOL Bahamas Limited, Sun Oil Limited, and Water and Sewerage Corporation. Any interruption in operations at Clifton Pier has the potential to negatively impact services at the national level.

Construction of the power plant and the introduction of employment could also increase demand on local essential services including medical, public education, and telecommunications. It will also increase pressure on existing infrastructure including roads and water.

6.5 Cultural Impacts

6.5.1 Losses of archaeological, historic and paleontological resources

The project site is an existing industrial facility, so there are no archaeological, historic or paleontological resources present. Losses of such resources are not a factor for this project.

6.5.2 Preservation of resources

With no cultural resources on the site, there is no need for preservation of such resources.

6.5.3 Impacts to tourist and recreational areas

There are no expected impacts to these areas other than short-term, temporary impacts from construction noise or traffic diversions.

6.5.4 Aesthetics and visual impacts

Construction activities are expected to impair aesthetic and visual impacts over the short-term, particularly with storage of equipment and materials as well as potential for dust emissions. Operation activities can impair aesthetic and visual impacts over the long-term if emissions are not controlled. As the project is on an existing industrial site, there are no existing natural features or areas utilized by the public or neighbouring residents for cultural or recreational purposes.

6.5.5 Impacts on community organizations

During the virtual meetings with environmental non-Governmental organizations (NGOs), no specific impacts were identified. The organizations did indicate their concern for impacts to marine water quality and expressed interest in being able to conduct monitoring as an objective third party. They also expressed a desire to collaborate with BPL on a public awareness campaign on sources and uses of energy.

BNT is involved in management of protected areas including the Primeval Forest and is interested in management of the Southwest New Providence Marine Managed Areas. BREEF is active at Clifton Heritage Park and funded installation of the underwater sculpture garden. Waterkeepers Bahamas is engaged on water quality issues in New Providence as well as other islands in The Bahamas. All three organizations along with reEarth are involved in increasing public awareness of environmental issues. The efforts of these organizations to conserve natural resources and ecosystems would be negatively impacted by any negative environmental impacts occurring during construction and operation of Station D.

6.6 Health and Safety Impacts

The World Health Organization defines health as a "*state of complete physical, mental and social well-being and not merely the absence of disease or infirmity* (WHO, 2020c). Where health impacts are defined as "*the overall effects, direct or indirect, of a policy, strategy, programme or project on the health of a population"* (European Centre for Health Policy (ECHP), 1999).

To evaluate the potential human health impacts a Human Health Impact Assessment (HIA) is completed which is defined as "*A systematic process that uses an array of data sources and analytic methods and considers input from stakeholders to determine the potential effects of a proposed policy, plan, program, or project on health of a population and the distribution of those effects within the population. HIA provides recommendations on monitoring and managing those effects*" (NRC 2011).

Essentially an HIA helps to identify, characterize and summarize the predicted health impacts (which can be positive, negative or neutral) of the proposed Project to human receptors. Since the Bahamas has not developed a standard for HIAs, the HIA has been completed following best practices outlined by various international agencies including International Finance Corporation (IFC) World Bank (IFC, 2009), Pan American Health Organization (PAHO) (PAHO, 2017), World Health Organization and USEPA (USEPA, 2013).

An evaluation matrix is developed for both the construction and operation phase of the proposed Project that includes consideration of the different characteristics of the potential health impacts including the geographical extent of the impact (is it restricted to those on site, or in the local area or could it be a regional impact), the magnitude and likelihood of occurrence. Each of these characteristics are independently evaluated based on information from the Environmental Impact Report, scientific literature, and professional judgement. The characteristics were evaluated assuming that project mitigation measures, as described in the Environmental Impact report were implemented. This HIA has assumed that the proposed project will be constructed and operated in a manner that meets international operating standards, such as the use of highly efficient engines with minimal emissions. Where these mitigation measures may not be protective enough, additional recommendations were made.

An HIA comprises six steps: Screening, Scoping, Assessment, Recommendations, Reporting, and Evaluation/Monitoring. Each of these steps are discussed below.

6.6.1 Screening

The proposed project aims to reduce long-term fuel costs, modernize power generation that increases efficiency and reliability, and reduce emissions. The proposed new power plant, referred to as Station D, is to be constructed on a vacant brownfield plot of land within the fence line of BPL's existing Clifton Pier Power Station (CPPS), see Figure 3-2. This area is currently used as a staging area with a temporary building at the entrance and abandoned infrastructure across the site. Engines in the new power plant can run on LNG, automobile diesel oil (ADO) or heavy fuel oil (HFO) also known as Bunker C. Assuming natural gas is ultimately used as the primary fuel, the project will lead to net reductions in the emissions. Similarly, given that the current fuel source at Station A is HFO, any reduction in HFO by supplementation with LNG will also lead to net reductions in emissions, but to a lesser extent than exclusive LNG use. If the proposed regasification facilities are not constructed to the east of the BPL site, the supply of diesel and heavy fuel oil (HFO) will come from BPL's existing storage tanks. Station D will have a generating capacity of 85-102 MW.

As part of the Project's construction phase, a remediation program for known impacts will be implemented as described in Appendix F. As such, improvements to the existing environmental conditions are anticipated during the construction phase. The construction phase will involve the transportation of materials to the Project site and the construction of the Station D Power Plant.

The facility is expected to operate 24/7, 365 days a year. The Station D power plant is designed to last 25 years with a maximum life of about 40 years. The assessment of the operation phase in the HIA considers potential health impacts that could occur during this period.

An HIA was determined to be required as a result of the proposed Project to assess potential risks to human health at the site and in the local and regional areas off-site during construction and operational stages. The screening step of the HIA has previously been completed in communication with the Bahamas Department of Environmental Planning and Protection (DEPP) at which time the HIA was determined to be required for this proposed project.

6.6.2 Scoping

The HIA is mandated as part of the Environmental Impact Assessment given that the potential for health impacts was identified. The HIA completed to date is largely a desk-top study utilizing existing information and predicted Project impacts.

The assessment population consists of on and off-site receptors. On-site receptors include construction workers, indoor and outdoor workers, and visitors. Off-site receptors were considered to either be local or regional where local receptors included those within a one-mile radius of the site whereas regional receptors are those living on the Island of New Providence, greater than a mile radius from the site. Off-site receptors both local and regional include residents, recreational users, as well as commercial and industrial workers.

Both environmental and social determinants of health were considered in the HIA. Health determinants are defined as "*the personal, social, cultural, economic and environmental factors that influence the health status of individuals or populations" (*ECHP, 1999). The determinants of health considered for both the Construction Phase and Operation Phase of the Project are listed in Tables 6-11 and 6-12, respectively, as are the relevance to health.

For each determinant of health evaluated in the HIA, a technical assessment of the potential health impact includes a discussion of all aspects of the evaluation matrix. For clarity, a definition has been provided for each element to provide context to the evaluation (Table 6-9).

Table 6-9: Definition of Characteristics within the Evaluation Matrix

Element or Characteristic	**Definition**	**Ranking**
Potential Health Outcome	Lists potential health outcomes associated with each health determinant	N/A

Element or Characteristic	Definition	Ranking
Vulnerable Populations	Populations that may be impacted more than others by the proposed project activities, such as but not limited to children, seniors, low-income, minorities, those with pre-existing respiratory ailments, device-dependent individuals, and individuals with existing medical conditions.	N/A
Spatial Extent	Whether the potential health impact would be contained to receptors on the Project site, within the immediate area (local) surrounding the Project site (i.e., within 1 mile radius of the site as shown on Map 2-3 or within the regional area (i.e., New Providence or within a 2 mile radius as shown on Map 2-3)	On-site Local - within one mile radius of Project site Regional - greater than one mile radius of Project site
Magnitude	The severity of the health impact including baseline conditions.	Low – the impact is minor and/or not lasting (temporary) Moderate – the impact is minor but detectable and poses a minor to moderate hazard/benefit to health High – the impact is significant, irreversible and poses a major hazard/benefit to health
Likelihood	What is the probability of the impact occurring based on the expected frequency of exposure?	Low - the impact is anticipated to occur rarely and be reversible Moderate - the impact is possible and it could occur on a regular basis but is reversible High - the impact will occur frequently and persist
Cumulative Health Determinant Outcome (Baseline and Proposed Project)	In consideration of all the characteristics, what is the overall impact of the determinant on health?	Positive – the impact is anticipated to positively affect health Neutral – the impact is not anticipated to have an effect on health

Element or Characteristic	Definition	Ranking
		Negative – the impact is anticipated to negatively affect health and mitigation measures should be considered
Additional Recommendations	If a negative health impact is anticipated, then additional mitigation measures are provided	N/A

6.6.3 Assessment

The baseline health profile for the Island of New Providence on which the site is located is provided in Section 5.5. This section of the HIA uses the baseline health profile to then assess and characterize potential human health impacts as a result of the proposed project in both the construction and operation phases. This HIA will assess incremental changes in health above the baseline health profile as a result of the proposed project and the cumulative impacts in each of the two phases.

The HIA identified ten categories of health determinants including:

- Air Quality
- Noise
- Water Quality
- Soil Quality
- Communicable Disease and Biological Injury
- Aesthetic
- Traffic
- Economic
- Social
- Cultural Heritage

These health determinant categories were selected because they were determined to have the greatest potential for human health outcomes from the proposed project at the site, as well as the off-site local and regional communities on New Providence Island. The HIA was a desktop study with limited data for review and therefore was completed as a qualitative assessment. The objective was to establish whether the construction and operation phases of the proposed project could have a negative, neutral, or positive effect on human health. It should be noted that the decommissioning stage was not included in the HIA as per client communication. A qualitative discussion of each health determinant is provided in the sections below. The overall health determinant outcome (i.e. negative, neutral, or positive) was assessed for each health determinant for both the construction and operation phases, as summarized in Tables 6-11, and 6-12, respectively.

AIR QUALITY

The air quality health determinant category for the construction and operation phases of the proposed project was assessed under four sub-categories: odour, chemical emissions, particulate matter (PM), and vapour intrusion.

Generally, trade winds blow in a predominantly easterly direction at the site. The prevailing wind is towards the west. Given that the site is in the lee of New Providence Island, it is more vulnerable to southerly or southeasterly winds (Section 5.1.1). Therefore odour, chemical emissions, and PM are anticipated to disperse to the south (i.e. the Atlantic Ocean) or west (i.e. adjacent industrial land use and Clifton Heritage National Park) of the site.

Odour could be a potential concern for a variety of reasons including but not limited to during the remediation of fuel in groundwater, chemical emissions, leaks, emergency spills, and fires. The health effects of odour include increased stress and annoyance, headaches, nasal congestion, cough, nausea, sleep problems, and dizziness (ATSDR, 2017).

Power plants are known sources of sulphur dioxide (SO_2), nitrogen oxides (NO_x), and PM, as well as greenhouse gases, carbon dioxide (CO_2) and methane (CH_4). Chemical emissions and PM are associated with numerous health impacts including but not limited to respiratory concerns (e.g. asthma, bronchitis), heart attacks, strokes, premature and low birth rates, and increased hospitalization (USEPA 2020; USEPA 2019; USEPA 2016).

ODOUR

The location of the proposed Station D power plant is in an existing industrial area. Petroleum odours could be released from the subsurface during remediation of impacts in groundwater, and during operations from chemical emissions and spills and from existing/remaining impacts in soil and groundwater. If a spill (e.g. chemical) or an incident (e.g., explosion, fire) were to occur during the construction or operation phases, then odours may be noticed primarily by on-site workers within the industrial area. Given that residential areas are not within the immediate vicinity of the site and are in opposing wind direction, it is less likely that odours would be detected by off-site local residents that are approximately 1.11 km (0.69 miles) to the northeast and 1.12 km (0.70 miles) to the southeast of the site.

As such, the potential health impacts associated with odours during both the construction and operation phases were evaluated as follows:

- Some individuals are more sensitive to odours, such as children, seniors, migraine sufferers, asthmatics or individuals with other respiratory ailments, and therefore would be considered more vulnerable to potential health impacts;
- Potential human receptors that could be impacted by odour from the proposed project generally include on-site workers;
- Magnitude of health impact is expected to be moderate as the health outcomes are associated with minor health symptoms (i.e. headaches, cough) or annoyance (i.e. increased stress), and impacts from odour are reversible; and,

- Likelihood of health impacts is high as odour is expected to occur frequently and persist on the site due to contaminated subsurface conditions, and chemical emissions from the power plant. Emergency incidents would be expected to occur rarely.

Based on a moderate magnitude and high likelihood of occurrence, odour as an overall determinant of health is considered to be generally negative during both the construction and operation phases.

CHEMICAL EMISSIONS

The burning of fossil fuels during the construction and operation phases contributes gases, such as CO_2, SO_2, and NO_x, to the atmosphere (USEPA 2020; USEPA 2019; USEPA 2016a). Sulphur dioxide inhalation can result in respiratory and circulatory system diseases, particularly in hypersensitive individuals, such as children and asthmatics (Freedman 2004; USEPA 2019). Ambient concentrations of nitrogen oxides can cause airway irritation, aggravating pre-existing conditions, such as asthma. Occupational exposure to these gases can result in impaired pulmonary function (Freedman 2004). If the proposed LNG terminal and regasification facilities receive regulatory approval and are constructed, then the current plans call for natural gas to eventually replace HFO and/or diesel as the primary fuel in the operation phase (Section 3.3). Burning fuels with lower carbon content reduces carbon emissions and therefore, may lessen associated health effects (USEPA 2020).

As shown in Section 2.2, Table 2-3, gas emission reports from 2014, 2017 and 2018 for CO_2, SO_2, and NO_x were reviewed. During this timeframe, emissions from the CPPS ranged from 14,300 to 60,600 tonnes CO_2, 1800 to 7400 tonnes SO_2, and 31 to 150 tonnes NO_x.

As discussed in Section 5.1.4 and Table 5-6, ambient air monitoring data was collected by Golder Associates from 2000-2006 and 2011-2013 at Clifton Pier (on-site) and Lyford Cay (within 2-mile radius of the site) for NO_2 and SO_2. There were no exceedances of the applicable WHO and US EPA standards for NO_2. The baseline concentrations of SO_2 exceeded the WHO guideline and Interim Target-1 guideline for 24-hour SO_2, but did not exceed the US EPA standards. Geosyntec (2020) also collected baseline ambient air quality data (over a 7.5 hour timeframe) on one day. Chemical concentrations of various parameters in ambient air were above acute (<14 days) and intermediate (14 – 365 days) Agency for Toxic substances and Disease Registry (ATSDR) minimal risk levels (MRLs), indicating that baseline air quality conditions may be impaired, if this single day sampling event is representative of typical air quality conditions.

<u>Construction Phase</u>

During the construction phase of the Station D power plant (i.e. the proposed project), potential chemical emissions may result from construction related activities, including the groundwater remediation program, the increased traffic to and from the site related to commuting and construction activities, and the use of fuel-operated machinery and equipment. Vapour intrusion will also occur as discussed in the sub-section below. The temporary emissions associated with the construction of the proposed project were not predicted in Section 6.2.4 of the EIA due to the unpredictable nature of the construction activities.

As such, the potential health impacts associated with chemical emissions during the construction phase were evaluated in a qualitative manner as follows:

- Some individuals are more sensitive to chemicals, such as asthmatics, individuals with respiratory ailments, or migraine suffers, and therefore would be considered more vulnerable to potential health impacts;
- Potential human receptors that could be impacted by chemical emissions from the proposed project construction phase include on-site and local receptors, such as site workers and residents within a mile of the site, especially those living adjacent to local roads leading to the site;
- Magnitude of impact is expected to be high. Emissions associated with construction equipment and remediation will contribute to the baseline air quality, which already exceeds the applicable health standards. Health impacts could range from acute symptoms (i.e. headaches, dizziness) to long-term health effects (i.e. cancer); and,
- Likelihood of health impacts are high as workers are expected to be exposed frequently and on a regular basis during the construction phase.

Based on the high magnitude and likelihood, the chemical emissions as an overall determinant of health are negative during the construction phase.

Operation Phase

During the operation phase, the air emissions will be primarily associated with fuels used to power the engines and other machinery for the proposed Station D project, as well as to a lesser extent, vehicular emissions from worker's vehicles commuting to and from the site, and existing soil and groundwater impacts. Vapour intrusion will also occur as discussed in the sub-section below. Accidental chemical spills as well as explosions and fires would also contribute chemical emissions to the airshed, should they occur. Explosions and fires are anticipated to occur rarely, if at all. The amount and chemical composition of emissions will depend on numerous factors, such as the type of fuel used (i.e. HFO, ADO, LNG), emission controls, operating procedures, and overall system efficiency. Station D is proposed to replace and/or improve upon existing, aged infrastructure, and is set to operate at similar production levels as the previous generation fleet (i.e. Station B and C), and alongside the newly updated Station A. Station D will be equipped with tri-fuel engines capable of being powered by LNG, ADO, and/or HFO. If the proposed LNG terminal and regasification facilities to be located to the east of the site are approved, then the future plan will be to replace HFO and ADO with LNG as the primary fuel. The timeline of future fuel replacement is unknown, but overall, the use of LNG will result in further reductions of emissions with corresponding benefits to the local airshed (Section 6.2.4). This HIA was completed in consideration of all three of these fuel types.

Air dispersion modelling runs were completed in Section 6.2.4 to predict the emission concentrations of NOx and SO_2 from the simultaneous operation of Station D and Station A under two different scenarios. The first scenario assessed the cumulative air impact from using the interim HFO as the primary fuel, whereas the second scenario focused on the emissions resulting from using LNG as the replacement fuel for the long-term operations at CPPS. Background concentrations from Clifton Pier

were incorporated into the analysis. Exceedances of the AAQS for both NOx and SO_2 were calculated for the worst-case scenario with HFO as the primary fuel, and exceedances of the AAQS for NOx were modelled for the worst-case scenario with LNG as the primary fuel. As shown in Table 6-7, Section 6.2.4, there is a significant decrease in emissions once HFO is replaced by LNG as the primary fuel source. It should also be noted that emissions from Station A, as modelled, were the primary contributor to the predicted maximum impacts. Station D modelling predicted significantly less emissions than Station A yet exacerbates the existing exceedances. A summary of the chemical emissions modelling in comparison to the applicable AAQS is presented in the table below.

Table 6-10: Summary of Chemical Emissions Modelling – Two Operational Scenarios based on Primary Fuel Source

Scenario	Pollutant	Averaging Period	WHO	USEPA	Result	Interpretation
HFO	NO_2	1 hr	200	188	1862	Exceedance of WHO and USEPA 1-hr guidelines. Exceedance of WHO annual guideline. Below US EPA annual guideline
		Annual	40	99.7	41.8	
	SO_2	1 hr	N/A	196	2805	Exceedance of WHO and US EPA 1-hr and annual guidelines where available.
		Annual	20	N/A	58.2	
LNG	NO_2	1 hr	200	188	310.5	Exceedance of WHO and US EPA 1-hr guideline. Below WHO and USEPA annual guideline.
		Annual	40	99.7	11.2	
	SO_2	1 hr	N/A	196	0.48	Below WHO and USEPA 1-hr and annual guidelines.
		Annual	N/A	N/A	0.01	

Notes:
All units in $\mu g/m^3$
WHO Ambient Air Quality Data (International Finance Corporation/World Bank Group General Environmental, Health, and Safety Guidelines (IFC/WBG) General EHS Guidelines). 2007.
US EPA National Ambient Air Quality Standards. 2016.

As such, the potential health impacts associated with chemical emissions during the operation phase are as follows:

- Some individuals are more sensitive to chemicals, such as asthmatics and individuals with respiratory ailments, and therefore would be considered more vulnerable to potential health impacts;
- Potential human receptors that could be impacted by chemical emissions from the operation phase of the project include on-site and local receptors such as site workers and residents within a mile of the site;
- Magnitude of impact is expected to be high. Emissions from power plant operations will exceed the AAQS under the worst-case scenarios for HFO and LNG (Table 6-5 and 6-6, Section 6.2.4) as modelled. Health impacts could range from acute symptoms (i.e. headaches, dizziness) to long-term health effects (i.e. cancer, cardiovascular, and respiratory ailments). There is also the potential, although unlikely for large-scale spills and explosions, which would have further negative health implications for local receptors; and,
- Likelihood of health impacts is high given that workers would be exposed to emissions on a regular basis for the lifetime of the project, approximately 25 years.

Based on the high magnitude and likelihood, the chemical emissions as an overall determinant of health are negative during the operation phase.

PARTICULATE MATTER

PM consists of both liquid droplets and solid particles that are inhalable and are classified by size as either less than 10 µm (PM_{10}) in diameter or less than 2.5 µm ($PM_{2.5}$) in diameter (USEPA 2018). $PM_{2.5}$ poses greater health concerns given its finer size and ability to penetrate lung tissue more deeply. PM primarily affects the lung and heart with such symptoms as airway irritation, aggravated asthma, irregular heartbeat, decreased lung function, and premature death in individuals with heart or lung disease (USEPA 2018). Adverse birth outcomes, such as low birthweight, pre-term birth, and health of the child throughout childhood have also been identified as result of PM exposure (AAP 2004).

As described in Section 5.1.4, the baseline data exceeded the 1-year averaging WHO guideline for PM_{10}, and exceeded the WHO Interim Guideline Target 3 and the WHO Guideline for 24-hour PM_{10} exposure where data was available for the years of 2000-2006 and 2011-2013 for PM_{10}.

<u>Construction Phase</u>

Particulate matter levels may increase during the construction phase of the project due to the mobilization of construction vehicles, soil and groundwater remediation activities, equipment usage, and the movement of earth (soil/rocks) and construction materials/debris/waste to and from the site.

Based on this information, the potential health impacts associated with particulate emissions during the construction phase are as follows:

- Some individuals would be considered more sensitive and thereby more vulnerable to potential health impacts such as asthmatics, pregnant females, and those with pre-existing respiratory ailments or heart conditions;
- Potential human receptors that could be impacted by particulate emissions from the proposed project include on-site and local receptors such as site workers and residents within a mile of the site, especially those living adjacent to local roads leading to the site;
- Magnitude of impact is expected to be high given that the proposed project would generate additional PM above baseline concentrations, which were noted to exceed the PM health guidelines (Table 6-4, Section 6.2.4). The potential health impacts could range from acute symptoms (i.e. airway aggravation) to long-term effects (i.e. lung disease); and,
- Likelihood of health impacts is high. Worker exposure is expected to occur frequently and on a regular basis for the duration of the construction phase.

Based on the high magnitude and likelihood, particulate matter emissions as an overall determinant of health are negative during the construction phase.

Operation Phase

While baseline PM levels exceed guidelines, the proposed new infrastructure is anticipated to reduce PM levels assuming that HFO and ADO is eventually replaced or significantly supplemented by LNG. Natural gas releases fewer particulates to the environment since it is a gaseous fuel and is typically less than 1 micrometer in size where larger molecular weight hydrocarbons have not entirely combusted (USEPA nd). This HIA was completed in consideration of all three fuel types (i.e. HFO, ADO, and LNG). During the operation phase, PM occurs as a fossil fuel combustion biproduct from powering engines and other machinery. PM may also be released in the event of a fire or explosion.

Air dispersion modelling runs were completed in Section 6.2.4 to predict the emission concentrations of PM from the simultaneous operation of Station D and Station A under two different scenarios. The first scenario assessed the cumulative air impact from using the interim HFO as the primary fuel, whereas the second scenario focused on the emissions resulting from using LNG as the replacement fuel for the long-term operations at CPPS. Baseline concentrations from Clifton Pier (10-year average) were incorporated into the analysis. Exceedances of the AAQS for PM were calculated for the worst-case scenario with HFO as the primary fuel, and for the worst-case scenario with LNG as the primary fuel. As shown in Table 6-7, Section 6.2.4, there is a significant decrease in emissions once HFO is replaced by LNG as the primary fuel source at Station D. It should also be noted that emissions from Station A were the primary contributor to the predicted maximum concentrations. Station D contributes significantly less emissions than Station A yet exacerbates the existing exceedances. A summary of the PM emissions modelling in comparison to the applicable AAQS is presented in the table below.

Table 6-11: Summary of PM Emissions Modelling

Scenario	Pollutant	Averaging Period	WHO	USEPA	Result	Interpretation
HFO	PM_{10}	24-hr	50	150	86.8	Exceedance of WHO 24-hr guideline. Below US EPA 24-hr guideline. Below WHO annual guideline.
		Annual	20	N/A	4.41	
	$PM_{2.5}$	24-hr	25	35	35.1	Exceedance of WHO and US EPA 24-hr guidelines. Below WHO and USEPA annual guidelines.
		Annual	10	12	3.98	
LNG	PM_{10}	24-hr	50	150	2.19	Below WHO and USEPA 24-hr and annual guidelines where available.
		Annual	20	N/A	0.169	
	$PM_{2.5}$	24-hr	25	35	2.19	Below WHO and USEPA 24-hr and annual guidelines.
		Annual	10	12	0.152	

Notes:
All units in µg/m³
WHO Ambient Air Quality Data (International Finance Corporation/World Bank Group General Environmental, Health, and Safety Guidelines (IFC/WBG) General EHS Guidelines). 2007.
US EPA National Ambient Air Quality Standards. 2016.

As such, the potential health impacts associated with particulate emissions in the operation phase are as follows:

- Some individuals would be considered more sensitive and thereby more vulnerable to potential health impacts such as asthmatics, pregnant females, and those with pre-existing respiratory ailments or heart conditions;
- Potential human receptors that could be impacted by particulate matter from the proposed project include on-site and local receptors such as site workers and residents within a mile of the site;
- Magnitude of impacts is expected to be high as operations will be contributing to existing baseline exceedances of PM guidelines. The potential health impacts could range from acute

symptoms (i.e. airway aggravation) to long-term effects (i.e. lung disease). There is also the potential, although rare, for large-scale spills and explosions, which would have further negative health implications for local receptors; and,
- Likelihood of health impacts is high. Workers are expected to be exposed to elevated concentrations of particulate matter on a regular basis for the lifetime of the project, up to 25 years.

Based on the high magnitude and likelihood, particulate matter emissions as an overall determinant of health are negative during the operation phase.

VAPOUR INTRUSION

Petroleum hydrocarbons and other volatile chemicals from existing soil and groundwater contamination sources at the Site and/or from future spills or leaks have the potential to impact the odour levels and chemical indoor air quality of the future proposed Station D via vapour intrusion pathways. Vapour intrusion was not included as part of the modelling in Section 6.2.4 of the EIA and will therefore be assessed qualitatively. Vapour intrusion is an active pathway in all on-site, enclosed structures associated with the proposed project during both the construction and operation phases.

As such, the potential health impacts associated with vapour intrusion in the construction and operation phases are as follows:
- Some individuals would be considered more sensitive and thereby more vulnerable to potential health impacts such as asthmatics and those with pre-existing respiratory ailments or heart conditions;
- Potential human receptors that could be impacted by vapour intrusion from the proposed project include on-site indoor workers;
- Magnitude of impacts is anticipated to be high given the chronic health effects (e.g. cancer, lung disease etc.) that could arise from exposure to high levels of contaminants emanating from soil and groundwater (dissolved and free phase); and,
- Likelihood of health impacts is high. Workers would be exposed to vapours on a regular basis for the duration of their work contract while indoors at the proposed Station D.

Based on the high magnitude and likelihood, vapour intrusion as an overall health determinant during both the construction and operation phases is negative.

SUMMARY OF AIR QUALITY

As discussed above, the emissions resulting from the proposed project were added to the baseline conditions to assess cumulative exposure from chemical emissions and PM as determinants of air quality. The ambient air concentrations for the area near the site were calculated as a 10-year average, as discussed in Section 6.2.4, and as such were assumed to be constant for the 25-year lifespan of the proposed project (i.e. Station D). Air dispersion modelling considers the impact of chemical emissions and PM by examining the individual contaminant concentration relative to the applicable standard. However, air consists of a mixture of gaseous chemicals and PM, which can have additive interactions if the chemicals have similar structures, target sites, mechanisms of action

and/or modes of action. For example, NO_x, SO_2 and PM all cause respiratory effects under acute or chronic inhalation exposures. The additive interaction of this mixture may worsen the symptoms associated with the respiratory system. There are also other chemicals that would be present in the air that were not included in the air quality assessment, such as volatile organic compounds (VOCs) and polycyclic aromatic hydrocarbons (PAHs). The chemicals within these parameter groups have various carcinogenic and non-carcinogenic health effects, and therefore, should be considered as part of the human health impact of air quality. In summary, the cumulative assessment of air quality is ranked negative for both the construction and operation phases of the proposed project given that each determinant was ranked as negative with respect to health in addition to the implications of additive toxic effects of mixtures.

NOISE

Noise Levels

As described in Section 4.1.3, there are no Acts or regulations in Bahamian law which include any numerical limits or standards that can be used to assess and manage airborne noise and therefore a qualitative assessment was conducted. Three noise sensitive receptors (NSR) have been identified in the local area surrounding the site (Section 5.1.5), including:

- NSR1: Recreational users at Clifton Heritage National Park to the west;
- NSR2: Residents to the northeast; and,
- NSR3: Residents to the southeast.

The HIA considered the three noise sensitive receptors (NSR1-3) given that noise levels can cause or contribute to some of the following health issues: sleep disturbances, hearing loss, and interference with speech comprehension (Health Canada 2017). Given the day use of Clifton Heritage Park, noise levels with respect to sleep disturbances pertain particularly to NSR2 and NSR3.

Noise can result from various construction activities, such as demolition, vehicle traffic, infrastructure construction, and the use of machinery. Construction phase noise levels have been planned by Wartsila, the engine manufacturer, as part of the proposed project where specifications for all proposed construction equipment and time of use is planned to not exceed noise thresholds. Construction activities are currently scheduled for between the hours of 7 am to 7 pm.

Occupational exposure to noise pollution for those who would work at the proposed Station D and surrounding site is also of particular concern. Power plants produce noise from the operation of machinery, including but not limited to, turbines, generators, fans, motors, and exhaust.

As such, the potential health impacts associated with noise during the construction and operation phases are as follows:

- NSR 1-3 and individuals with pre-existing hearing impairment may be more sensitive to potential health impacts from increased noise levels;
- Potential human receptors that could be impacted by noise from the Project include on-site and local receptors, such as site workers (both construction and operation) and residents within a mile of the site;

- Magnitude of impacts is expected to be high as construction and operation noise estimations are currently predicted in the noisy range; and,
- The likelihood of impacts is anticipated to be high as the construction is scheduled to occur daily from 7 am to 7 pm and the operations will occur 24/7 for 25 years.

Based on the high magnitude and high likelihood, noise as an overall determinant of health is negative during both the construction and operation phases.

WATER (SURFACE AND GROUNDWATER) QUALITY

Site hydrogeology was reported by GeoSyntec (2020) where 57 site wells were used by CH2M to characterize the site (Appendix G1). Several areas of shoreline have been identified (CH2M 2016) to have LNAPL discharge. The presence of drain lines, piping trenches, disposal wells, waste-oil storage tanks, and spillage were noted on the site (GeoSyntec 2020). The measured thickness of LNAPL at the site ranged from 0.03 to 28.9 m (CH2M, 2016). Analysis of LNAPL collected at the site indicated a mixture of fuels that were used at the site that have been weathered following multiple and different spill events (GeoSyntec 2020). Geosyntec (2020) reported that oil is present on the water table at the BPL property and an oil and groundwater recovery system will be installed shortly to recover subsurface oil. An environmental remediation plan has been developed in conjunction with the Ministry of Public Works and the Ministry of Environment & Housing to support the redevelopment of the proposed project (Appendix F). Baseline conditions of groundwater at the site are expected to improve with the implementation of the remediation program, thereby also improving off-site surface water conditions as a result of groundwater flow from the terrestrial to marine environment. However, given that there is currently a maximum measured LNAPL thickness of 28 m, it is currently unknown how effective the groundwater remediation will be.

During both the construction and operation phases of the proposed project, chemical spills resulting in additional groundwater contamination are possible. Chemical spills may result from leaks, accidents, malfunctions/blowouts, seasonal storm surges, and natural disasters, such as hurricanes and earthquakes.

The impact to human health would depend on the severity of the spill and the ability to remediate the spill. The impact would be greatest to receptors in closest proximity to the spill. Acute health effects from exposure to petroleum contaminated groundwater and surface water, include skin and eye irritation, headaches, dizziness, respiratory difficulties, and stress. Chronic exposure can result in damage to the central nervous system, respiratory system, hematological system, and immune system (ATSDR, 1999).

<u>Chemical Exposures</u>

Construction Phase

Occupational exposure to chemicals in water during the construction phase may result from incidental groundwater contact while remediating existing groundwater contamination. There is also the potential for new groundwater contamination from incidental releases of substances, such as fuels, concrete washout water, hazardous waste, and maintenance products. Chemical spills and

material debris could migrate to surface water via surface runoff or groundwater migration to surface water. As a result, off-site recreational receptors in the vicinity of the site have the potential to be exposed to contaminants while swimming, boating, and fishing, however these activities are unlikely to occur adjacent to the site due to the industrial nature of the area.

The potential health risks associated with the construction phase are as follows:

- Vulnerable populations include those with pre-existing conditions or chemical sensitivities;
- Potential human receptors that could be impacted by chemical exposure from the proposed project include on-site and local receptors, such as site workers and recreational users within a mile of the site;
- Magnitude of impact is expected to be high given the potential for both acute and chronic health symptoms from exposure to PHCs and other chemicals; and,
- The cumulative likelihood of health impacts is considered to be moderate since workers would be exposed to baseline conditions for a short duration during remediation or subsurface activities, whereas additional chemical spills are expected to occur rarely. Few recreational users would be present for any length of time adjacent to industrial facilities due to the nature of activities in such areas.

Based on the high magnitude and moderate likelihood, water quality as an overall determinant of health is negative during the construction phase.

Operation Phase

Occupational exposure to groundwater and surface water, following installation of the proposed project infrastructure at Station D would be limited during the operation phase, except in the event of a chemical spill that requires clean-up. As a result, off-site recreational receptors in the vicinity of the site have the potential to be exposed to contaminants while swimming, boating, and fishing, however these activities are unlikely to occur adjacent to the site due to the industrial nature of the area.

The potential health risks associated with the operation phase are as follows:

- Vulnerable populations include those with pre-existing conditions or chemical sensitivities;
- Potential human receptors that could be impacted by chemical exposure from the proposed project include on-site and local receptors, such as site workers and recreational users within a mile of the site;
- Magnitude of impact is expected to be high given the potential for both acute and chronic health symptoms from exposure to PHCs and other chemicals; and,
- Likelihood of health impacts is considered to be low since subsurface activities and chemical spills to water are expected to rarely occur. Few recreational users would be present for any length of time adjacent to industrial facilities due to the nature of activities in such areas.

Based on the high magnitude and low likelihood, water quality as an overall determinant of health is negative during the operation phase. Site operation and remediation workers should follow a health and safety plan and wear appropriate PPE.

SOIL QUALITY

Soil sampling was completed in March 2020 by GeoSyntec (2020) where both shallow and deep soil samples were collected (Appendix G1). Exceedances of the applicable criteria established by Geosyntec for the analyzed parameters which included metals, mercury, pesticides, polychlorinated biphenyls (PCBs), asbestos, volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs)) were limited to arsenic at two locations to the east of the proposed Station D power plant. It should be noted that soil samples were not analyzed for petroleum hydrocarbons, despite visual staining. As such, it is possible that soil impacts above levels that are considered safe for humans may be present at the site.

During both the construction and operation phases of the proposed project, chemical spills resulting in soil contamination are possible. The impact to human health would depend on the severity of the spill and would be greatest to receptors in closest proximity to the spill. Acute health effects from exposure to petroleum contaminated soil, include skin and eye irritation, headaches, dizziness, respiratory difficulties, and stress. Chronic exposure can result in damage to the central nervous system, respiratory system, hematological system, and immune system (ATSDR, 1999).

<u>Chemical Exposures</u>

Exposure pathways for on-site receptors during the construction and operation phases of the proposed project include direct contact with soil, such as incidental ingestion, dermal contact, and particulate inhalation. Exposure to soil is anticipated during the construction and operation phases for activities that involve the disturbance and movement of existing and/or newly contaminated soil from spills. Off-site local and regional receptors are not anticipated to be affected by on-site soil impacts as the exposure pathways are incomplete given the general immobility of soil.

As such, the potential health impacts associated with chemical exposures in soil for both the construction and operation phases are as follows:

- Vulnerable populations could include those with pre-existing conditions or chemical sensitivities;
- Potential human receptors that could be impacted by chemical exposures from the Project are limited to on-site receptors, such as construction and operational workers at the site;
- Magnitude of impact is expected to be high given the potential for both acute and chronic health symptoms from exposure to PHCs and other chemicals in surface soils; and,
- The cumulative likelihood of health impacts is high given that the baseline conditions of soil PHC contamination are expected to be poor since there are reports of spillage at surface throughout the site.

Based on the high magnitude and likelihood, soil quality as an overall determinant of health is negative during construction and operations.

COMMUNICABLE DISEASE AND BIOLOGICAL INJURY

Communicable diseases are spread through direct or indirect contact with a human or animal vector infected with a virus, bacteria, or parasite (Edemekong et al., 2020). Mosquito and other invertebrate vector related diseases include but are not limited to malaria, schistosomiasis, dengue, onchoceriaciasis, lymphatic filariasis, yellow fever, West Nile, and Zika (IFC 2009). Diseases, such as human immunodeficiency virus (HIV) and Hepatitis B or C, could potentially be introduced by foreign workers to the local community and be transferred from person to person through activities such as unprotected sex, sharing needles or medical equipment, and breastfeeding (CDC, 2019). Other diseases, such as tuberculosis (TB) and coronavirus (Covid-19), can spread from person to person through air droplets following coughing, sneezing, or close contact (WHO, 2020). As stated in the baseline health assessment (Section 5.5), communicable diseases are prevalent in The Bahamas. Vaccinations and preventative measures are key to limiting their spread.

Biological organisms can also cause poisoning and wounds. Bites and stings from snakes, bees/wasps, scorpions, and spiders, as well as dermal contact and ingestion of certain plants may result in injuries.

<u>Occurrence</u>

Vector-related diseases typically occur as a result of standing water, which for example enables mosquitos to propagate and spread disease (CDC, 2016). Mosquitos and flies could spread disease both on-site and off-site.

Improper storage and disposal of waste materials can also attract pests that are known disease vectors, such as rats.

As such, the potential health impacts associated with occurrence of communicable disease and biological injury for both the construction and operation phases are as follows:

- Vulnerable populations could include pregnant female workers (e.g. Zika virus);
- Potential human receptors that could be impacted by diseases mainly include on-site receptors such as workers at the site but could also include local individuals off-site as vectors could leave the site;
- Magnitude of impact is expected to be high given that diseases can result in serious long-term health effects and death; and,
- Likelihood of health impacts is low as many of these vector-borne illnesses and diseases are not prevalent in the area.

Based on the high magnitude and high likelihood, communicable disease and biological injury as an overall determinant of health is negative during both the construction and operation phases.

AESTHETICS

Aesthetics improve overall desirability of being in or living amidst a particular place. Industrial development can affect overall local aesthetics.

Visual

Off-site local receptors may feel annoyance, stress, anxiety, and/or negative perceptions with respect to the proposed project and presence of the larger industrial footprint. The proposed project will necessitate building new infrastructure, storage of materials and waste, and staging areas. In the past, BPL has received concerns and inquiries from adjacent landowners relating to new development at the site.

As such, the potential health impacts associated with visual aesthetics for both the construction and operation phases are as follows:

- Vulnerable populations are not applicable;
- Potential human receptors that could be impacted by visual aesthetics include off-site local receptors within a mile of the site;
- Magnitude of impact is expected to be moderate given the potential for negative mental health impacts; and,
- Likelihood of health impacts is moderate.

Based on the moderate magnitude and likelihood, visual aesthetics as an overall determinant of health is negative during both the construction and operation phases.

TRAFFIC IMPACTS

Development of the site for the proposed project has the potential to increase traffic flow in the general area of the site during both the construction and operation phases, but particularly during construction. Southwest Road is the only road that provides access to CPPS. It is a two-lane public road that is used by all types of vehicles. Traffic delays during peak hours are possible along Southwest Road during the construction phase. The increased traffic will also increase pressure for maintenance activities on existing road infrastructure.

Accidents

Construction Phase

According to a Bahamas Ministry of Health Survey conducted in 2019, approximately 45% of Bahamians do not consistently use their seatbelts and 75% of motorcycle/scooter drivers do not always wear a helmet (MOH, 2019). Due to the increased number of vehicles associated with the construction of the proposed project, it is possible that vehicular related accidents resulting in injuries and fatalities could increase. Construction accidents could occur in the marine environment (i.e. boats) or on land at the project site. Pedestrians along the Southwest Road to the proposed project site could be affected, especially at higher traffic flow times.

As such, the potential health impacts associated with traffic accidents for the construction phase are as follows:

- Vulnerable populations include pedestrians and cyclists, especially children and seniors as well as visual and hearing-impaired individuals;
- Potential human receptors that could be impacted by traffic include on-site receptors and local and regional off-site receptors;

- Magnitude of impact is high due to the possibility of severe injury or death; and,
- Likelihood of health impacts is moderate as accidents are more likely to occur relative to baseline conditions based on increased traffic.

Based on the high magnitude and moderate likelihood, traffic accidents as an overall determinant of health are negative during the construction phase.

Operation Phase
Operational accidents are expected to be similar to the baseline conditions since traffic flow to and from the site will be similar to that of the operation of the existing power plants (i.e. Station A, B and C).

As such, the potential health impacts associated with traffic accidents for the operation phase are as follows:

- Vulnerable populations include pedestrians and cyclists, especially children and seniors as well as visual and hearing-impaired individuals;
- Potential human receptors that could be impacted by traffic include on-site receptors, local, and regional off-site receptors;
- Magnitude of impact is low for the proposed project as the severity of the health impact is not expected to change from baseline traffic conditions; and,
- Likelihood of health impacts is low as the frequency of health impacts is not expected to change significantly relative to the baseline traffic conditions, and accidents would occur infrequently.

Based on the low magnitude and low likelihood, traffic accidents as an overall determinant of health are considered to be neutral during the operation phase.

ECONOMIC
Economic changes associated with the proposed project are anticipated to be beneficial to the local and regional community surrounding the site. Given the nature of the project, imported labour will likely be required in order to meet the technical capacity required for the construction of the new facility, however employing Bahamians to supplement the construction would be advantageous where possible. It is understood that Wartsila will operate and maintain the plant via an Operation and Maintenance Agreement that trains local Bahamians.

<u>Employment</u>
Construction Phase
Employment opportunities are expected to increase during the construction phase. The health benefits of employment include decreased financial stress and increased physical and mental well-being as a result of available income to spend on nutritious food, safe housing, and health services, such as dental and pharmaceuticals (Goodman, 2015).

As such, the potential health impacts associated with employment for the construction phase are as follows:

- Vulnerable populations not applicable;
- Potential human receptors that could be impacted by employment include local and regional receptors in the workforce;
- Magnitude of the impact is expected to be moderate. Employment opportunities will be available short term, for the length of construction, and will provide benefits to health for that period of time; and,
- Likelihood of health impacts occurring are moderate since the associated health benefits are not long-term.

Based on the moderate magnitude and likelihood, employment as an overall determinant of health is positive during the construction phase.

Operation Phase

The level of employment during the operation phase is expected to be similar to the level of employment under baseline conditions with the existing power plants since the proposed project is not intended to increase production, as discussed in Section 5.3.2. Wartsila is expected to operate and maintain the plant via an Operation and Maintenance Agreement using a fully trained Bahamian workforce.

As such, the potential health impacts associated with employment for the operation phase are as follows:

- Vulnerable populations include those living in poverty or the unemployed/underemployed;
- Potential human receptors that could be impacted by employment include local and regional receptors in the workforce;
- Magnitude of the impact is expected to be low since employment is expected to be similar to the baseline employment levels at the site; and,
- Likelihood of health impacts are low since the employment rate is expected to be similar to the baseline employment levels at the site.

Based on the low magnitude and likelihood, employment as an overall determinant of health is neutral during the operation phase.

<u>Property Values</u>

Property values are an indicator of socioeconomic status. Higher residential property values are therefore expected to be correlated with lower health risks. This inverse relationship has been demonstrated by studies that found that higher property values are associated with lower risk of obesity, diabetes, high density cholesterol, and hypertension (Coffee et al., 2013; Drewnowski et al., 2014). Property development may also cause increased stress and anxiety in adjacent property owners due to the lack of uncertainty with the impact on their property values.

Property values adjacent to the site are not anticipated to differ based on the proposed project. Land use will remain as industrial. The improved infrastructure associated with the proposed project is not anticipated to reduce local property values. Residential neighbours should be informed of this during the public meetings to ease stress and anxiety. It is also possible that property values might benefit from the replacement of HFO and ADO with LNG in the future. However, this HIA was completed in consideration all three fuel types. It is possible that some workers could choose to live closer to where they work. It is understood that the residential neighbourhoods closest to the site are approximately one third vacant.

As such, the potential health impacts associated with property values with respect to economic impacts during both the construction and operation phases are as follows:

- Vulnerable populations include current and future property owners in the local vicinity of the site;
- Potential human receptors that could be impacted by property values include local receptors, such as property owners within a one mile vicinity of the site;
- Magnitude of impact is expected to be low as health outcomes are not anticipated other than minor stress and anxiety; and,
- Likelihood of health impacts are low as property values are not expected to change from redevelopment.

Based on the low magnitude and likelihood, property values as an overall determinant of health is neutral during the construction and operation phases.

Local Revenue

Local revenue is linked to the availability of services associated with health, including but not limited to clinics and hospitals, social services (e.g. addiction counselling), child services, education, emergency services (police, fire, ambulance), greenspace initiatives, road maintenance, and drinking water infrastructure. The proposed project will generate local revenue in the form of taxes for the region. Taxes associated with construction and operation will benefit the community at large and contribute to overall health and well-being. Active involvement by community members can have positive effects on human health by achieving a sense of belonging, as well as increased self-esteem and ability to cope with stress (Cohen et al., 2000; Poortinga, 2006).

Wartsila is responsible for the design and construction of Station D and will transfer operations to BPL staff (as described in Section 3.5). Foreign workers are expected to be on-site to supervise and direct construction activities due to the technical nature of some aspects of the project that require previous experience. It is likely that these workers will contribute revenue for local hotels and short-term rentals, as well as other small businesses, such as restaurants and entertainment.

In the future, hydro bills for local residents and businesses may also decrease due to an increase in system efficiency, reliability, and tri-fuel technology. This could lead to cost savings and growth opportunities in the community.

As such, the potential health impacts associated with local revenue with respect to economic impacts during both the construction and operation phases are as follows:

- Vulnerable populations include those living in poverty;
- Potential human receptors that could be impacted by local revenue include regional receptors across the Island;
- Magnitude of impact is expected to be moderate since local revenue will likely benefit the regional community as it can generate additional funds for community projects depending on how the local revenue is allocated (e.g. parks, community centres, etc.); and,
- Likelihood of health impacts are moderate.

Based on this information, local revenue with respect to economics as a health determinant is positive during both the construction and operation phases.

SOCIAL

Protecting social welfare is an important aspect to overall health. A significant benefit of this proposed project will be the production of more reliable and stable energy production that will positively impact the local and regional communities across the entire island.

Community engagement can increase sense of belonging, increasing self-reported health status, and strengthening ability to cope with stress (Poortinga 2006). As described in Section 6.1.4 of the EIA, three webinars were held to enable stakeholders from the community groupings outlined below to learn about the proposed project design and to identify impacts and proposed mitigation measures:

1. General public and neighbouring residents;
2. Environmental non-Governmental organizations; and,
3. Private businesses.

<u>Hazard Perception</u>

Residential proximity to industrial sites has been correlated with negative mental health impacts (Downey et al., 2005; Boardman et al., 2009). People living within the vicinity of industrial activities often have negative perceptions, such as viewing industry as a health threat and the cause of neighborhood disorder and powerlessness (Downey et al., 2005). The employment opportunities generated by the project development will also potentially attract foreign workers, which could lead to negative perceptions amongst the local community about hiring foreign workers during periods of high local unemployment (Section 6.4.4).

As such, the potential health impacts associated with hazard perception with respect to social impacts during both the construction and operation phases are as follows:

- Vulnerable populations include locals that are unemployed or underemployed;
- Potential human receptors that could be impacted by hazard perception include local receptors within the vicinity of the site;
- Magnitude of impact is expected to be moderate given the potential for negative mental health impacts; and,
- Likelihood of health impacts is moderate.

Based on the moderate magnitude and likelihood, hazard perception as a determinant of health is negative during the construction and operation phases.

Recreational Use

The project is not anticipated to negatively affect recreational areas given that development of the proposed project will occur on land that is currently industrial. There is no direct tourist or recreational areas on the site. Recreational areas are present off-site in the local area around the site but are not anticipated to be affected incrementally by the new infrastructure associated with the proposed project. Baseline conditions of groundwater at the site are expected to improve with the implementation of the proposed plan which could reduce any off-site migration of contaminants.

As such, the potential health impacts associated with recreational use with respect to social impacts during both the construction and operation phases are as follows:

- Vulnerable populations include recreational users;
- Potential human receptors that could be impacted by recreational use include local receptors potentially using waterbodies adjacent to the site;
- Magnitude of impact is expected to be low as health outcomes are not anticipated from social impacts with respect to recreational use other than minor annoyance by local receptors (i.e. increased stress); and,
- Likelihood of health impacts are low.

Based on the low magnitude and likelihood, recreational use as a determinant of health is neutral during the construction and operation phases.

CULTURAL HERITAGE

Cultural heritage in the context of this proposed project include the potential for uncovering archeological and paleontological resources, built heritage resources, and community organizations (Section 5.4). As the site is in an industrial area, impacts to cultural heritage are not expected, and losses of such resources are likely not a factor for this project. A recreational and cultural heritage area, Clifton Heritage National Park, is located approximately 2,165 ft or 0.4 mi (660 m) west of the center of the proposed project site and is therefore considered to be present locally. Cultural heritage provides education, social engagement, and spiritual connection for community members, providing benefits for mental health (Power and Smyth, 2016).

The historical resources within the proposed project area of influence are protected at the Clifton Heritage National Park. There are no known archaeological and historical resources at the proposed BPL power plant site. It is therefore unlikely that any cultural heritage impacts will be encountered as a result of the proposed project given the industrial history of the site. This is most applicable during the construction phase of the proposed project when construction related digging or transportation and delivery of materials by water might be required. An archeological plan should be developed for the construction project such that if anything is uncovered, proper measures to accommodate it will be in place. Any discovery of historical, archaeological, or cultural resources are required to be reported to AMMC (Section 4.1.8).

As such, the potential health impacts associated with cultural heritage during both the construction and operation phases are as follows:

- No vulnerable populations applicable;
- Potential human receptors that could be impacted by cultural heritage include on-site and local receptors;
- Magnitude of impact is expected to be low as health outcomes are not anticipated from cultural heritage other than annoyance by on-site personnel (i.e. increased stress) in the event that historical artifacts are uncovered and work is delayed; and,
- Likelihood of health impacts are low as site work is unlikely to affect cultural heritage.

Based on the low magnitude and likelihood, cultural heritage as a determinant of health is neutral during the construction and operation phases.

Table 6-12: Summary of Health Determinant Assessment during the Construction Phase

Health Determinant	Potential Health Outcome	Vulnerable Populations	Spatial Extent	Magnitude	Likelihood	Cumulative Health Determinant Outcome (Baseline and Proposed Project)
Air Quality Impacts						
Odour	Respiratory ailments	Odour sensitive individuals, asthmatics, individuals with respiratory ailments, migraine sufferers	On-site and Local	Moderate	High	Negative
Chemical Emissions	Respiratory ailments, asthma, lung and heart disease, cancer, adverse birth outcomes	Individuals with chemical sensitivities, asthmatics, respiratory ailments, migraine sufferers	On-site and Local	High	High	Negative
Particulate Matter	Respiratory and heart ailments, adverse birth outcomes.	Individuals with pre-existing respiratory or heart conditions, asthmatics	On-site and Local	High	High	Negative
Vapour Intrusion	Respiratory ailments, asthma, lung and heart disease, cancer, adverse birth outcomes	Individuals with chemical sensitivities, asthmatics, respiratory ailments, migraine sufferers	On-site and Local	High	High	Negative
Noise Impacts						
Levels	Sensitivity, hearing loss, sleep disturbance	NSR1-3, pre-existing hearing impairment	On-site and Local	High	High	Negative
Water Quality Impacts (ground and surface)						
Chemical exposures	Acute and chronic ailments	Individuals with pre-existing conditions or chemical sensitivities	On-site and local	High	Moderate	Negative

Health Determinant	Potential Health Outcome	Vulnerable Populations	Spatial Extent	Magnitude	Likelihood	Cumulative Health Determinant Outcome (Baseline and Proposed Project)
Soil Quality Impacts						
Chemical exposures	Acute and chronic ailments	Individuals with pre-existing conditions or chemical sensitivities	On-site	High	High	Negative
Communicable Disease and Biological Injury Impacts						
Occurrence	Malaria, West Nile, Zika etc.	Pregnant female workers	On-site	High	Low	Negative
Aesthetic Impacts						
Visual	Perception related: annoyance, anxiety, stress	None	Local	Moderate	Moderate	Negative
Traffic (Marine, Land) Impacts						
Accidents (Pedestrian, Vehicular, Marine)	Physical harm, death	Pedestrians, children, blind/deaf	On-site, local and regional	High	Moderate	Negative
Economic Impacts						
Employment	Physical and mental well-being	None	Local and Regional	Moderate	Moderate	Positive
Property Values	Stress, anxiety, cardiovascular	Current and Future Property Owners	Local	Low	Low	Neutral
Local Revenue	Access to public services, mental health, sense of community	None	Regional	Moderate	Moderate	Positive
Social Impacts						
Hazard Perception	Psychological perception: mental health	Unemployed or Underemployed	Local	Moderate	Moderate	Negative
Recreational Use	Cardiovascular, mental health	Recreational users	Local	Low	Low	Neutral

Health Determinant	Potential Health Outcome	Vulnerable Populations	Spatial Extent	Magnitude	Likelihood	Cumulative Health Determinant Outcome (Baseline and Proposed Project)
Cultural Heritage Impacts						
Cultural heritage	Mental health; annoyance (delays), sense of belonging	None	On-site	Low	Low	Neutral

Table 6-13: Summary of Health Determinant Assessment during the Operation Phase

Health Determinant	Potential Health Outcome	Vulnerable Populations	Spatial Extent	Magnitude	Likelihood	Cumulative Health Determinant Outcome (Baseline and Proposed Project)
Air Quality Impacts						
Odour	Respiratory ailments	Odour sensitive individuals, asthmatics, individuals with respiratory ailments, migraine sufferers	On-site and Local	Moderate	High	Negative
Chemical Emissions	Respiratory ailments, asthma, lung and heart disease, cancer, adverse birth outcomes	Individuals with chemical sensitivities, asthmatics, respiratory ailments, migraine sufferers	On-site and Local	High	High	Negative
Particulate Matter	Respiratory and heart ailments, adverse birth outcomes.	Individuals with, pre-existing respiratory or heart conditions, asthmatics,	On-site and Local	High	High	Negative
Vapour Intrusion	Respiratory ailments, asthma, lung and heart disease, cancer, adverse birth outcomes	Individuals with chemical sensitivities, asthmatics, respiratory ailments, migraine sufferers	On-site and Local	High	High	Negative
Noise Impacts						
Levels	Sensitivity, hearing loss, sleep disturbance	NSR1-3, pre-existing hearing impairment	On-site and Local	High	High	Negative
Water Quality Impacts (ground and surface)						
Chemical exposures	Acute and chronic ailments, sensitivities,	Individuals with pre-existing conditions or chemical sensitivities	On-site and local	High	Low	Negative
Soil Quality Impacts						
Chemical exposures	Acute and chronic ailments	Individuals with pre-existing conditions or chemical sensitivities	On-site	High	High	Negative
Communciable Disease and Biological Injury Impacts						
Occurrence	Malaria, West Nile, Zika etc.	Pregnant female workers	On-site	High	Low	Negative
Aesthetic Impacts						
Visual	Perception related: annoyance, anxiety, stress	None	Local	Moderate	Moderate	Negative
Traffic (Marine, Land) Impacts						
Accidents (Pedestrian, Vehicular, Marine)	Physical harm, death	Pedestrians, cyclists, children, seniors, visual and hearing impaired individuals	On-site, local, regional	Low	Low	Neutral
Economic Impacts						
Employment	Physical and mental well-being	Those living in poverty and the unemployed	Local and Regional	Low	Low	Neutral
Property Values	Stress, anxiety, cardiovascular	Current and Future Property Owners	Local	Low	Low	Neutral

Health Determinant	Potential Health Outcome	Vulnerable Populations	Spatial Extent	Magnitude	Likelihood	Cumulative Health Determinant Outcome (Baseline and Proposed Project)
Local Revenue	Access to public services, mental health, sense of community	None	Regional	Moderate	Moderate	Positive
Social Impacts						
Hazard Perception	Psychological perception: mental health	Unemployed or Underemployed	Local	Moderate	Moderate	Negative
Recreational Use	Annoyance, cardiovascular, mental health	Recreational users	Local	Low	Low	Neutral
Cultural Heritage Impacts						
Cultural heritage	Mental health	None	On-site	Low	Low	Neutral

6.6.4 Monitoring and Evaluation

The HIA identified 10 health determinants relevant to the proposed project. Each determinant was assessed qualitatively based on literature research, previous environmental assessments, predictive air modelling, and documentation provided by BPL. The health outcome for the determinant was categorized as either positive, neutral or negative depending on the magnitude and likelihood of the hazards or benefits associated with both the construction and operation phases of the proposed project. Positive health outcomes are linked to the economy through increased employment opportunities and local revenue, whereas negative health outcomes are linked to traffic accidents, air quality, water quality, soil quality, noise, visual aesthetics, communicable disease and hazard perception. The remaining health determinants are not expected to have a substantial effect on health based on the current information. The overall potential impact that the proposed project will have on the health of workers and off-site receptors is complex but is anticipated to be negative since the potential negative health effects of the proposed project outweigh the positive health effects.

The recommendations outlined in section 7.6 will mitigate any potential negative impacts to human health. The proposed project has a lifespan of 25 years, and therefore, monitoring will be required throughout operation of the proposed project. This will include compliance monitoring for air, soil, and water quality as well as noise and odour levels. The community should also be engaged long-term through public meetings and public outreach to enhance community relations with BPL and to keep the general population informed on potential changes in operations that could influence the health of the local and regional community.

7.0 PROPOSED MITIGATION MEASURES

7.1 Summary of mitigation measures

Table 7-1 below summarizes the mitigation measures that are recommended to minimize or eliminate any negative environmental impacts from the project.

Table 7-1: Summary of Environmental Mitigation Measures

	Mitigation Measures
Materials	Any toxic or hazardous chemicals to be utilized on site can be done so according to Safety Data Sheet (SDS) guidance and safety protocols can be established by project management. Demolished building materials containing hazardous materials, such as mold, will be safely removed and properly disposed of to prevent any risks to human health.
Air quality and dust	Incorporate dust control measures to reduce dust on site and from vehicles leaving the site. Implement best management practices to minimize exhaust emissions which will be outlined in the EMP for the project. Controlling air pollution and recapture of soot and other pollutants will reduce long term risks to birds and humans.
Waste management	Physical supply debris, such as spools for cables, and all plastic packaging on and around the properties should be inventoried and where possible full lifecycle waste management should be implemented. Before an item is imported, the end disposal of its packaging and leftover materials should be planned.
Landscape and visual	Removal of invasive Casuarina trees will occur during clearing of the site. Any landscaping that will occur will utilize native or endemic plant and tree species. A skilled arborist or landscaping contractor will be engaged for any tree trimming necessary along the transport route for equipment being moved from Arawak Cay to CPPS during construction. The contractor will be guided by BPL staff as trimming may entail working near power lines. Construction site will be fenced and a wind screen will be applied to the perimeter fencing to aid in dust control. Construction equipment should be properly maintained to ensure they do not impair air quality.

Water resources	The proposed 'BPL Groundwater Treatment System Project' along with frequent water quality checks (preliminary for hydrocarbon) is recommended to commence prior to the construction of Station D. An annual survey of the groundwater wells is recommended to monitor the groundwater relative to sea level, for predictions of elevated levels as a result of climatic change.
Ecology	Planting diverse trees on property and contributing to tree planting initiatives throughout the Bahamas can mitigate habitat loss and GHG emissions. Contribution to local and national conservation action via targeted finding mechanisms will allow impacted species to be supported in locations external to the development.
Avifauna	Planting native trees on property and supporting local terrestrial conservation will help mitigate effects on native and migratory birds.
Traffic and transport	Develop a traffic management plan to be implemented for the duration of construction. Appropriate signage should be put in place at the project site and along Southwest Road alerting motorist of construction and the potential for delays. Roadside debris from operational supplies should be removed to local waste management facilities. Full lifecycle assessment of supplies and supply waste should be conducted to plan for disposal before import.
Contaminated land	A hazardous waste management plan will be developed as a part of the Environmental Management Plan for the project to ensure construction and operation staff have guidance on safe handling and proper disposal of hazardous materials and waste. While the design of the fuel transport system is closed loop to avoid any spill of material and resulting contamination, the plan will cover transport of fuel into the Station as a potential risk and requisite guidance on necessary action in the event of a spill incident.
Human health	Measures specific to mitigating health impacts are provided in Table 7-2.
Occupational health and safety	Workers will be provided with appropriate protective personal equipment (PPE) for the assigned tasks, including hard hats and high0visibility safety vests.

	All workers will receive training in proper handling of equipment and materials as a part of their orientation before being admitted to the site. There will be regular reinforcement of occupational health and safety procedures during weekly meetings. Information on health and safety procedures (e.g. Material Safety Data Sheets) will be accessible to staff during working hours. At least one staff member will be assigned to ensuring health and safety procedures are being followed during construction and operation activities. Workers will adhere to COVID-19 Emergency Orders requirements inclusive of wearing masks and social distancing.
Impacts on neighbouring communities	Engage stakeholders in the public and private sector, including residents in the communities surrounding Clifton Pier, in advance of construction. Establish lines of communication that will allow for the dissemination of information and the identification of concerns.

7.2 Mitigation measures for the Physical Environment

7.2.1 Mitigation measures for water resources impacts

In an effort to minimize the risk to the water quality, the proposed 'BPL Groundwater Treatment System Project' along with frequent water quality checks (preliminary for hydrocarbon) is recommended.

The purpose of the 'BPL Groundwater Treatment System Project' is "to extract, treat and control contamination". The system comprises of a series of wells, pumps, separators, holding tanks and aeration treatment. Product will be recovered/pumped from the wells and piped to the oil/water separators where it will separate the product from the water. The remediation system will include 37 new recovery wells 7 new monitoring wells and at least three (3) new injection wells.

All recovery wells will be installed with pneumatic, top-loading total-fluids pumps to recover both LNAPL and groundwater and also to monitor oil and groundwater elevations. Monitoring/recovery well will be 8" diameter PVC finished well, with 15 feet of casing from the surface, and an open rock hole drilled to an approximate depth of 45 feet. Each well will have a concrete/bentonite seal along the casing to the surface. Injection wells will be an 8"-diameter well, with 200 feet of casing from the surface, and an open rock hole drilled to a total depth of 300 feet. The injection wells will have a concrete/bentonite seal along the casing to the surface. The injection well network will have the capacity to receive over 300 gallons per minute (gpm) per well at a pressure of no greater than 50 pounds per square inch(psi). More details on the treatment system are provided at Appendix F,

This BPL remediation activity should commence prior to the proposed construction activities for the LNG-Power at Station-D.

Further, any additional cooling supply wells should have a greater horizontal spacing and extended to a depth of 800-Ft (243.84-m) below ground level for colder (temperatures of 72oF / 22oC or lower), higher yield (>7,500-GPM), untainted sources of water.

7.2.2 Mitigation measures for climate change impacts

An annual survey of the groundwater wells is recommended, as part of the Health and Safety Requirements – particularly the shallow fire supply wells, which are more susceptible to the low-density fuel/oil contaminants floating in the upper horizon of the groundwater lens.

The annual well analysis can be utilized to monitor the groundwater levels relative to possible sea level predictions, as a result of climatic change.

7.2.3 Mitigation measures for solid, liquid and hazardous wastes

Covered dumpsters will be used for construction waste. Covered waste receptacles will be strategically placed around the construction site to be utilized by construction staff to dispose of litter (e.g. food containers). Prohibited waste that should not be placed in the waste receptacles or the construction waste dumpsters include waste oil and used absorbent materials; these should be disposed of separately as this type of waste cannot go into the landfill. In order to maintain a clean site, there should be morning and afternoon “walk-throughs” of the project area by designated workers to pick up any stray litter.

A licensed local waste management company will dispose of solid waste from the site during construction and operation in accordance with DEHS standards and only with their approval. Disposal of solid waste from construction and operation will be done at a licensed facility (the New Providence Ecology Park) in compliance with DEHS requirements.

Sewage generated by portable toilets during construction should be pumped away and disposed of at a DEHS-approved facility by a specialist subcontractor. The Water and Sewerage Corporation (WSC) may outline methodologies for disposal of wastewater generated during construction. There will be no drainage of sewage or wastewater on land comprising or near the project site at any time. All activities related to sewage and wastewater management during construction will be subject to approval of respective Government agencies, including the WSC and the Department of Environmental Services (DEHS). The design of toilet facilities and sewage system constructed to be utilized during operation must be approved by WSC and DEHS prior to their construction to ensure they meet national standards.

Any waste oil will be collected in a dedicated oil container and delivered offsite by a local waste management company for disposal and recycling.

The BPL remediation of existing groundwater contamination is expected to improve state of water resources on the site. Construction of Station D with proper management of waste streams from that facility means that negative impacts to groundwater resources are not expected.

7.3 Mitigation measures for Biological Resources

7.3.1 Mitigation measures for habitat loss and degradation

The loss and degradation of local terrestrial habitat can be mitigated through avoiding removal of native plant species, when found; planting native species on the property to increase food resource availability for wildlife and supporting local habitat conservation initiatives and organizations, on the Island of New Providence and nationwide, to plant native trees in permanent locations and to restore other habitats. Wherever landscaping is planned, native species should be utilized. If no landscaping has been planned, native species can be planted along the perimeter of the property with the goal to create a vegetated corridor between green areas outside the project site that smaller animals (e.g. lizards) can traverse.

Landscaping of the developed property with native species will partially mitigate biodiversity loss by replacing key species of trees that support wildlife use, but it is unlikely to completely compensate for the loss of bird, arthropod and reptile diversity. Most species will have to find other nesting and roosting sites and may use landscaping trees for daily forage only.

In addition to supporting native biodiversity, planting native trees can mitigate effects on the visible appearance of the landscape, noise pollution and carbon sequestration or GHG production. Landscaping on the property during development should include native tree species with high quality food value, such as Gum elemi (*Bursera simarouba*), which has value for a variety of bird and animal species. Birds will utilize these trees for resting, feeding and possibly nesting. Landscaping would likely occur towards the end of the construction phase once the Station D and its associated infrastructure is complete.

7.3.2 Mitigation measures for biodiversity impacts (especially on rare and protected species)

The native plants that occur on the site or in the nearby environment should be transplanted or propagated to replace the plant diversity where possible especially for protected plant species. Providing habitat and food tree species for native wildlife will support the endangered and rare birds, but further research would be needed to determine the effect on their populations. The assessment period did not include the winter migrant season and so several species of internationally protected and conservation important bird species may not have been reported although they use the locations for food and roosting sites. Further surveys during migratory bird season are recommended to determine their activity in the area and the impact of development activities on those birds.

7.4 Mitigation measures for Socio-economic Impacts

7.4.1 Mitigation measures for land use impacts

Physical barriers, such as fences and netting, can be used to ensure that dust emissions from construction activities do not go beyond the BPL property. Daily watering of the site during construction can also aid in minimizing dust emissions. Periodic monitoring of the project site will ensure that storage, staging, and parking areas are maintained, and other construction activities do not encroach on nearby properties.

7.4.2 Mitigation measures for impacts on neighbouring communities

Engaging stakeholders prior to the start of construction will allow for communication channels to be established and tested. Stakeholders should be given the opportunity to voice concerns and provide input periodically, so as to ensure that all concerns can be addressed in a timely fashion. This would also reduce the risk of any major conflicts with stakeholders arising unexpectedly and potentially derailing or slowing down the project. Stakeholders should include, but not be limited to, public and private sector entities at Clifton Pier and in the neighboring communities listed in this assessment.

Consultations should also take place with agencies that provide services in the area or have interests and assets in the adjacent area. This is critical as it will allow for better coordination of activities. This would also potentially reduce costs and impacts to the entities and communities they provide services to.

7.4.3 Mitigation measures for traffic impacts

Development of a traffic management plan to be implemented for the duration of construction will reduce impact to traffic. The plan should contain direction for the use of proper speed in and around residential areas, near the school territory, and in locations with known pedestrian traffic.

Appropriate signage should be put in place at the project site and along Southwest Road alerting motorist of construction and the potential for delays. Advertisements and notifications should be sent out in advance to surrounding communities and businesses if significant delays area planned.

Public transportation is not currently available in the area of Clifton Pier and as such, bus transportation for workers who live in surrounding communities should be considered as a means to reduce the impact of increased vehicular use in communities. It would also reduce the need for employee parking on site and lower non-construction vehicular traffic in the immediate area.

Periodic vehicle servicing and inspections to ensure proper functioning may reduce exhaust emissions.

7.4.4 Mitigation measures for economic impacts

A visible hiring campaign that spans The Bahamas, would go a long way in reframing the perception that the preference is to employ foreigners rather than locals. Leveraging local media outlets including print, television, and radio would allow for the casting of a broad reach of potential employees.

7.4.5 Mitigation measures for aesthetic and visual impacts

Physical barriers such as fencing, netting, and temporary storage and staging areas can be used to ensure that visually unappealing aspects of the construction site are not visible outside of the site.

7.4.6 Mitigation measures for impacts on infrastructure and public services

Implementation of a traffic management plan will control aspects of transportation that may impact infrastructure and public services, specifically the use of the public road.

Engaging service providers in advance of construction will allow for proper planning and ramping up of services prior to the increase in demand.

7.5 Mitigation Measures for Cultural Impacts

7.5.1 Mitigation measures for losses of archaeological, historic and paleontological resources

No mitigation measures are necessary due to no archaeological, historic and paleontological resources being present on the project site.

7.5.2 Preservation of resources

No preservation of cultural resources is necessary due to lack of cultural resources on the site.

7.5.3 Mitigation measures for impacts to tourist and recreational areas

The only tourist and recreational activities that may be impacted by the project would include birdwatching due to noise disturbances, and walking and jogging due to any traffic diversions. These impacts are expected to be short-term and temporary. Mitigation during construction would include public notifications of any planned traffic diversions or impacts. No mitigation should be necessary once the plant is in operation.

7.5.4 Mitigation measures for impacts on community organizations

The impacts identified for community organizations are related to their work to conserve natural resources and ecosystems. The mitigation measures for negative environmental impacts, particularly emissions, will support the efforts of these organizations. Partnership with these organizations on water quality monitoring and public education on sources and uses of energy will be pursued by BPL.

7.6 Health and Safety Mitigation Measures

The assessment of each health determinant provided in Section 6.6 and summarized in Tables 6-11 and 6-12 were used to inform the following recommendations of mitigation measures for human health regarding the proposed project. The responsible party for ensuring recommendations are followed is BPL. The following recommendations will be further detailed within the Environmental Management Plan (EMP). Fulfillment of these recommendations will mitigate the potential negative health outcomes described in Tables 6-11 and 6-12.

Table 7-2: Summary of Recommendations of Mitigation Measures for Human Health Determinants

Health Determinant	Recommendation(s) of Mitigations Measures
Air Quality	• Vapour collection system and/or vapour barrier for new and existing buildings. • Continual remediation of groundwater and soil impacts to reduce odours and vapour intrusion. • Long-term indoor air monitoring program. • Complete required compliance air quality monitoring at established regular intervals throughout the year throughout all project stages. • Use LNG as the main fuel source once infrastructure is in place and phase out reliance on HFO and ADO. • Maintain a record of any complaints related to odour or emissions, and respond to complaints by taking mitigative action, if warranted. • Should monitoring results exceed an established target level, conduct additional air monitoring, and implement control measures. • Notify local community when emission levels could impact health. • Use energy efficient construction vehicles and equipment. • Integrate green building technologies into the proposed project where possible. • Implement dust control measures, such as using canvas to cover loads of construction materials, and applying water spray to tires, dirt roads, and other areas. • Ensure routine maintenance of construction equipment/vehicles. • Ensure routine maintenance of operation equipment. • Prepare an emergency response and preparedness plan and public awareness program for workers and the local community in the event of a spill, fire, and/or explosion.
Noise	• Construction and operation workers should be provided a health and safety plan and applicable PPE including hearing protection. • The dates and times of increased noise levels should be communicated with the public during the construction phase. • Model noise associated with construction traffic in advance of construction activities. • Ensure routine maintenance of equipment and vehicles. • Implement noise management plan that includes noise abatement and control measures as necessary during construction and operation phases.
Water Quality	• Site construction and operation workers should follow a health and safety plan and wear appropriate PPE.

Health Determinant	Recommendation(s) of Mitigations Measures
	• Routine monitoring and maintenance of site infrastructure and immediate clean-up of any spills or leaks as per the emergency response plan. • Complete supplemental groundwater and surface water sampling and long-term monitoring programs following completion of the remediation program. • Prepare an emergency response plan and preparedness awareness program for workers and the local community in the event of a spill, fire, and/or explosion.
Soil Quality	• Characterize the site with respect to PHCs in soil and develop a remedial or risk management plan to address the impacts, as suggested by Geosyntec (2020). • Remediation and construction workers would be required to wear appropriate PPE and follow a health and safety plan. • Routine monitoring and maintenance of site infrastructure and immediate clean-up of any spills or leaks as per the emergency response plan. • Prepare an emergency response plan and preparedness awareness program for workers and the local community in the event of a spill, fire, and/or explosion.
Communicable Diseases and Biological Injury	• Develop a maintenance plan to avoid the presence of standing water. • Use of screens on new infrastructure. • Develop a waste management plan to avoid improper waste storage. • Education of workers on-site with respect to breeding sites, use of spray repellants, properly maintained screens on doorways and windows, and the overall mitigation plan.
Aesthetics	• Aesthetic mitigation measures such as reducing glare and excessive lighting, use of paints that are dull or non-reflective, and wrapping stacks. • Integrate green building technologies. • Communication plan to bring public awareness of new development infrastructure and overall visibility.
Traffic	• Traffic flow study to ensure that road network can accommodate increased construction traffic. • Limit designated construction routes to major roadways avoiding residential areas. • Limit construction traffic times to low traffic periods of the day to minimize accidents and truck idling. • Post construction related traffic signs including speed limits, and heavy-equipment crossings on-site. • Educate employees regarding pedestrian safety during commuting times and encourage carpooling and use of public transportation. • Provide public notification of possible traffic delays at certain hours in advance of construction activities.

Health Determinant	Recommendation(s) of Mitigations Measures
Economics	• Hire local talent to complete construction work and operations where possible. • Retain goods and services from local companies where possible. • Where foreign workers are required due to experience requirements, communicate this requirement to the public in advance of arrivals as part of community engagement plan. • Plans to hire local workers should be shared across various media (newspapers, radio, television etc.) to ensure that local individuals have ample opportunity to apply for available positions. • Provide international workers with list of local amenities (e.g. restaurants, lodgings, parks etc.). • Public awareness of the low impact of the project on property values. • Off property value protection agreements for local residents (within one-mile radius of the site). • Inform public on potential impacts to household electricity bills. • Form a community advisory group as part of a community engagement plan to make community specific and informed recommendations on how to spend revenue within the community (e.g. parks, community centres).
Social	• Share air monitoring, soil, surface water and groundwater results with the local community in a timely and user-friendly manner to show progress and work being completed. • Maintain communication with stakeholders including the local community (e.g. newsletters, meetings) to promote social cohesion and education. • Plans to hire local workers should be shared across various media (newspapers, radio, television etc.). • Conduct community livability and quality of life indicator studies on an annual basis that include family-level surveys, focus group discussions and key informant interviews.
Cultural Heritage	• An archaeological mitigation plan should be prepared prior to the construction phase such that a plan is in place should historical artefacts or cultural resources be uncovered.

8.0 PUBLIC CONSULTATION

8.1 Stakeholder Engagement

During development of the BPL Power Plant EIA, SEV conducted a series of three (3) virtual meetings for stakeholders as grouped below:

1. General Public & Neighbors
2. Environmental groups
    a. BREEF
    b. BNT
    c. reEarth
    d. Waterkeepers Bahamas
3. Governmental Agencies
    a. Ministry of Environment and Housing
        i. Department of Environmental Planning and Protection (formerly BEST Commission)
        ii. Department of Environmental Health Services
        iii. Forestry Department
    b. Ministry of Works
    c. Department of Physical Planning
    d. Clifton Heritage Authority
    e. Royal Bahamas Defence Force (RBDF)
    f. Water & Sewerage Corporation

The virtual meetings were hosted by SEV on WebEx (Government agencies and NGOs) and on Zoom (General public). Arcadis also participated in the meetings. Each meeting was scheduled for one (1) hour with 20 minutes for a PowerPoint presentation on the project as well as an overview of potential impacts and proposed mitigation measures and then 40 minutes for Q&A by meeting participants.

BPL and Wartsila technical representatives participated in each meeting to answer any technical questions about Station D and its design.

BPL acknowledges that there will be the need for additional consultations during the EIA review process of the Department of Environmental Planning and Protection. These are expected to occur in early 2021 per the guidance of DEPP. Due to the likelihood of COVID-19 restrictions still being in place with requisite social distancing requirements and prohibition on large indoor gatherings, it is recommended that these consultations follow a similar format as was utilized for the consultations described above, i.e. virtual meetings.

8.2 Minutes of the Stakeholder Consultations

The minutes of the stakeholder consultations can be found at Appendix I.

9.0 ENVIRONMENTAL MANAGEMENT PLAN

An EMP will be prepared for the proposed project that covers mitigation measures, monitoring, and institutional strengthening, to the extent required. An outline of the EMP and its planned components are provided below. The EMP will be fully developed after No Objection to the EIA. Once the No Objection of the EMP is received, the project will be issued a Certificate of Environmental Clearance by DEPP to enable construction to begin on the project site.

Executive Summary
A summary of the project and proposed mitigation measures.

1.0 Introduction
An overview of the project and its location. This section will also include the objectives of the EMP and its scope with respect to mitigation measures.

2.0 Project Description
A description of the project and its location inclusive of project site plan.

3.0 Proposed mitigation measures
Details on the mitigation measures as outlined in the project EIA specifically as it relates to the following:

3.1 Materials
3.2 Air quality and dust control
3.3 Waste management
3.4 Landscape and visual
3.5 Water resources
3.6 Ecology
3.7 Avifauna
3.8 Traffic and transport
3.9 Contaminated land
3.10 Human health
3.11 Occupational health and safety – Details on safety measures for worker health and safety inclusive of handling materials contaminated with mold and measures to be taken to adhere to COVID-19 Emergency Orders.
3.12 Impacts on neighbouring communities – inclusive of public awareness and communication measures that will be taken to keep the public, particularly neighbouring businesses and residents of construction activities that may impact them, such as traffic delays.
3.13 Environmental and social monitoring – Description of monitoring activities that will occur inclusive of scheduled site inspections.

4.0 Conclusions
Concluding remarks on implementation of recommended mitigation measures.

References
Any reference materials utilized in preparation of the EMP.

Appendices
The EMP will include the following appendices to support the main text of the document:

- Appendix I: Demolition Schedule
- Appendix II: Spill Response Plan
- Appendix III: Hazardous Material Management Plan
- Appendix IV: Emergency Response Plan
- Appendix V: Hurricane Preparedness Plan
- Appendix VI: Complaint Form
- Appendix VII: Inspection Form

10.0 CONCLUSIONS

Through this Environmental Impact Assessment, there has been identification of potential impacts from the BPL Station D project. Mitigation measures have been identified for those impacts that have been categorized as negative. With implementation of these measures, the project can be executed in an environmentally sustainable manner. BPL is committed to doing this.

APPENDICES

APPENDIX A: GHG DATA SHEETS AND INDICATIVE FLUE GAS EMISSIONS

The GHG and Flue Gas Emissions Data Sheets were provided by Wärtsilä.

Stack is calculated as a cluster of 6 stacks with a calculated equivalent stack diameter of 3.92 m, not as individual stack pipes; if stack is to be calculated as individual stacks, individual stack diameters must be given separately. Flow-velocity and temperature per pipe will be the same. Stack sources are for engines only. Wärtsilä cannot guarantee AAQ figures as they are dependent on things outside of their control (including background, other sources, topography, weather conditions and the like).

Doc. Name	BPL Station D 18V50DF D, HFO - GHG Data Sheet		
Doc. ID	DESA00007786	**Revision**	-
Doc. Type	Data Sheet	**Pages**	1 (1)
Author	Söderlund, Michael - Wärtsilä Energy Business	**Status**	Approved
Oppertunity	**Error! Unknown document property name.** Söderlund, Michael 23 Apr. 20		

This document provides typical greenhouse gases (CO_2, CH_4 and N_2O) as CO_2 equivalents. Greenhouse gases as CO_2 equivalents are principally calculated following the IPCC guideline 2006[1] with global warming potential factors from IPCC 2007 AR4. Countries reporting greenhouse gases to the United Nations Framework Convention on Climate Change (UNFCCC).i.e following the Kyoto protocol must report their emissions with global warming potentials from IPCC 2007 AR4 from year 2015 onwards.[2] [3]

Engine: Wärtsilä® 18V50DF D at 514 RPM (constant speed), CR 12, NOx tuning 970 ppm at 15 vol-% O_2, dry

Site design conditions:

- Intake air or ambient temperature	30	°C
- Relative humidity	78	%
- Min. absolute humidity	6	$g_{water}/kg_{dry\ air}$
- Altitude above sea level	15	m

Heat rate (LHV)	8433	kJ/kWh at generator terminal

Typical greenhouse gases as CO_2 equivalents at normal steady full (100 %) load at site conditions and HFO operation after engine:

- CO_2 emissions	max.	652,7	g/kWh	at generator terminals
- CH_4 as CO_2 equivalents	max.	0,6	g/kWh	at generator terminals
- N_2O as CO_2 equivalents	max.	4,5	g/kWh	at generator terminals

- **Typical total greenhouse gases as CO_2 equivalents**
  max. 657,8 g/kWh at generator terminals

[1] http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Vol. 2 – Energy, Chapter 1:Introduction, Table 1.4 on page 23-24

[2] UNFCCC Decision 24/CP.19, 2 http://unfccc.int/resource/docs/2013/cop19/eng/10a03.pdf#page=2)

[3] IPCC AR4 2007 factors: https://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html

Doc. Name	BPL Station D 18V50DF D, LNG - GHG Data Sheet		
Doc. ID	DESA00007785	**Revision**	-
Doc. Type	Data Sheet	**Pages**	1 (1)
Author	Söderlund, Michael - Wärtsilä Energy Business	**Status**	Approved
Oppertunity	**BPL Plant Extension (OP657569)** Söderlund, Michael 23 Apr. 20		

This document provides typical greenhouse gases (CO_2, CH_4 and N_2O) as CO_2 equivalents. Greenhouse gases as CO_2 equivalents are principally calculated following the IPCC guideline 2006[1] with global warming potential factors from IPCC 2007 AR4. Countries reporting greenhouse gases to the United Nations Framework Convention on Climate Change (UNFCCC).i.e following the Kyoto protocol must report their emissions with global warming potentials from IPCC 2007 AR4 from year 2015 onwards.[2] [3]

Engine: Wärtsilä® 18V50DF D at 514 RPM (constant speed), CR 12

Site design conditions:

- Intake air or ambient temperature	30	°C
- Relative humidity	78	%
- Min. absolute humidity	6	$g_{water}/kg_{dry\ air}$
- Altitude above sea level	15	m

Heat rate (LHV)	8071	kJ/kWh at generator terminal

Typical greenhouse gases as CO_2 equivalents at normal steady full (100 %) load at site conditions and gas operation after engine:

- CO_2 emissions	max.	452,8	g/kWh	at generator terminals
- CH_4 as CO_2 equivalents	max.	65,8	g/kWh	at generator terminals
- N_2O as CO_2 equivalents	max.	3,8	g/kWh	at generator terminals

- **Typical total greenhouse gases as CO_2 equivalents**
  max. 522,4 g/kWh at generator terminals

[1] http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Vol. 2 – Energy, Chapter 1:Introduction, Table 1.4 on page 23-24

[2] UNFCCC Decision 24/CP.19, 2 http://unfccc.int/resource/docs/2013/cop19/eng/10a03.pdf#page=2)

[3] IPCC AR4 2007 factors: https://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html

Classification: Confidential

Name:	BPL Station D 18V50DF D, HFO - Indicative Emissions		
Author:	Söderlund, Michael	**Doc ID:**	DESA00007782
Created on:	4/23/2020	**Status:**	Approved
Modified by:	Söderlund, Michael	**Revision:**	-
Type:	Data Sheet	**Modified:**	4/23/2020
Project name:	BPL Plant Extension (OP657569)		

Wärtsilä Energy Business

This document provides indicative flue gas emissions, i.e. average values for emissions measured over a period of minimum 60 minutes at steady engine load. The indicative emissions are based on the site conditions, fuel quality and measurement methods specified in this document.

Engine

Engine type	W 18V50DF D	at 514 RPM (constant speed)

Site conditions

Ambient air temperature	°C	30
Ambient air relative humidity	%	78
Minimum humidity ratio	g_{water}/kg_{air}	6
Altitude above sea level	m	15

Typical variations in ambient conditions for the site are covered for the given emission values.

HFO specification

Viscosity, max.	at 50 °C	cSt	380
Density, max.	at 15 °C	kg/m^3	1003.0
Sulphur, max.		%-mass	3.00
Ash, max.		%-mass	0.150
MCR, max.		%-mass	18
Asphaltenes, max		%-mass	10
Min. Lower Heating Value:		kJ/kg	39,800

Lubricating oil: According to Wärtsilä's specification.

Other fuel parameters according to Wärtsilä's specification.

Indicative maximum flue gas emissions at steady load after exhaust gas heat recovery

Generator load		%	100
NO_x Nitrogen oxides	as NO_2, dry 15% O_2	mg/Nm^3 milligram / normal cubic meter	2000
SO_2 Sulphur oxides	dry 15% O_2	mg/Nm^3 milligram / normal cubic meter	1800.00
PM Particulate matter (as dry dust)	dry 15% O_2	mg/Nm^3 milligram / normal cubic meter	125.0

Exhaust gas volume defined at *0 °C , 101,325 kPa (absolute pressure)*
Minimum exhaust gas temperature at measurement location 250 °C

Emission measurement methods

Emission data provided in this document is valid only with the measurement methods listed below

Nitrogen oxides (NO_x)

EN 14792:2017. Stationary source emissions. Determination of the mass concentration of nitrogen oxides. Standard reference method. Chemiluminescence.

Sulphur oxides (SO_2)

ISO/CD 8178-1:2017 Chapter 7.3.7.1: Sulphur oxides are calculated from sulphur content in the fuel.

Particulates

Particulate matter (as dry filterable dust)
ISO 9096:2017. Stationary sources emissions - Manual determination of mass concentration of particulate matter (in-stack filtration)

Oxygen (O_2)

EN 14789:2017. Stationary source emission - Determination of volume concentration of oxygen - Standard reference method: Paramagnetism

Based on mutual written consent, emission measurements can be made using alternative methods.

Measurement uncertainties and acceptance: The measurement tolerances (uncertainties) will be as specified by the measurement consultant. Assessment of the fulfilment of the guarantees shall be made according to Section 6.2 of the VDI 2048 guidelines "Uncertainties of measurement during acceptance tests on energy-conversion and power plants".

Measurement principles: Before emission testing, the engines to be tested shall be operated minimum two (2) hours on the guarantee load. Emission testing for particle emissions shall be carried out with the engines at steady load by taking appropriate amount of samples from stacks and calculating the engine-specific average result based on these samples. For emission guarantees to be valid, fuel samples should be taken during the emission test to verify that fuel quality is according to the fuel specification in this document.

At tested site conditions, same type of engines with identical tuning settings have similar emission performance. In plants having multiple engines, appropriate amount of engines will be tested, one engine per stack cluster or one engine per engine hall is typically enough. Based on the judgement of the measurement consultant, the results of the individual samples with abnormally high deviation shall be excluded. The plant average result of all the tested engines is calculated from the engine-specific average results. The plant average result, after corrected with the measurement tolerances as specified above, shall be used to verify the fulfilment of the guarantee. In case the plant average result is not in compliance with the guarantee value, the engine(s) causing the non-compliance with high engine-specific average results as per the evaluation and decision by Wärtsilä, shall be checked and adjusted. The flue gas emissions of those re-adjusted engi-ne(s) shall be re-tested according to the same guidelines as used in the original emission tests.

Classification: Confidential

Name:	BPL Station D 18V50DF D, LNG - Indicative Emissions		
Author:	Söderlund, Michael	**Doc ID:**	DESA00007781
Created on:	4/23/2020	**Status:**	Approved
Modified by:	Söderlund, Michael	**Revision:**	-
Type:	Data Sheet	**Modified:**	4/23/2020
Project name:	BPL Plant Extension (OP657569)		

This document provides indicative flue gas emissions, i.e. average values for emissions measured over a period of minimum 60 minutes at steady engine load. The indicative emissions are based on the site conditions, fuel quality and measurement methods specified in this document.

Site conditions

Engine type	W 18V50DF D	at 514 RPM (constant speed)
Compression ratio		12.0
Ambient air temperature	°C	30
Ambient air relative humidity	%	78
Minimum humidity ratio	g_{water}/kg_{air}	6.0
Altitude above sea level	m	15

Fuel gas specification

The emissions are valid for following gas composition. It is understood that variations in the gas compostion inside this specification will occour and are permitted; however sudden extreme changes in gas temperature, pressure or composition are not allowed.

Methane Number (MN) min			80
CH_4	Methane, min	mol %	97.07
C_2H_6	Ethane, max	mol %	1.83
C_3H_8	Propane, max	mol %	0.49
i-C_4H_{10}	i-Butane, max	mol %	0.11
n-C_4H_{10}	n-Butane, max	mol %	0.11
i-C_5H_{12}	i-Pentane, max	mol %	0.03
n-C_5H_{12}	n-Pentane, max	mol %	0.02
n-C_6H_{14}	n-Hexane, max	mol %	0.02
n-C_7H_{16}	n-Heptane and higher, max	mol %	0.00
CO_2	Carbon dioxide	mol %	0.01
N_2	Nitrogen	mol %	0.31
S	Total sulphur, max	ppm-v	10

No silicon and aromatic based compounds

Other gas parameters according to Wärtsilä's specification.

Liquid fuel analysis

Viscosity, max.	at 40 °C	cSt	11
Density, max.	at 15 °C	kg/m^3	834.8
Sulphur, max.		%-mass	0.0015
Ash, max.		%-mass	0.010
Min. Lower Heating Value:		kJ/kg	42,910
Cetane number, min			40

Other fuel parameters according to Wärtsilä's specification.

Lubricating oil: According to Wärtsilä's specification.

Indicative maximum flue gas emissions at steady load after exhaust gas heat recovery

Generator load		%	100
NO_x Nitrogen oxides	as NO_2, dry 15% O_2	mg/Nm^3 milligram / normal cubic meter	400

Exhaust gas volume defined at *0 °C , 101,325 kPa (absolute pressure)*

Emission measurement methods

Emission data provided in this document is valid only with the measurement methods listed below

Nitrogen oxides (NO_x)

EN 14792:2017. Stationary source emissions. Determination of the mass concentration of nitrogen oxides. Standard reference method. Chemiluminescence.

Oxygen (O_2)

EN 14789:2017. Stationary source emission - Determination of volume concentration of oxygen - Standard reference method: Paramagnetism

Based on mutual written consent, evaluation of emission levels can be made by using alternative methods.

Measurement uncertainties and acceptance: The measurement tolerances (uncertainties) will be as specified by the measurement consultant. Assessment of the fulfilment of the guarantees shall be made according to Section 6.2 of the VDI 2048 guidelines "Uncertainties of measurement during acceptance tests on energy-conversion and power plants".

Measurement principles: Before emission testing the engines to be tested shall be operated minimum two (2) hours on the guarantee load. Emission testing for particle emissions shall be carried out with the engines at the full steady load by taking appropriate amount of samples from stacks and calculating the engine-specific average results based on these samples.

At tested site conditions, same type of engines with identical tuning settings have similar emission performance. In plants having multiple engines, appropriate amount of engine will be tested, one engine per stack cluster or one engine per engine hall is typically enough. Based on the judgement of the measurement consultant, the results of the individual samples with abnormally high deviation shall be excluded. The plant average result of all the tested engines is calculated from the engine-specific average results. The plant average result, after corrected with the measurement tolerances as specified above, shall be used to verify the fulfilment of the guarantee. In case the plant average result is not in compliance with the guarantee value, the engine(s) causing the non-compliance with high engine-specific average results as per the evaluation and decision by Wärtsilä, shall be checked and adjusted. The flue gas emissions of those re-adjusted engine(s) shall be re-tested according to the same guidelines as used in the original emission tests.

APPENDIX B: MAPS & DRAWINGS

APPENDIX C: REFERENCES TO LITERATURE AND SOURCES

2010 Census of Population and Housing: New Providence. (2012). Nassau, Bahamas: Department of Statistics of the Bahamas.

American Academy of Pediatrics (AAP). 2004. Ambient Air Pollution. Health Hazards to Children. *Pediatrics*, 114, 6.

Areces-Mallea AE. Weakley AS, Li X, Sayre RG, Parrish JD, Tipton CV, Boucher T. (1999). *A guide to Caribbean vegetation types: Preliminary classification system and descriptions*. Panagopoulos N (Ed.), Arlington, VA: The Nature Conservancy. Retrieved from https://www.conservationgateway.org/ConservationByGeography/NorthAmerica/Documents/A-Guide-to-Caribbean-Vegetation-Types.pdf

ATSDR. 2017. *Are Environmental Odours Toxic?* Available from: https://www.atsdr.cdc.gov/odours/

ATSDR. 1999. *Toxicological Profile for Total Petroleum Hydrocarbons (TPH)*.

Bahamas National Trust website. (2009). www.bnt.bs

Cant, R. V., and Weech, P. S. (1986). A review of the factors affecting the development of Ghyben-Hertzberg Lenses in the Bahamas. In *Journal of Hydrology*.

Centers for Disease Control and Prevention. 2016. The National Institute for Occupation Safety and Health (NIOSH) Mosquito – Borne Diseases. Available from: https://www.cdc.gov/niosh/topics/outdoor/mosquito-borne/default.html

CH2M. 2016. *Preliminary Activities Summary Report. January*.

Coffee, N.T., Lockwood, T., Hugo, G., Paquet, C., Howard, N.J., Daniel, M. 2013. Relative residential property value as a socio-economic status indicator for health research. *International Journal of Health Geography*. 12:22

Cohen, S., Underwood, L.G., Gottlieb, B.H. 2000. *Social Support Measurement and Intervention*. Oxford University Press. New York.

Currie, D., Wunderle, J. M., Ewert, D. N., Davis, A., & McKenzie, Z. (2005). Winter avian distribution and relative abundance in six terrestrial habitats on southern Eleuthera, The Bahamas. *Caribbean Journal of Science*, 41(1), 88–100.

Currie, D., Wunderle, J. M., Freid, E., Ewert, D. N., & Lodge, D. J. (2019). *The natural history of the Bahamas: a field guide* (1st ed.). Retrieved from https://lccn.loc.gov/2018035574

Department of Statistics. (2019). *Press Release on Preliminary Results of Labour Force Survey, New Providence*.

Drewnowski, A., Aggarwal, A., Rehm, C.D., Cohen-Cline, H., Hurvitz, P.M., Moudon, A.V. 2014. Environments Perceived as Obesogenic Have Lower Residential Property Values. *American Journal of Preventative Medicine*. 47 (3): 260 – 274.

ECHP (European Centre for Health Policy – WHO Regional Office for Europe), 1999. *Gothenburg Consensus Paper – Health Impact Assessment Main Concepts and Suggested Approach*.

Florida Department of State. 2020. *Contaminant Cleanup Target Levels*. Available online at https://www.flrules.org/gateway/ChapterHome.asp?Chapter=62-777. Accessed Sept 2020.

Freedman, Bill. 2004. *Environmental Science a Canadian Perspective*. Pearson, Prentice Hall, Toronto.

Geosyntec Limited. 2020. *Powerplant Pre-Construction Environmental Survey Clifton Pier Power Station Nassau, the Bahamas*. Prepared for BPL. May 2020

Goodman, N. 2015. *The Impact of Employment on the Health Status and Health Care Costs of Working-age People with Disabilities*. Lead Center, Policy Brief.

Health Canada (HC). 2017. *Guidance for Evaluating Human Health Impacts in Environmental Assessment Noise*.

IFC (International Finance Corporation World Bank Group). 2009. *Introduction to Health Impact Assessment*.

International Association for Impact Assessment. (1999). *Principles of Environmental Impact Assessment Best Practice*. Fargo, ND: IAIA.

Measure Evaluation. 2020. *Results-Based Financing Indicator Compendium for Reproductive Maternal Newborn Child and Adolescent Health. Adolescent Fertility Rate*. Available online at: https://www.measureevaluation.org/rbf/indicator-collections/health-outcome-impact-indicators/adolescent-birth-rate. Accessed June 2020.

MOH, Ministry of Health (The Government of Bahamas). 2020. The Official Website of the government of the Bahamas, Ministry of Health. Available online at: http://www.bahamas.gov.bs/health

MOH, Ministry of Health (The Government of Bahamas). 2019. *Fact Sheet The Bahamas STEPS Survey 2019*.

MOH, Ministry of Health (The Government of Bahamas). 2018a. *Live Births, Bahamas (1993-2016)*. Available online at https://www.bahamas.gov.bs/wps/wcm/connect/27884f58-8e95-4a54-8751-04d8709d1df3/Live+births+1992-2016e-mail.pdf?MOD=AJPERES. Accessed June 2020.

MOH, Ministry of Health (The Government of Bahamas). 2018b. *Still Births, 1995-2016*. Available online at: https://www.bahamas.gov.bs/wps/wcm/connect/b6212f98-8258-4b33-ba9b-90b4eca8c243/Stillbirths+1992-2016e-mail.pdf?MOD=AJPERES. Accessed June 2020.

MOH, Ministry of Health (The Government of Bahamas). 2018c. *Infant (Under 1 year) Deaths, Bahamas, 1995-2016)*. Available online at: https://www.bahamas.gov.bs/wps/wcm/connect/004f4d5f-4b88-425a-a561-d91a6febd939/Infant+Deaths+1992-2016e-mail.pdf?MOD=AJPERES. Accessed June 2020.

MOH, Ministry of Health (The Government of Bahamas). 2018d. *National HIV/AIDS Programme, 2017 HIV Surveillance Fact Sheet.* Available online at: http://www.bahamas.gov.bs/wps/wcm/connect/d3771cb3-06ed-4e27-af96-5f51e982313c/HIV+Surveillance+Fact+Sheet+2017.pdf?MOD=AJPERES. Accessed June 2020.

MOH, Ministry of Health (The Government of Bahamas). 2017. *Mortality Total by Gender – 2014*. Available online at: https://www.bahamas.gov.bs/wps/wcm/connect/468a0f12-8d38-45ce-b6ad-b7e05755a1d3/Mortality+2014+by+Gender-EMAIL+%281%29.pdf?MOD=AJPERES. Accessed June 2020.

MOH, Ministry of Health (The Government of Bahamas). 2013. *Basic Health Indicators 2013*, available online at http://www.bahamas.gov.bs/wps/wcm/connect/c5623e5f-86f7-477c-acfc-2f792490b8be/HIRU+Brochure+Nov.+2014%28Final%29.pdf?MOD=AJPERES.

National Research Council (NRC). 2011. *Improving Health in the United States, The Role of Health Impact Assessment*.

PAHO (Pan American Health Organization). 2020. Available online at https://www.paho.org/en/bahamas. Accessed June 2020.

PAHO. 2019. *Core Indicators 2019 Health Trends in the Americas*. Washington, DC. 2019.

PAHO. 2017. *Health in the Americas- Bahamas*. Available online at https://www.paho.org/salud-en-las-americas-2017/?p=2291

Poortinga, Wouter. 2006. Social Relations or Social Capital? Individual and Community Health Effects of Bonding Social Capital. *Social Science and Medicine.* 63(1): 255-270.

Power, A., Smyth, K. 2016. *Heritage, health and place. The legacies of local community-based heritage conservation on social wellbeing*.

Raffaele, H., Wiley, J., Garrido, O., Keith, A., & Raffaele, J. (1998). *A Guide to the Birds of the West Indies*. Princeton, New Jersey: Princeton University Press.

Socio-Economic Report 2008-2012. (2012). Nassau, The Bahamas: Department of Statistics.

USEPA. 2020. *Overview of Greenhouse Gases*. Available at: https://www.epa.gov/ghgemissions/overview-greenhouse-gases#carbon-dioxide

USEPA. 2019. *Sulfur Dioxide Basics*. Available at: https://www.epa.gov/so2-pollution/sulfur-dioxide-basics#effects

USEPA. 2018. *Particulate Matter (PM) Basics*. Available at: https://www.epa.gov/pm-pollution/particulate-matter-pm-basics#PM.

USEPA. 2016a. *Basic Information About NO_2*. Available at: https://www.epa.gov/no2-pollution/basic-information-about-no2#What%20is%20NO2

USEPA. 2016b. *NAAQS Table*. Available online at https://www.epa.gov/criteria-air-pollutants/naaqs-table

USEPA, 2013. *A Review of Health Impact Assessments in the U.S.: Current State-of-Science, Best Practices, and Areas for Improvement.* EPA/600/R-13/354

USEPA. ND. *Natural Gas Combustion*. Available at: www3.epa.gov>ttnchie1.final

WHO (World Health Organization), 2020a. *Bahamas*. Available online at https://www.who.int/countries/bhs/en/. Accessed June 2020.

WHO (World Health Organization), 2020b. *Noncommunicable diseases*. Available online at: https://www.who.int/health-topics/noncommunicable-diseases#tab=tab_1. Accessed June 2020.

WHO (World Health Organization), 2020c. *Basic Documents Forty-Ninth Edition*, ISBN 978-92-4-000051-3. Available online at: https://apps.who.int/gb/bd/pdf_files/BD_49th-en.pdf#page=1

WHO, 2015. *Stillbirth Rate*. Available online at: http://origin.who.int/healthinfo/indicators/2015/chi_2015_29_mortality_stillbirth.pdf

WHO. 2005. *Air Quality Guidelines Global Update 2005*.

WHO, 2001. *The Use of Indicates for Communicable Disease Control at District Level*. WHO/CDS/TB2001.289.

World Bank Group, 2020. *Adolescent Fertility Rate*. United Nations Population Division, World Population Prospects. Available online at: https://data.worldbank.org/indicator/SP.ADO.TFRT?contextual=region

World Population Review, 2020. Available online at https://worldpopulationreview.com/countries/bahamas-population/. Accessed June 2020

APPENDIX D: PERSONNEL INVOLVED IN THE ESHIA

The following persons were involved in the development of ESHIA. Their CV.s were provided to the Department of Environmental Planning and Protection and pre-approved before they commenced work on the study.

SEV Consulting Group:
Stacey Helena Moultrie - Project Lead (ESHIA lead author and editor)
Sharrah Hackett - Socio-economic assessment & GIS specialist
Ancilleno Davis, PhD - Flora and fauna assessments

Arcadis:
Fred Bernard - Team Lead for Arcadis
Stephanie Dryden-Cripton – Deputy Lead for Arcadis
Wasef Jamil - Air quality assessment
Russ Jalbert - Air quality assessment
Barbara Hard - Health impact assessment
Jennifer Kirk – Health impact assessment

APPENDIX E: SPECIES LISTS

PLANT SPECIES

Common Name	Scientific Name	Category	Location
Alexander Palm	*Archontophoenix alexandrae*	NN	Eastern fence boundary of Station D
Assorted Grasses	Various species	NA	Along roadsides and in south west corner
Banana	*Musa sp.*	NN	In south west corner of property
Brazilian Pepper	*Schinus terebinthifolius*	IN	Along northern fence boundaries
Casuarina (Australian Pine)	*Casuarina sp.*	IN	North west holding tanks
Coconut	*Cocos nucifora*	NN	
Florida Strangler Fig	*Ficus aurea*	NN	East of entrance
Gum Elemi	*Bursera simaruba*	NA	Along northern fence boundary
Juju	*Ziziphus jujuba*	NN	
Poison Wood	*Metopium toxiferum*	NA	Along northern fence boundary
Hawaiian Scaevola	*Scaevola Taccata*	IN	In south west corner of property
Shepherd Needle	*Bidens pilosa*	NA	Along parking lot boundaries
West Indian Almond	*Terminalia catappa*	IN	
Willow Bustic	*Sideroxylon salicifolium*	NA	North west corner of site

Key - Native (NA), Nonnative (NN), or Invasive (IN)

BIRD SPECIES

Common name	Scientific Name	Range	Status	Observations
Laughing Gull	*Leucophaeus atricilla*	PRB	LC	F
Osprey	*Pandion haliaetus*	PRB	LC	S
House Sparrow	*Passer domesticus*	PRB	LC	F
Common Ground-dove	*Columbina passerine*	PRB	LC	F
Northern Mockingbird	*Mimus polyglottos*	PRB	LC	F
Palm Warbler	*Setophaga palmarum*	WR	LC	F
Yellow-rumped Warbler	*Setophaga coronata*	WR	LC	S
Smooth-billed Ani	*Crotophaga ani*	PRB	LC	F
Cattle Egret	*Bubulcus ibis*	PRB	LC	S
White-crowned Pigeon	*Patagioenas leucocephala*	PRB	NT	S

Thick-billed Vireo	*Vireo crassirostris*	PRB-E	LC	S
Prairie Warbler	*Setophaga discolor*	WR	LC	S
Western Spindalis	*Spindalis zena*	PRB-E	LC	F

TABLE KEY:		
RANGE	**STATUS**	**OBSERVATIONS**
PRB = Permanent Resident Breeding	**LC =** Least Concern (Conservation - IUCN)	**S =** Single (1)
RNB = Resident Non-Breeding	**NT =** Near Threatened (Conservation – IUCN)	**F =** Few (2-10)
WR = Winter Resident	**VU =** Vulnerable (Conservation – IUCN)	**M =** Many (>10)
E = Endemic (Distribution)		

APPENDIX F: BPL PLAN FOR REMEDIATION

As indicated in the body of the EIA and documented in the Geosyntec Report entitled *Power Plant Pre-Construction Environmental Survey - Clifton Pier Power Station* (May 2020), there is existing contamination at the Station D project site. The Geosyntec report is attached at Appendix G1.

This appendix outlines how BPL has started to address remediation and will continue to remediate the site.

Groundwater Treatment System

The development of the groundwater treatment system is the final stage of collaborative efforts between the Department of Environmental Health Services, Ministry of Public Works and Bahamas Power & Light to extract, treat and control contamination.

Stakeholders agreed to install a large oceanside barrier containment wall, which was funded and coordinated by the Bahamas Ministry of Works (MOW). The containment wall construction was added to the MOW's Clifton Pier dock restoration project, as the barrier/containment wall extended from the dock towards the east and towards the west. There were nine recovery sumps, large-diameter drainage piping (to encourage oil migration towards the sumps during pumping), and utility piping (for future oil/groundwater conveyance) installed as part of the MOW's barrier wall system.

To complement the works already completed, BPL will design, install and operate a remediation system that would prevent future contamination while remediating the existing oil.

Goals for BPL's remediation system are:

1. Recovery of oil and groundwater along the recovery sumps installed along the barrier wall – This is to prevent oil accumulation along the wall which could otherwise back up and potentially find other pathways around the wall;
2. Aggressively recover oil and groundwater in voids and fractures in the subsurface at the CPPS facility along the facility property, providing capture of oil prior to groundwater migrating off-site;
3. Install oil retention basins on the storm sewer outfalls at the project site to minimize direct oil impacts to the ocean from CPPS cooling water system outfalls;
4. Develop a relatively simple process to recover, treat, and reinject groundwater (without the need to run electrical components to light non-aqueous phase liquid or LNAPL recovery locations);
5. Separate oil for recovered oil/water streams; and
6. Store LNAPL in properly contained oil tanks for subsequent disposal or re-use.

The design drawings for the BPL remediation system are attached.

The system comprises of a series of wells, pumps, separators, holding tanks and aeration treatment. Product will be recovered/pumped from the wells and piped to the oil/water separators where it

will separate the product from the water. The remediation system will include 37 new recovery wells 7 new monitoring wells and at least three (3) new injection wells. All recovery wells will be installed with pneumatic, top-loading total-fluids pumps to recover both LNAPL and groundwater and also to monitor oil and groundwater elevations. Monitoring/recovery well will be 8" diameter PVC finished well, with 15 feet of casing from the surface, and an open rock hole drilled to an approximate depth of 45 feet. Each well will have a concrete/bentonite seal along the casing to the surface. Injection wells will be an 8"-diameter well, with 200 feet of casing from the surface, and an open rock hole drilled to a total depth of 300 feet. The injection wells will have a concrete/bentonite seal along the casing to the surface. The injection well network will have the capacity to receive over 300 gallons per minute (gpm) per well at a pressure of no greater than 50 pounds per square inch(psi).

Recovered oil (product) from the well will be pumped from the oil/water separators via transfer pumps to one oil holding tank (minimum 20,000-gallon). The water will then go to the clarifier where it is further filtered and treated. The separators will be will be rated for a liquid flow rate of 200 gpm. The entire inside of the separator shall be coated with a protective sealant to minimize corrosion and outside of the stainless-steel oil/water separators must be painted to provide additional corrosion protection.

Groundwater will then be transferred from the clarifying tank to an 18,000-gallon aeration tank via a gravity feed pipe connection. Effluent from the groundwater treatment system will be pumped by two transfer pumps to on-site injection wells after going through a series of bag filters, with a by-pass line around the filter system. This will provide the final treatment before the water is reinjected into the ground.

A telemetry package with an Allen-Bradley style control panel will be installed so that BPL can be notified via email upon system shut-down. This system will also consist of a remote monitoring and control system and include all flow sensors and transducers to provide remote monitoring of tank levels, flow rates, pump cycling, alarms, and pressures. All water and product lines with pumps shall include flow sensors/meters. This system will also provide outputs to BPL remote SCADA monitoring equipment.

APPENDIX G: PREVIOUS STUDIES OF RELEVANCE

G1: Geosyntec Powerplant Pre-Construction Environmental Survey Clifton Pier Power Station, Nassau, The Bahamas

G2: Wartsila Noise Impact Study BPL Plant Extension 6xW 18V50DF

Provided on flash drive.

APPENDIX H: STAKEHOLDER PRESENTATION

BPL Station D Power Plant
At Clifton Pier Power Station

Stakeholder Consultations

17 December 2020

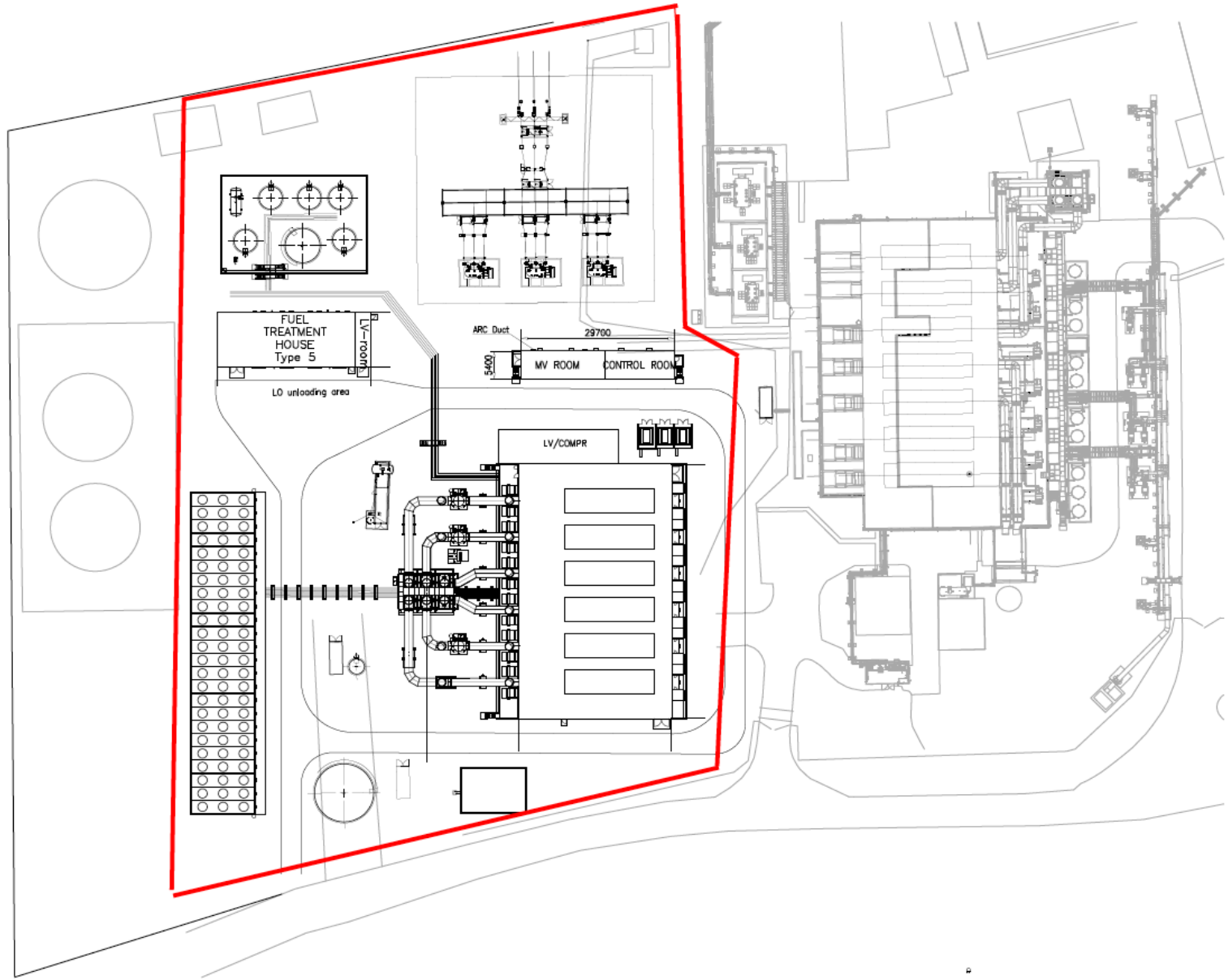
SEV Consulting Group

ARCADIS Design & Consultancy for natural and built assets

Project Overview

- New power plant – Station D
- Objective - to modernize power generation that increases efficiency and reliability while reducing cost to the consumer
- Station D to replace some of BPL's existing aging generation fleet at CPPS and transfer generation from existing inefficient and old assets to newer, more efficient technology
- Wärtsilä - Engineering, Procurement and Construction (EPC) contractor
- Construction phase – 14 months
- Design life – 25 to 40 years

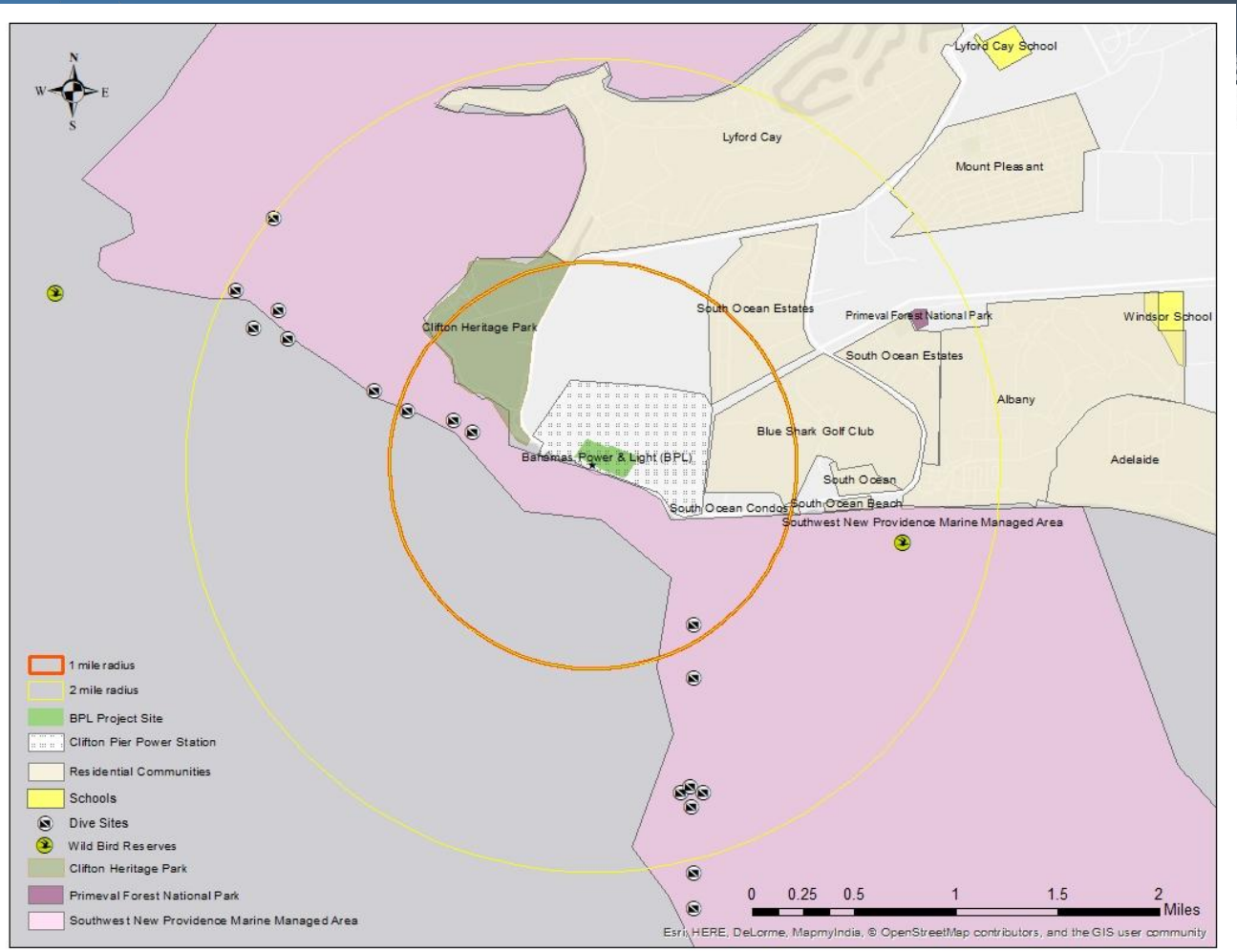
Proposed Location for Station D


FUEL
TREATMENT
HOUSE
Type 5
LV-room
LO unloading area
ARC Duct
29700
5400
MV ROOM
CONTROL ROOM
LV/COMPR

EIA Team Expertise

SEV Consulting Group	Arcadis Inc.
• Botany • Environmental planning • Environmental legislation • Environmental science • Hydrology • Ornithology • Zoology • All team members with Master's degree minimum	• Environmental planning • Air quality monitoring • Health assessments • Engineering • Assessing oil and gas projects

CPPS and Environs



Plants on the site

Birds on the site

Significant Impacts

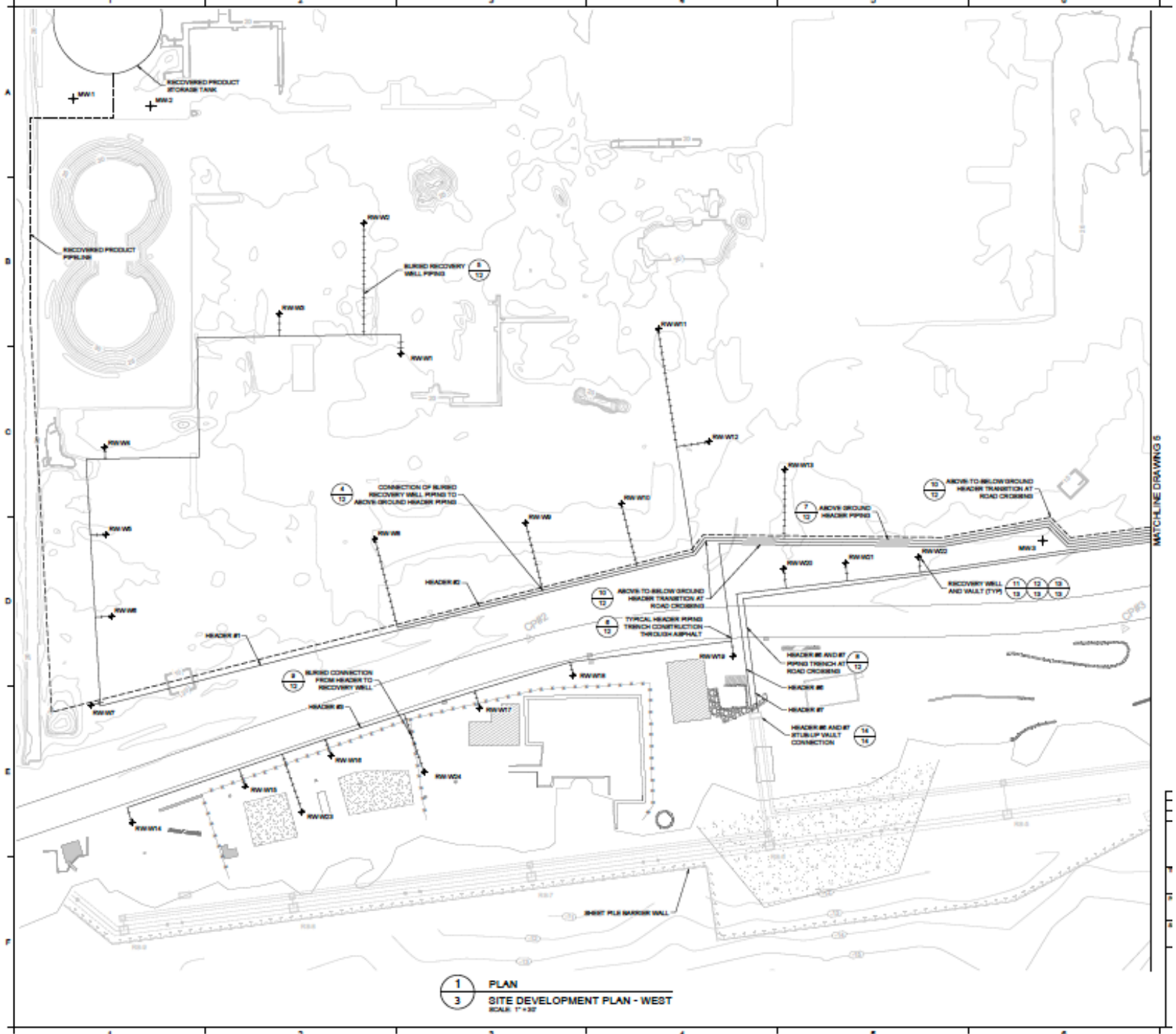
- Avifauna
- Invasive species
- Occupational health & safety
- Human health

Mitigation Measures

Impacts	Proposed Mitigation Measures
Avifauna	Planting native trees on property and supporting local terrestrial conservation will help mitigate effects on native and migratory birds.
Invasive species	Removal of invasive Casuarina trees will occur during clearing of the site. Any landscaping that will occur will utilize native or endemic plant and tree species.
Occupational health & safety	Workers will be provided with PPE and receive training in proper handling of equipment and materials as a part of orientation, Regular reinforcement of OHS procedures during weekly meetings. Workers will adhere to COVID-19 Emergency Orders requirements.
Human health	Vapour collection systems for new and existing buildings. Air quality monitoring at regular intervals throughout the year. Continual remediation of groundwater and soil impacts to reduce odours and vapour intrusion. Notify local community when emissions levels could impact health. Maintain a record of any complaints related to emissions and respond by taking mitigation action, if necessary.

BPL Plan for Remediation

- Groundwater treatment system
- Large oceanside barrier containment wall (In place)
- 9 recovery sumps, large-diameter drainage piping and utility piping
- 37 new recovery wells, 7 new monitoring wells and 3 new injection wells
- Oil retention basins for stormwater outfalls
- Recover, treat and reinject groundwater
- Store recovered oil in properly contained tanks for subsequent disposal or reuse



1/3 PLAN

SITE DEVELOPMENT PLAN - WEST

SCALE: 1" = 30'

Other Impacts Assessed

- Materials
- Air quality & dust
- Waste management
- Ecology
- Traffic & transport
- Contaminated land
- Impacts on neighbouring communities

Next Steps

1. Incorporation of stakeholder comments into the EIA
2. Submission of EIA for the project to DEPP
3. DEPP review process inclusive of public consultations on the EIA
4. Once EIA is approved, EMP for the project will need to be developed and submitted to DEPP for its review
5. CEC issued on completion of satisfactory review of EMP

Contacts

- Bahamas Power & Light
- pr@bplco.com

- Stacey Moultrie
- SEV Consulting Group
- info@sevconsulting.com

Questions?

APPENDIX I: MINUTES OF STAKEHOLDER CONSULTATIONS

The introduction and presentation were similar across the meetings. The notes in this regard are only included in the first meeting to avoid repetition. The participants and the discussion during the Q&A period for each meeting are provided.

BPL – Gov WebEx
17 December 2020

Start time: 9:33 am
End time: 10:20 am

28 participants at start of meeting
30 participants at the end of the meeting

1. Stacey Moultrie – SEV Consulting Group
2. Bernard Smith – SEV Consulting Group
3. Fred Bernard – Arcadis
4. Stephanie Dryden-Cripton – Arcadis
5. Jennifer Kirk – Arcadis
6. Lauren McDonald – Arcadis
7. Wasef Jamil – Arcadis
8. Patrick Rollins – BPL – Executive Director
9. Rochelle McKinney – BPL – Manager for Environmental Services
10. Ian Pratt – BPL – Chief Operating Officer
11. Kenya Longley – BPL – Project Engineer
12. K Quincy Parker – BPL – Director of Public Relations
13. Alton Mckenzie – BPL
14. Anthony Strachan - BPL
15. Burlington Strachan – BPL – Director of Grid Solutions & Support Services
16. Vincent Wallace-Whitfield – BPL – Legal Counsel
17. Edmund Phillips – Wartsila
18. Michael Soderlund - Wartsila
19. Arana Pyfrom - DEPP
20. Charles Hamilton - DEPP
21. Christopher Russell – Forestry Unit - Director
22. Danielle Hanek-Culmer – Forestry Unit
23. Melanie Roach – MOW – Director
24. Damian Francis – MOW – Deputy Director
25. Robert Mouzas – MOW – Deputy Director
26. Alexio Brown – MOW
27. Dwayne Ferguson - MOW
28. Vasco Ferguson - RBDF

29. Warren Smith – RBDF – Senior Commander
30. William Smith - RBDF

Absent:
Clifton Heritage Authority, DEHS, Department of Physical Planning and WSC

Introductions - Stacey Moultrie
Moultrie introduced the teams from SEV, Arcadis, BPL, and Wartsila as well as confirmed participants from DEPP, MOW, Forestry Unit and RBDF.

PowerPoint presentation - Stacey Moultrie
Moultrie noted that today's presentation covered the project to develop the BPL Power Plant at the Clifton Pier Power Station (CPPS). The Environmental Impact Assessment (EIA) is in progress and includes stakeholder consultations. Due to the COVID-19 pandemic, consultations are virtual. All comments, questions, and responses from today's consultation will be included in the EIA. The EIA will be submitted to the Department of Environmental Planning and Protection (DEPP).

The main objective for constructing Station D is to modernize the power station on New Providence. BPL wants to increase efficiency and reliability while reducing cost to its customers. Station D will replace existing aging generation fleet at CPPS and transfer generation from existing and old assets to newer more efficient technologies. Wartsila is the contractor for the project and construction will last 14 months. The design life of the new station is projected at 25 years (minimum) and up to 40 years.

Moultrie showed the site map of CPPS location for Station D, which is adjacent to Station A. Layout of Station D was also shown, outlined in red. Station D will accommodate 6 reciprocating engines with a generating capacity of 85-102 MW. The engines will be tri-fuel which means they can run on automotive diesel, heavy fuel oil or natural gas. The combined complex (Station A and D) will provide for 200-220 MW of operational power. LNG will be utilized once the fuel becomes available. The initial construction will utilize automotive diesel and heavy fuel oil.

The team responsible for the development of the EIA is a partnership between SEV Consulting Group and Arcadis. The EIA will encompass impacts at the project site and everything within a 2-mile radius. Map indicating 1- and 2-mile radius shown.

Several species have been identified on the project site. Examples include Hawaiian Scaevola, Australian Pine, and Florida Strangler Fig. Invasives such as the Australian pine will be removed from the site. Birds documented on site include the Western spindalis, Osprey, and Laughing gull. All birds are protected under Bahamian law under the Wild Birds Protection Act. The EIA will speak to the potential impacts to these species and the intended mitigation for each.

There are various potential impacts of the project and the significant impacts will be reflected in the EIA. The significant impacts have potential high impact in terms of magnitude and lasting impact in

terms of time. The significant impacts included in the EIA are grouped into four categories: avifauna, invasive species, occupational health and safety, and human health.

Moultrie discussed two categories – avifauna and occupational health and safety. In the avifauna category, fumes, dust, and noise from the development and operation activities may disrupt bird behavior beyond the physical boundaries of the site and onsite avifauna diversity may be impacted significantly. In terms of occupational health and safety, workers may be at risk if they do not wear the proper personal protective equipment (PPE) as well as if equipment or materials are mishandled. It will be important for workers to adhere to safety protocols to prevent injury. COVID-19 will be an important consideration in 2021 and workers must also adhere to the Emergency Orders and related safe health practices.

The mitigation measures for the remaining two categories (invasive species and human health) were discussed. Invasive species will be removed from the project site and the new landscaping planned for the perimeter of the site will utilize native and endemic plant species.

In terms of human health, one concern is vapour intrusion from contamination in the soil. Vapour collection systems will be part of construction of any new or existing buildings. Air quality monitoring will be conducted at regular intervals and continual remediation of groundwater and soil already existing on the site. Mitigation will also include notifying surrounding communities when there may any emissions that can impact human health. BPL will also maintain a record of any complaints from the local community (businesses or residents) related to emissions and take action if deemed necessary.

Rochelle McKinney (BPL) presented BPL's plan for remediation at the site and the existing conditions. McKinney noted that BPL is continuing the work started by the Ministry of the Environment and Ministry of Works related to oil seeping out into the sea. MOW constructed a barrier wall and dock system that included 9 recovery sumps. BPL will be installing a groundwater treatment system on site with 37 new recovery wells to recover the oil in the subsurface and what is collected in the sumps for the barrier wall system.

The oil collected will go into a multi-stage treatment system that will separate the oil from water and treat the remaining water for discernable levels of hydrocarbons. The treated water will then be disposed of via deep well injection. The remaining oil will then be disposed of, either through incineration or removal. BPL is currently in the procurement phase for a contractor to carry out the remediation work and anticipate that start date in the second quarter of 2021. Completion of construction of recovery system is estimated to take 9 months and recovery to begin in early 2022.

McKinney showed a map of the west side of the power plant where the recovery wells will be located. The bulk of the recovery wells will be on the western side where the majority of the oil exists. The southern side (waterfront) will have many wells including the existing sump recovery wells and the additional wells that will be installed for recovery of oil. All of the oil collected from the various wells will be piped into a common collection and treatment system on the east side of the facility.

Moultrie highlighted other impacts assessed, considered low to medium impacts, including traffic and transport. Southwest Road is the only access road to CPPS and most of the Clifton area. There may be some disruption due to movement of heavy equipment during construction. This disruption is expected to cease once the new plant is in operation.

Impacts to neighboring communities may be short- to long-term in terms of construction activities, including movement of materials and heavy equipment. From time to time, there may be low noise and impairment of air quality, but through the proposed mitigation measures, it is believed that all of these impacts can be addressed. These other impacts (as shown on the slide) would not be considered significant impacts.

In terms of next steps after this meeting, all comments from this session and the two other sessions planned for NGOs and the general public will be incorporated into the EIA document. Once the comments are incorporated into the EIA document, it will be formally submitted to DEPP for their review. By law, DEPP has 60 days to review the EIA. Through the review process with the new legislation on stream for DEPP, there will be consultations on the EIA specifically. Those consultations with stakeholders will be organised and managed by DEPP with BPL and its environmental consultants.

Once the EIA is approved, the Environmental Management Plan (EMP) for the project will need to be developed. That will be submitted to DEPP for their review. The Certificate of Environmental Clearance (CEC) will be issued upon completion of the satisfactory review of the EMP. The project may be able to start construction end of March/early April.

Moultrie shared contact information for BPL and SEV and opened the floor to questions.

<u>Question & Answer Period</u>

Question 1: Director Roach, MOW
What will happen to Stations B and C? Are they going to be demolished?
Answer by Rollins, BPL:
Station B and C will be kept as redundancy should the need for backup arise.

Question 2: Deputy Director Francis, MOW
What are the anticipated traffic movements (including vehicle types) into and out of the new site?
Answer by Phillips, Wartsila:
Once engines are delivered to New Providence, the primary equipment will be the prime mover and generator itself. Other than that, there will be several trailer routes carrying plant equipment. During construction, there will be movement of the generator itself and about 150 containers from the Arawak Cay Port to the BPL facility. As was done previously, transportation will be planned in a way to minimize impact to the public. After construction, there should not be any impact to traffic and

transportation, other than workers and contractors entering and leaving the plant. In the immediate construction area, there will be forklifts moving materials around, but no cranes will be used.

Question 3: Director Roach, MOW
The transportation of the last generator from Arawak Port to CPPS involved mass clearing of trees along the route. What steps will be taken to properly trim trees along the route this time?
Answer by Rollins, BPL:
Better instructions will be given to the subcontractor responsible for clearing prior to the start of works, so as to avoid unwanted or unnecessary cutting of trees along the transit route.

Moultrie added that unwanted tree cutting along the transit route will be documented in the EIA as a potential impact and will need to be addressed in the EMP as well.

Question 4: Deputy Director Francis, MOW
There appears to be a building (square) outline shown on the site plan that is on the southern boundary adjacent to the main road. What is the existing right of way (ROW) and has any consideration been given to future road widening at this location?
Answer by Rollins, BPL:
It depends on what MOW requires. BPL will accommodate whatever request is made by MOW.
Comment: Director Melanie Roach, MOW
MOW will need to see the cadastral survey in order to see what right of way currently exists. Then MOW would be better able to give input.
Response by Phillips, Wartsila:
The square structure appears to be a fuel treatment container.
Response by Strachan, BPL:
Along the roadway, there is already existing pipework on the site. He is confident that everything being proposed for the project is on the field side, not the roadside. Nothing should be getting closer to the road than the existing infrastructure.
Additional response by Phillips, Wartsila:
He agreed with Mr. Strachan and confirms that Wartsila will take all of it into consideration. Phillips confirmed that everything located on the drawing has been considered in terms of necessary safety distances, across the entire site. If MOW wants to see anything specifically addressed, Wartsila will address it.

Question 5: Deputy Director Francis, MOW
He expressed concern about the ROW boundary. He saw a plan previously that showed a ROW of 40 ft. He is concerned about the impact on future road widening, should it need to occur. When Wartsila says safety – is that from edge of pavement or infrastructure on the property?
Response by Phillips, Wartsila:
It is mainly referring to safety for the infrastructure on the property. For example, if you're locating a fuel tank, you want to have a safe distance around the tank.

Question 6: Deputy Director Francis, MOW:
So if for example MOW identifies a 20-25 ft requirement for road widening, what can be done?
Response by Phillips, Wartsila:
Yes, so in that case, Wartsila will look for an alternative location for placement of equipment in order to accommodate the required area for MOW.

Question 7: Deputy Director Francis, MOW
Looking into the future, if traffic flow increases along this roadway, the proposed project site will likely have an impact. Has any consideration been given to creating a right turn lane into the facility?
Response by Phillips, Wartsila:
Operations will require approximately 8 persons per shift, so no significant impact to traffic is foreseen. During construction, there will be 150-200 persons employed, entering the site in the morning hours and leaving the site in the evening. This will be temporary.

Question 8: Deputy Director Francis, MOW
How is the fuel (3 different types) being delivered to the property? Will all be piped in or will some be trucked in?
Answer by Rollins, BPL:
All three will be barged to CPPS and piped to the plant. Once the LNG plant is built, LNG will be stored and regassified on site, then piped to the plant via the piping system.

Recommendation by Director Russell, Forestry Unit
With reference to the tree trimings en route, I suggest recruitment of competent arborist/landscape firm to undertake this work. Work in collaboration with BPL and tree trimming subcontractor.
Answer by Rollins, BPL:
BPL will take the recommendation into consideration. One big issue is the need for experienced persons to be involved in the trimming of trees around high powered lines. In the previous tree trimming exercise, Enviroscape was the company used.
Comment by Deputy Director Francis, MOW:
Supports Director Russell's recommendation for supervision of the company selected by a competent arborist.
Additional comment by Director Russell, Forestry Unit:
The competent arborist/firm should work in close collaboration with BPL.

Question 9: Deputy Director Francis, MOW
What type of onsite surface drainage system is being proposed at the site?
Answer by Phillips, Wartsila:
When the site was designed, various drainage options were incorporated. Unable to speak specifically to the type of drainage, but confirmed that drainage designs have been specified. Wartsila will have to consult with the civil engineering team regarding specific types.

Question 10: Vanderpool Wallace, BPL:
Concerned about fuel that end up in the marine environment. Sources of spills vary. If there will be runoff, what containment will be incorporated into the proposed project to prevent/address this? Is there any plans or provisions for runoff and other contaminants that end up in the water?
Answer by Phillips, Wartsila:
The way the proposed plant is designed, all areas within the plant where potential spillage of fuel may occur will be captured by way of design. For example, at the existing Station A, there are grooves around the engine foundation. The engine itself is separated from the main foundation. There are tubes that go around the main foundation and capture any leakage that may potentially come from the cylinders themselves. The facility has various lube oil collectors around the plant to capture any leakage, preventing any leakage to the ocean.
Additional response by Moultrie, SEV:
With the design of the remediation plan and associated wells, the intent is that some components will remain in place to assist with monitoring to ensure prevention of contamination into the future.
Additional response by McKinney, BPL:
Several monitoring wells will be installed at the new power station and will continue to monitor the existing stations. BPL will be vigilant in monitoring any potential spill and has plans to strengthen existing systems that address any liquid discharges at the power station. BPL is working very closely with the DEPP and DEHS to ensure that past issues are not repeated moving forward.
Additional response by Phillips, Wartsila:
Plants are no longer designed to allow for leaking, especially those built by Wartsila.

With no additional questions or comments, Moultrie closed the meeting. She reminded participants that all comments will be included in the EIA and that other opportunities to participate in dialogue about the project through the DEPP consultative exercises. Government agencies will also likely engage again with BPL and Wartsila through the construction permitting process once the environmental permitting process is complete.

BPL – NGO WebEx
17 December 2020

Start time: 3:05 pm
End time: 4:00 pm

22 participants at start of meeting
27 participants at the end of the meeting

Present on the call:

1. Stacey Moultrie – SEV Consulting Group
2. Sharrah Hackett – SEV Consulting Group
3. Fred Bernard – Arcadis
4. Stephanie Dryden-Cripton – Arcadis
5. Wasef Jamil – Arcadis

6. Lauren McDonald – Arcadis
7. Patrick Rollins – BPL – Executive Director
8. Ian Pratt – BPL – Chief Operating Officer
9. Burlington Strachan – BPL – Director of Grid Solutions & Support Services
10. Rochelle McKinney – BPL – Manager for Environmental Services
11. Kenya Longley – BPL – Project Engineer
12. K. Quincy Parker – BPL – Director of Public Relations
13. Alton Mckenzie – BPL
14. Vincent Wallace-Whitfield – BPL
15. Edmund Phillips – Wartsila
16. Michael Soderlund – Wartsila
17. Eric Carey – Bahamas National Trust – Executive Director
18. Shelly Cant-Woodside – Director of Science and Policy
19. Portia Sweeting – Bahamas National Trust
20. Shantell Curtis – Bahamas National Trust
21. Kristoff Francois – Bahamas National Trust
22. Brent Williamson – Bahamas National Trust
23. Anwar Rolle – Bahamas National Trust
24. Bradley Watson – Bahamas National Trust
25. Gloria Miller – Bahamas National Trust
26. Sam Duncombe – reEarth
27. Rashema Ingraham – Waterkeepers Bahamas/Save the Bays

Apologies: Casuarina McKinney-Lambert – BREEF – Executive Director

Introductions - Stacey Moultrie
Moultrie introduced teams from Arcadis, BPL, Wartsila, and each of the NGOs (BNT, reEarth, and Waterkeepers Bahamas/Save the Bays). Apologies were given for BREEF. Moultrie indicated that each NGO would be given 10 minutes to speak before opening floor to Q&A.

PowerPoint presentation - Stacey Moultrie
The same PowerPoint presentation from Government agencies meeting was given.

Moultrie encouraged NGOs to ask any questions they wished and to make any comments they wanted, including any impacts of concern to the organisations on the call.

Question & Answer Period
Question 1: Cant-Woodside, BNT
What are the depths for remediation wells in relation to the freshwater lens?
Answer by McKinney, BPL:
Wells will be to a depth at about 25 feet. In the Clifton area the water table is at about 20 feet.

Question 2: Cant-Woodside, BNT
What is the seasonality of the bird assessments conducted thus far? How many times a year and how many times a day were surveys done?
Answer by Moultrie, SEV:
Bird assessments were done in April and May and consideration was given to birds that may only be present at certain times of the year, such as migratory birds. This is included in the EIA.

Question 3: Carey, BNT
Given that the proposed site is heavy impacted and doesn't represent any significant ecological value, what if any offsets (for emissions, etc.) are BPL considering as mitigation? What is BPL committed to in terms of offsetting activities that contribute to climate change and the like?
Answer by Strachan, BPL:
The new plant will be significantly more efficient, so things like emissions levels will be significantly lower than the existing plant. The new plant is also designed to be a tri-fuel station, which is part of BPL's long-term plan of switching over to LNG, which has significantly lower carbon emissions. He was unable to speak to any specific offsets, but BPL is also exploring renewables on the Family Islands in an effort to adjust its energy mix countrywide.

Question 4: Cant-Woodside, BNT
As the plant will continue to contribute to producing carbon into the country, will there be consideration to commit energy towards development of renewables in the country?
Answer by Strachan, BPL:
Part of BPL's overall long-term strategy is to introduce renewables where possible and where appropriate. BPL is currently working with Government partners in several locations on the Family Islands to get those projects funded and executed. For New Providence, renewables are not practical for the type of plant being installed which is a base-load plant. Renewables are more appropriate for targeted efforts, such as single-family dwellings which BPL is encouraging.

Question 5: Carey, BNT
Why doesn't BPL look to solar energy to generate the 85MW needed for New Providence?
Answer by Strachan, BPL:
Essentially, as a base-load plant, energy needs to be produced 24/7 and at adequate levels. In order to achieve the same level of energy output, BPL would need to build a plant that is about 360 MW of traffic in order to produce the same amount of energy. For a solar operation of this scale, 1,400-1,800 acres of land would be required for the solar field and a significant amount of battery storage to hold ¾ of the 360 MW for when direct sunlight is not available. These factors make solar energy impractical for a new plant on New Providence.

Question 6: Ingraham, Waterkeepers Bahamas/Save the Bays
How will runoff be monitored? What will be done to offset runoff into the marine environment?
Answer by McKinney, BPL:
BPL will be installing an oil recovery system for the subsurface and with that system there will be a system of monitoring wells at the plant. It will allow for monitoring of water quality throughout the

area. Additionally, the collection system on the existing dock allows for monitoring water quality at the shoreline. BPL has oil/water separators for each of the power stations where sampling points exist. Sample points are located at the exit of the plant, midway, and prior to discharge into the sea. Samples can also be collected at the point of discharge. The entire space for the system and the infrastructure previously installed by the Ministry of Works (MOW) can facilitate monitoring of water quality and will be used to ensure that BPL is not negatively impacting the environment. In terms of the surrounding marine environment, the Ministry of Environment commissioned a study in 2017 that looked at the impact of runoff from Clifton to the marine environment. The results indicated no significant impact to the marine environment and that the sea life was robust. No real issues were identified by that study. This was prior to the completion of the containment wall installed by the MOW. BPL will continue to monitor water and soil quality at the plant and at discharge points to the sea.
Additional answer by Rollins, BPL:
Station D will also be using a closed looped system.

Question 7: Ingraham, Waterkeepers Bahamas/Save the Bays
Will BPL be open to other entities doing water quality monitoring programs at the site? Organisations like Waterkeepers Alliance?
Answer by Rollins, BPL:
BPL would like to partner with as many local NGOs to ensure that the environment is as sound as it can be.

Question 8: Duncombe, reEarth
What is the expansion? Is it LNG?
Answer by Moultrie, SEV:
It's a tri-fuel power station which can run on automotive diesel, heavy fuel oil or natural gas.

Question 9: Duncombe, reEarth
Will any land be cleared for the expansion of the plant?
Answer by Moultrie, SEV:
No, it is an existing power plant site.

Question 10: Watson, BNT
Given the intensity of recent storms like Hurricane Dorian and the impact it had on the Equinor industrial site, have there been any considerations made for hurricane preparedness in the design of the plant?
Answer by Rollins, BPL:
The plant is designed to withstand a category 5 hurricane and will be slightly elevated to reduce any related potential tidal activity.
Additional answer by Phillips, Wartsila:
Wartsila has also considered the design wind speed of the plant, to reduce impact of any major hurricane.

Question 11: Sweeting, BNT
This sounds like an excellent opportunity to educate the public on sources and uses of energy. Who will be your education outreach partner?
Answer by Parker, BPL:
BPL has initiated a conversation with the Bahamas Chamber of Commerce to address ways in which members of the business community can assist with getting the word out about the different types of energy that can be used in The Bahamas. BPL will also be engaging schools and has a calendar of activities that includes National Science Day, International Energy Efficiency Day, National Electricity Day, and International Energy Conservation Day. These days will be used as opportunities to educate the public. BPL is willing to discuss possible opportunities for educational outreach with BNT. BPL has also reached out to BREEF and The Nature Conservancy. BPL has also approached media houses for assistance in the outreach effort.

Question 12: Duncombe, reEarth
What will air emissions be at the new plant?
Answer by Moultrie, SEV:
We may not be able to answer that in detail on this call. Air quality information will be detailed in the EIA. No significant air emission impacts expected by the new plant. Mitigation will be in place to keep levels of emissions within limits that are safe to humans/human health.

Question 13: Duncombe, reEarth
What will the cost of the new plant be?
Answer by Rollins, BPL:
No cost has been finalized as yet.

Question 14: Cant-Woodside, BNT
Does the EIA take into consideration spills that can happen at the various stages: 1) collection from the barge; 2) storage and energy production; and 3) distribution throughout the island? Or is it only considering the actual site itsel?. I do feel that the general expansion of a petroleum-based operation needs to look into all aspects and opportunities for environmental impact...which needs to look at weaknesses along the entire chain from acquiring to delivering.
Answer by Rollins, BPL:
The fuel for all BPL plants comes in and is offloaded at the jetty, then is stored in tanks on the BPL property. The process will remain the same for fuel for the new plant, so no additional risk is foreseen.

Comment from Williamson, BNT:
It would be a good idea to include some joint monitoring program for the marine environment. Additionally, BPL should get the involvement of the National Oil Spill Committee at the earliest opportunity to seek to add credibility and assist in monitoring.
Response by McKinney, BPL:
BPL was involved in the National Oil Spill Committee in years past. Not sure if the committee is still active. BPL welcomes any opportunity to be involved in the committee should the committee extend an invitation.

Question 15: Duncombe, reEarth
LNG is one of the most polluting forms of fuel with regards to greenhouse gasses and climate change. Why are we continuing to spend money on fossil fuel projects?
Answer by Rollins, BPL:
There aren't any viable alternatives.

Question 16: Sam Duncombe, reEarth
Has BPL considered the offset of a solar water heating project across New Providence versus using fossil fuels? Or creating a plant that is a combination of renewables?
Answer by Strachan, BPL:
BPL has been involved with the Ministry of the Environment in the past and with some of their current projects, promoting the use of solar water heaters. BPL has frequently suggested individuals and agencies consider it as it is a good opportunity given our environment. As I stated earlier, the idea of a blended conventional and renewable power station, considering the energy density from renewables for this level of capacity and use profile on New Providence, is not really practical. Even if the solar installation only provides 10 MW, a significant acreage of land would be required. BPL is looking to encourage use of solar from the customer side, through its SSRG program. The Small-Scale Renewable Generation (SSRG) program allows individuals and business owners to generate energy using solar and tie that generation into the grid, so that they can self-consume and sell the remainder to BPL. There are currently about 100 individuals and companies enrolled in the program. Applications for participation in the program can be made to BPL. BPL is also looking at renewable integration in the Family Islands, for example Ragged Island, where BPL is doing deep penetration for renewables.

Question 16: Duncombe, reEarth
Has BPL considered warehouse roof tops, schools, government buildings, and parking lots for renewables?
Answer by Strachan, BPL:
Yes, the Ministry of Environment, Government agencies, and the Inter-American Development Bank are currently working on installation projects. Anatol Rodgers High School installation, National Stadium parking lot installation, and the Office of the Prime Minister parking lot installation are some of the existing projects. About nine other sites are being investigated as possible renewable energy building installations.

With no further comments or questions submitted, Moultrie closed the meeting. She reminded participants that all comments will be included in the EIA and that there will be other opportunities to participate in dialogue about the project through the DEPP consultative exercises. There will be public consultation on the EIA led by DEPP. They will ensure the document is publicly available. Usually, it means that they make it available through their website and they will give guidance to BPL as to when that will happen. It will likely be the new year. SEV will also send out notifications to those on the call to let them know when those consultations will take place.

BPL – General Public Zoom
17 December 2020

Start time: 6:02 pm
End time: 6:49 pm

32 participants at start of meeting
36 participants at the end of the meeting

Present on the call:

1. Stacey Moultrie – SEV Consulting Group
2. Sharrah Hackett – SEV Consulting Group
3. Fred Bernard – Arcadis
4. Stephanie Dryden-Cripton – Arcadis
5. Wasef Jamil – Arcadis
6. Lauren McDonald – Arcadis
7. Patrick Rollins – BPL – Executive Director
8. Ian Pratt – BPL – Chief Operating Officer
9. Burlington Strachan – BPL – Director of Grid Solutions & Support Services
10. Rochelle McKinney – BPL – Manager for Environmental Services
11. Kenya Longley – BPL – Project Engineer
12. K Quincy Parker – BPL – Director of Public Relations
13. Alton Mckenzie – BPL
14. Vincent Wallace-Whitfield – BPL
15. Edmund Phillips – Wartsila
16. Michael Soderlund – Wartsila
17. Wilfred Marvin Smith
18. Chester Robards
19. DeCosta Bethel
20. Joseph Gaskins
21. Adderley – Sun Oil

Public participants could not be all identified as many did not use their full names or names at all, instead using device names (e.g. iPhone).

<u>Introductions</u> - Stacey Moultrie
The purpose of today's meeting is to introduce the public to the new power station project BPL is in the process of developing an Environmental Impact Assessment (EIA) for and to document that stakeholder consultations on the project have been done. Moultrie introduced the teams from SEV Consulting Group, Arcadis, BPL and Wartsila and provided an overview of the format of the meeting.

<u>PowerPoint presentation</u> - Stacey Moultrie
The same PowerPoint presentation from Government agencies meeting was given.

Question & Answer Period

Question 1:
How much will the construction cost and how is it being funded? Is it linked to the Rate Reduction Bond?
Answered by Rollins, BPL:
Yes, while we don't have an exact cost for the plan, it is somewhere in the range of $80-100 million dollars and it will be funded under the rate reduction bond.

Question 2:
Has a timeline been finalized for the completion of Station D?
Answered by Moultrie, SEV:
The construction timeline is 14 months from start to finish, but the start date will be determined by DEPP review process, as construction cannot start until the Certificate of Environmental Clearance (CEC) is issued.

Question 3:
Will this meeting be recorded and shared with all participants?
Answered by Moultrie, SEV:
The presentation can be shared to all persons making requests; send your email to info@sevconsulting.com. All notes from this meeting will be included in the EIA which everyone will have access to once DEPP issues it.

Question 4:
What guarantees does BPL have that they will successfully place the Rate Reduction Bond?
Answered by Rollins, BPL:
BPL had hoped to place it this year, but it was delayed due to the COVID-19 pandemic. We are hopeful that we can move forward next year and get it successfully placed.

Question 5:
We've been hearing about the Shell deal for some time. What is their involvement?
Answered by Rollins, BPL:
At the onset, Shell was to build Station D along with the LNG plant. Shell's preference was to do everything at one time, once the agreement was in place. BPL decided to proceed with building of the power plant, while negotiations continue with Shell. So, Shell has agreed that BPL will build the plant ahead of the LNG terminal to be built by Shell.

Question 6:
What happens if BPL does not successfully place the bond to construct the plant/
Answered by Rollins, BPL:
There are other financing options that will then be considered.

Question 7:
With the completion of Station D, what percentage of New Providence load will the station be capable of handling during peak summer period?
Answer by Rollins, BPL:
Peak summer is about 250-260 MW and Station A and B is capable of about 220 MW which is about 70% of the power. The rest is Station D. Do the math; those are the numbers.

Question 8:
Follow-up from question 6 - Do those other "options" include raising taxes?
Answer by Rollins, BPL:
That option is not being pursued by the board.

Question 9:
The Government has been talking about renewable energy. How do the new engines fit in with their plans to move toward renewables?
Answer by Strachan, BPL:
The new engines are part of BPL's overall efficiency improvement strategy, so these engines are significantly more efficient and are more environmentally friendly, than the older generation which fits into BPL's improved energy mix approach. With respect to renewables, BPL's primary focus right now is on the Family Islands where BPL is able to create higher penetration projects on those islands to keep them in the green and pristine condition that they're in and develop that as an attractive element to the tourism product. Station D on New Providence is specifically a baseload plant and so when BPL considered looking at renewables, the challenge is the amount of renewables that BPL would need to put in place. A plant capable of producing the same amount of energy as Station D would require between 1,400 and 1,800 acres of land for construction. For that reason, BPL tabled solar and pursued the other elements of its improvement strategy.

Question 10:
To clarify, Stations A and D will put out 220 megawatts (Not Stations A and B)?
Answered by Moultrie, SEV:
Yes, it's 200-220 MW.

Question 11:
Please advise what the other options are to fund construction for the public.
Answer by Rollins, BPL:
There are other financing options, but I don't want to go into detail about what those are.

Question 12:
You mentioned improved efficiency, has BPL made a final decision on engine type to be used, or is BPL open to reviewing other options that maybe more efficient than what has been examined thus far?
Answer by Rollins, BPL:
I don't know what they mean by more efficient than what has been examined thus far. We have all reciprocating engines at Clifton, and at Blue Hills, we have air derivative turbine technology engines.

It's better to keep one type of engine, in terms of maintenance and repair, than it is to have different engines with different operating and maintenance schedules, requirements, and parts. BPL has settled on the reciprocating engines at Clifton Pier. The board decided on that some years back. We did a tender, and Wartsila was selected as the EPC contractor for the project. Wartsila provides some of the most efficient reciprocating engines in the world.

Question 13:
Did Mr. Rollins say they went to tender for the engines chosen?
Answer by Rollins, BPL:
Yes, it has already happened.

Question 14:
What is the timeline for shutting down Station B?
Answer by Rollins, BPL:
There is currently no timeline for shut down of Station B. There is still some economic and commercial life left in that unit. It will be used as a backup to the new engines.

Question 15:
Is the oil remediation effort on the property underway and what is the progress?
Answer by McKinney, BPL:
BPL's oil remediation project is scheduled to start construction in the second quarter of 2021.

Question 16:
Is there any updates you can give us regarding negotiations with Shell North America?
Answer by Rollins, BPL:
Yes. Negotiations are ongoing. That's about all I will say on that at this time.

Question 17:
Is BPL making transmission upgrades to ensure that the system can handle the new output?
Answer by Pratt, BPL:
Yes, BPL is making transmission upgrades to move power from Clifton Pier to uptown New Providence. Studies along the route began last year. BPL knew that it had sufficient capacity to transport power from Station A, which has been happening successfully since last December. Sufficient capacity plus the ability to sustain loss of a line for any reason is needed. Current design work is looking at what needs to be done to enhance export capacity from Clifton Pier in order to provide for what we call the N-1 reliability (if a circuit is lost, there is still sufficient capacity in the transmission network) to bring all of the power being generated at Clifton Pier uptown.

Question 18:
The press said the MOU dates for the Shell negotiations has ended?? If yes, why is negotiations with Shell still continuing?
Answer by Rollins, BPL:
I repeat my previous answer. Negotiations with Shell North America are ongoing.

Question 19:
How many jobs will the construction of Station D create?
Answer by Phillips, Wartsila:
During construction there will be about 150-200 local jobs created.

Question 20:
Will there be an economic impact assessment accompanying the EIA?
Answered by Moultrie, SEV:
A socioeconomic impact assessment is done as part of the EIA. We look at baseline social conditions as well as potential impacts, and some economic impact. Not at the level an economist would do, but we do talk about existing jobs in the area, income levels for residents, and what potential job creation would occur. Costing of the project and other implications to the economy, hiring, duration of jobs, etc. would not be in the report. DEPP typically does not require that level of detail. Their focus is usually on social and environmental impact. Usually, those economic assessment reports are required by the Bahamas Investment Authority, particularly for foreign development projects. This is a local organization doing a project, so BPL would need to indicate whether they have to make any formal submission to Cabinet or another entity.
Additional answer by Rollins, BPL:
BPL will not have to provide an economic assessment for Cabinet. The board will have some studies done related to finances, but that is as far as it goes.

With no additional questions or comments, Moultrie provided closing remarks. She advised all those participating to send any follow-up questions or comments to info@sevconsulting.com or pr@bplco.com. Participants can also request a copy of the presentation.