Suite 109, Church Street, Sandyport Plaza
Cable Beach, West Bay Street
P. O. Box EE – 16922
NASSAU, The BAHAMAS
Telephone:1(242) 605-7142|376-7142

Environmental Baseline Assessment (EBA) for Wilson City Power Station, Wilson City, Gt. Abaco Island

Prepared by: Russell Craig & Associates Ltd

On behalf of: EA Energy LTD

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Table Of Contents

1.0 Executive Summary 5

1.2 Biological Baseline Studies 5

1.3 Environmental Impacts 5

1.4 Socio-economic Impacts 6

1.5 Key Mitigation Measures and Recommendations 7

2.0. Description of Proposed Project and Scope 8

2.1. Description of Proposed Project 8

2.1.1. Conceptual Master Plan: 8

2.2 Description of Alternatives 13

2.2.1 The "No-action" Alternative 13

2.2.2 Proposed Alternative 13

3.0 Agency Consultation and Public Involvement 13

3.1 Agency consultation activities and results 13

4.0 Baseline Description of Affected Environment 14

4.1. Geographical Location and Boundaries 14

4.2 Physical Environment 15

4.2.1 Climate 15

4.2.2 Topography 15

4.2.3 Hydrogeology and soils 16

4.2.4 Air Quality 18

4.2.5 Noise 18

4.2.6 Geotechnical Findings 18

4.3 Natural Environment 19

4.3.1 Terrestrial Surveys Methodology 19

4.3.2 Vegetation Map 20

4.3.3 Vascular Plant Diversity 21

4.3.4 Protected Tree Species Identified 24

4.3.5 Invasive Species 39

4.4 Avian Assessment 39

4.4.1 Methodology 39

4.4.2 Habitat Utilization 44

4.5 Biodiversity Assessment 44

4.6 National Parks and Protected Areas 47

4.6.1 Abaco National Park 47

4.7 Socio-economic Aspects....48
4.7.1 Land Use 48
4.7.2 Population.... 48
4.7.3. Economy Abaco's economy is based on a combination of industries, including agriculture, tourism, and rebuilding efforts. Abaco is the third largest contributor to the GDP of The Bahamas.... 48
4.7.4 Transportation 48
4.8 Cultural Resources....48
4.9 Touristic and Recreational Areas....49
4.10. Waste Streams....49
4.10.1 Solid Waste streams 49
4.10.2 Liquid Waste streams 49
4.11 Utilities....49
4.11.1 Potable water Potable water in Abaco is distributed and maintained by the Bahamas Water and Sewerage Corporation.... 49
4.11.2 Electricity 49
4.11.3 Fuel storage and distribution 50
4.11.4 Construction & Material Sources 50
5. Legal Aspects.... 50
5.1 Local Legislation and Policies.... 50
5.2 International legislation and Conventions of relevance.... 53
5.3 Government Institutions.... 53
6. 0 Anticipated Environmental Impacts of the Proposed Project 56
6.1. Impact Assessment Methodology....56
6.1.1 Assessment Criteria Tool 57
6.1.2 Severity Criteria Tool 57
6.2. Impacts to the Physical Environment....58
6.2.1. Impact Assessment for Site Preparation, Infrastructure Development and Plant Assembly 58
6.3 Socio-economic Impacts....61
7.0 Proposed Mitigation Measures 62
8.0 Public Consultation Process.... 64
9.0 Environmental Management Plan (EMP) 64
10.0 Conclusions Regarding Environmental Acceptability of the Proposed Project.... 66
11. Recommendations.... 66
12. References.... 67
APPENDICES.... 70
Appendix – A: Abaco Island Concept Design for Wilson City Power Plant....70

Appendix – B: Geotechnical Engineering Exploration Report 95

Appendix – C: Hydrogeological Reference Data 107

Appendix – D: CV of Environmental Consultant 116

List of Figures

FIGURE 2.1: IMAGERY REFLECTING SURVEY BOUNDARY OF 60 ACRES NEW PLANT, AND ITS RELATION TO THE EXISTING BPL PLANT 9
FIGURE 2.2: GENERAL LAYOUT OF THE POWER PLANT AT WILSON CITY ABACO 10
FIGURE 2.3: 3D VIEW OF GASIFICATION SYSTEM 12

FIGURE 4.1: GENERAL MAP OF GT & LITTLE ABACO SHOWING LAND COVER TYPES 14
FIGURE 4.2: MAP DEPICTING DISTINCTIVE VEGETATION TYPES FOUND ON THE PROJECT SITE (DRY PINE EVERGREEN FOREST) 21
FIGURE 4.3 : LOCATION OF PLOT 1 25
FIGURE 4.4: GRAPH FIGURES FOR PLOT 1 26
FIGURES 4.5 & 4.6 : SHOWING PINE TREE CANOPY 26
FIGURES 4.7 & 4.8: SHOWING TOPOGRAPHY (LEFT) AND PINE FOREST(RIGHT) 27
FIGURE 4.9: LOCATION OF PLOT 2 27
FIGURE 4.10: GRAPH FIGURES FOR PLOT 2 28
FIGURES 4.11 & 4.12: SHOWING PINE FOREST 28
FIGURES 4.13 & 4.14: SHOWING JUVENILE PINE (LEFT) AND UNDERSTORY (RIGHT) 29
FIGURE 4.15: LOCATION OF PLOT 3 29
FIGURE 4.16: GRAPH FIGURES FOR PLOT 3 30
FIGURES 4.17 & 4.18: SHOWING PINE FOREST 30
FIGURES 4.19 & 4.20: SHOWING UNDERSTORY (LEFT) AND TREE CANOPY (RIGHT) 31
FIGURE 4.21: LOCATION OF PLOT 4 31
FIGURE 4.22: GRAPH FIGURES FOR PLOT 4 32
FIGURE 4.23 & 4.24: SHOWING JUVENILE PINES 32
FIGURE 4.25: SHOWING PINE REGENERATION AND UNDERSTORY 33
FIGURE 4.26: LOCATION OF PLOT 5 33
FIGURE 4.27: GRAPH FIGURES FOR PLOT 5 34
FIGURES 4.28 & 4.29: SHOWING PINE TREE CANOPY AND REGENERATION 34
FIGURE 4.30: SHOWING TOPOGRAPHY OF SHRUBS AND FERNS. 35
FIGURE 4.31: LOCATION OF PLOT 6 35
FIGURE 4.32: GRAPH FIGURES FOR PLOT 6 36
FIGURES 4.33 & 4.34: SHOWING THATCH PALM (LEFT) AND PINE REGENERATION (RIGHT) 36
FIGURES 4.35 AND 4.36: SHOWING PARADISE TREE (LEFT) AND COPPICE UNDERSTORY (RIGHT) 37
FIGURE 4.37: GRAPH SHOWING TOTAL PROTECTED TREE TALLY PER ACRE 38
FIGURE 4.38: SHOWING CUBAN PEE WEE 41
FIGURE 4.39: SHOWING LOGGERHEAD KINGBIRD 42

FIGURE 4.40: SHOWING THICK BILLED VIREO ON BRANCH 42
FIGURE 4.41: SHOWING CUBAN PEE WEE ON BOUNDARY 43
FIGURES 4.42 & 4.43: SHOWING HOG SCAT WITH TREE BARK (LEFT) AND EATEN TREE BARK DURING FEEDING (RIGHT) 45
FIGURE 4.44: SHOWING COMMON SNAIL 46
FIGURE 4.45: SHOWING LADYBUG 46
FIGURE 4.46: SHOWING ABACO BOA 46
FIGURE 4.47: SHOWING PAPER WASP 46
FIGURES 4.48 & 4.49: SHOWING THE LOCATIONS OF NATIONAL PARKS OF ABACO AND THE SURROUNDING CAYS (LEFT) AND THE ABACO NATIONAL PARK (RIGHT) 47

1.0 Executive Summary

This Environmental Baseline Assessment (EBA) has as its prime objectives, (i) to assess present environmental quality and the environmental impacts and (ii) to identify environmentally significant factors that could preclude project development. In doing so, regard must be made to local legislation, international conventions, and BEST management practices. Guidelines for the drafting of the EBA was prepared in collaboration with the Department of Environmental Planning and Protection (DEPP), Ministry of the Environment and Natural Resources to facilitate the granting of the Environmental Clearance Certificate (CEC) for the commencement of project development activities.

EA Energy Limited proposes to develop 60 acres of Crown leased property into a first-class fully sustainable, solar and natural gas powered, Wilson City, Abaco Power Station. The property is situated in Wilson City, Abaco.

Key features of the development include:

- Investment of some B$45,000,000.00
- Hybrid Microgrid of Solar PV, Battery Storage and Natural Gas Engines
- Provision of Reliable Energy Source for Abaco
- Employment of 45-60 Bahamian workers during construction
- Employ permanently 20 - 25 Bahamians.

1.2 Biological Baseline Studies

Botanical and avian surveys took place over the course of five days (January 13th- 17th 2025) to document existing biological conditions. Botanical results and on ground inspections determined that the entire area is dominated by a Dry Pine Forest Ecosystem which are common in the northern islands of The Bahamas. Common plant species include the Caribbean Pine (*Pinus Caribaea)* Silver Thatch Palm (*Cocothrinax argentata),* Poison wood (*Metopium toxiferum),* and Bracken Fern *(Pteridium aquilinum)*. Some eight (8) species found in site are protected under the ***Forestry (Declaration of Protected Tree) Order, 2021***, and hence the need for a mitigation strategy to offset their removal, and associated biodiversity habitats during construction of the plant and associated developments. These species include Gum Elemi *(Bursera simaruba),* Silver Thatch palm *(Cocothrinax argentata*), Joewood *(Jacquinia keyensis),* Wild Tamarind *(Lysiloma latisiliquum*), Buccaneer Palm *(Pseudophoenix sargentii*) Paradise Tree (*Simarouba glauca),* Short Leaf Blolly *(Guapira discolor*) and Caribbean pine *(Pinus caribaea*).

The site is home to many avian species, with nineteen (18) species identified, and include the endemic Bahama Mockingbird *(Mimus gundlachii*). This species is protected under the Wild birds Protection Act, 1952.

1.3 Environmental Impacts

Impacts were viewed in the context of how the physical environment will be impacted by both the infrastructural developments (roads, water supply, waste management infrastructure, solar powered systems)

and resort development (residences, club house, pools, etc.) separately, utilizing qualitative criteria (i.e., nature, type, likelihood, scale, duration, reversibility, and significance) to assess impact.

The criterion of severity is used to measure the magnitude of impact an event has on the environment (i.e., terrestrial, fauna, wildlife, coastal, visual and aesthetics, hydrology, soils, and socio-economic, etc.). Severity in this circumstance was given ratings of 1 for low impact, 3 for medium impact and 5 for high impact.

The most direct impact associated with the Wilson City Power Plant project is the removal of vegetation to accommodate the infrastructural plant development and the footprint for the constructions with associated facilities. Due to the size of the area, subject to vegetation removal, the qualitative criteria rating significance was high. Additionally, the magnitude of the severity of the overall average impact to the natural and physical environment was scaled as high. Although Noise levels and Air quality impacts were rated as High, due to the anticipated construction activities, these will be temporal in nature once construction activities are completed. It is anticipated that waiver for the removal of the Protected Trees identified will be obtained from the Forestry Unit, Ministry of the Environment and natural resources, to allow for the removal of the protected trees. A buffer zone of natural vegetation will be retained along the periphery boundary of the site as green space, and serve as a biodiversity corridor and protected buffer for the power plant, from high winds.

Native and endemic plant species will be used in the landscaped areas to offset any losses of protected trees. In this respect, particular attention will be given the Forestry (Declaration of Protected Trees) Order, 2021, in the selection of replacement Trees for areas subject to landscaping.

The project in its current form and associated operational activities will have no negative impact on the marine environment.

1.4 Socio-economic Impacts

The Wilson City Power Station construction timeline is anticipated to be up to 17 months. Total development costs are anticipated to be up to BSD 45,000,000.00. At full build, the project anticipates annually accommodating up to 119 mkWh of electricity based on expected data received from BPRL and Ministry of Energy and Transport (MoET).

The project anticipates creating many jobs for Bahamians during construction and jobs for Bahamians during operations.

This vast investment in sustainable energy is expected to contribute to the environment by reducing the CO2 emission and pollutants, inevitable ensuring the growth of Abaco's ecosystem. The removal of outdated diesel facilities and replacing it with natural gas engines will not only reduce the cost of fuel imports as well as aid in preventing excess emissions and pollutants which may have contributed to ocean acidification and pollution of surrounding vegetation. While meeting the energy needs of the inhabitants of Abaco with reliable and robust power source. These are just a few ways the Wilson City Abaco Power Station will become a conduit for economic and environmental growth and development.

1.5 Key Mitigation Measures and Recommendations

***Terrestrial*:**

- Relocate where practical, protected species identified within the footprint of the new road reservations and building footprints, solar panels installations, prior to construction activities.
- Remove invasive species (Australian Pine (*Casuarina equisetifolia*) and Hawaiian Sea Lettuce *(Scaevola taccada)* from Human altered area and coastal areas.
- Plant native and endemic species in landscape areas.
- Maintain a 25 to 50 feet vegetation buffer ring at the periphery of the power station to serve as protective mechanism from strong winds associated with any potential tropical storm/hurricane event, and also function as a wildlife/biodiversity corridor.

***Avian*:**

- Protected trees identified and flagged for removal (a permit from the Forestry Unit, Ministry of the Environment and Natural Resources, under the Forestry Act, 2010), or to be maintained, where feasible.
- Train staff in the importance of birds.

***Hydrology*:**

- Implement fuel and chemical BEST management practices to ensure ground water resources are not negatively impacted.
- Retention of natural vegetation buffer around periphery of property boundary
- Given the geological conditions, uncased boreholes should be used to abstract water from the limestone aquifer. Also, abstraction should be spread over many boreholes

Geotechnical matters

- The subsurface soil profile consists of approximately 3 inches of relatively loose sand TOPSOIL underlain by the LIMESTONE formation to the explored depths.
- The encountered subsurface soil conditions are suitable to support the structures on a system of shallow foundations bearing on the existing LIMESTONE or engineered fill material.
- Design the footings using a maximum allowable bearing pressure of 5,000 lb/ft2 and sliding coefficient of 0.35 (0-4 if bearing on LIMESTONE).

***Air Quality and Noise*:**

- Employ BEST practices in construction methods to minimize dust emissions which impairs air quality.
- Construction workers to always wear PPE

***Solid and hazardous Waste*:**

- Solid waste generation limited to construction waste, and vegetation removal from road
- Vegetation removed will be reused/mulched for landscaping purposes.
- Solid and hazardous waste will be placed in containers and properly disposed of (removed to the mainland of Abaco Landfill Site) in accordance with Department of Environmental Health Services (DEHS) regulations and standards.

***Fire and Hurricane Preparedness*:**

- A Fire Control and Prevention Plan, to be prepared detailing steps to prevent, contain and control fires during construction and operation the residential resort.
- Maintain a 25 to 50 feet vegetation buffer ring around the periphery of property
- All buildings will follow fire requirements of the Bahamas Building Code.
- A Hurricane Preparedness and Contingency Plan will be developed in the event the island is impacted by a storm or hurricane.

***Occupational Health and Safety*:**

- Workers to be provided appropriate Protective Personal Equipment (PPE).
- All workers be trained in handling of equipment, before starting work on property.
- Regular enforcement of occupational health and safety protocols on a weekly basis.

Environmental Management Plan

The purpose of the Environment Management Plan (EMP) is to outline the mitigation measures and monitoring necessary to reduce or eliminate the identified negative impacts associated with the project activities (both developmental and operational). The Plan will be developed once a No Objection to the EBA is received from the DEPP.

Conclusion:

The Wilson City power plant project with its investment of some $45,000,000.00 is expected to generate much need economic stimulus for Abaco (construction jobs, permanent jobs, and entrepreneurial activities). The project benefits far out way any limited unavoidable negative environmental impact identified.

Employment of BEST management practices, having regard to national environmental legislation and International Conventions and standards will ensure the project is developed and becomes operational in a sustainable manner. The developers have indicated their intention to, and based on the Masterplan, ensure that the project lives up to its expectations (retention of vegetation buffer zone around the property boundary, solar energy, reduce impact,) on the natural environment. Utilizing the mitigation measures will guarantee that the negative impacts identified are reduced/or are mitigated and is sustained.

2.0. Description of Proposed Project and Scope

2.1. Description of Proposed Project

2.1.1. Conceptual Master Plan:

EA Energy Limited proposes to develop 60 acres of Crown leased property into a first-class fully sustainable, solar and natural gas powered, Wilson City, Abaco Power Station ***(see Appendix – A).*** The property is situated in Wilson City, Abaco, located adjacent to the existing diesel power plant. ***(see Figure 2.1)***

Figure 2.1*: Imagery reflecting survey boundary of 60 acres new plant, and its relation to the existing BPL plant*

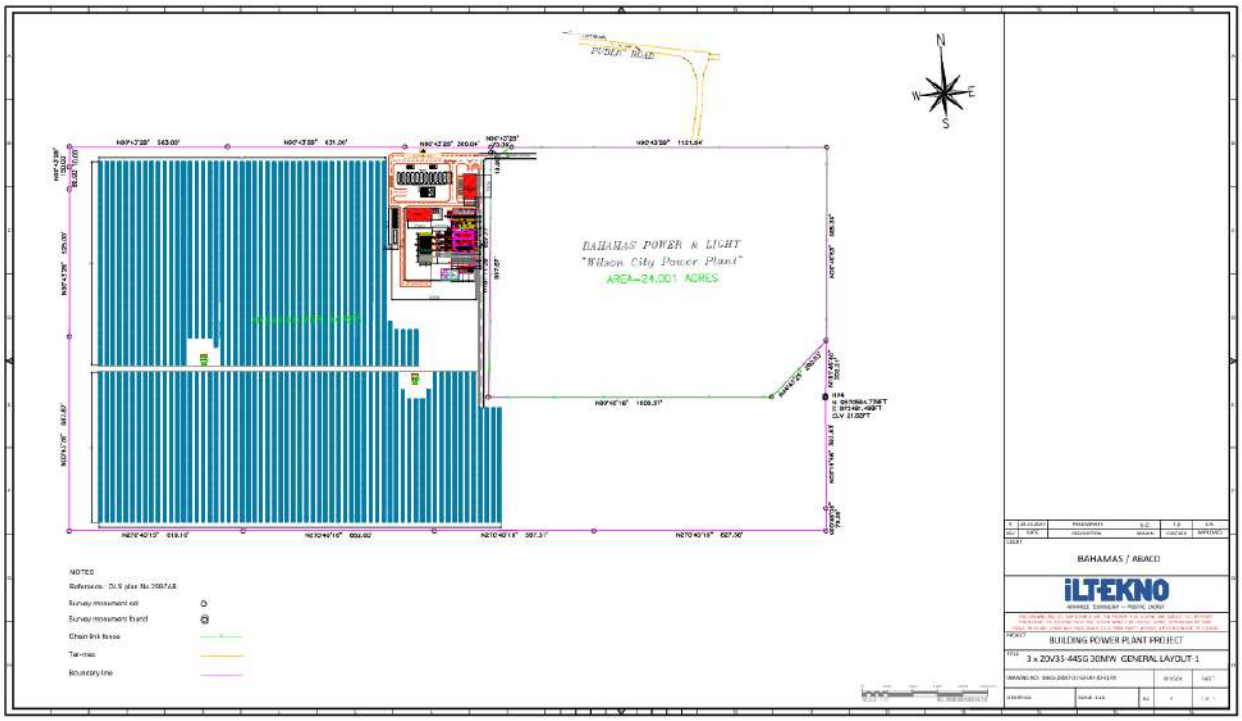


Figure 2.2: *General layout of the power plant at Wilson City Abaco*

Project Capacity Selection

The primary reason for selecting a baseload power plant is that, as the sole power producer on Abaco Island, it must ensure that the baseload capacity can meet the demand even during both planned and unplanned outages of the generators. In this regard the baseload plant has been selected with 3 x 9,976kWe net output MAN 20V35- 44 G model with total capacity 29.9kWe. As per the requirement by the MoE specification for the renewable energy, following configuration is selected;

1. 15 MWp Solar PV selected with AC output of 13.05 MWe
2. 1 x 7.5MWe (settable) AC usable power @ POI and 15.564 MWh AC usable power capacity @ POI Battery System

Battery storage system has been selected in 15MWe 0.5C (7.5MWe/15MWh) due to below reasons;

1. During any unplanned outage of any genset at baseload plant, in order to cover the response time of gas engines.
2. For covering the 5MWe of island demand alone for approximately two hours in case of any unplanned outage at the baseload plant.
3. In order to cover load steps of Genset due to the instant load profile change in the Island

In this regard the Plant configuration studied as follows;

29.9MWe Baseload + 15MWp Solar + 15 MWe Battery Storage Abaco Power Plant

Via PVsyst software, hourly generation study performed for Solar Plant and according to the load profile provided by MoE for the 85,597MWh yearly production value, below results have been gathered;

i. Solar Power - 25,188 MWh production directly to the grid and capacity usage 19.31% whereas the surplus amount of energy to be utilized for filling the batteries depending on the load demand and forecast
ii. Gensets - 93,953 MWh production with 35.84% capacity usage
iii. Remaining 860 MWh demand will be covered with batteries where the demand is lower than the Gensets' low load limit
iv. Running hours of batteries is calculated as 307 hours

Based on the hourly production values provided by MoE, the selected capacity will be sufficient to provide reliable and constant electricity to the Island. To meet the demand in future years, an additional two reserve Genset area will be considered in the layout studies together with its electrical and mechanical auxiliaries.

Solar Plant

The Solar Power Plant will consist of 33,344 x 450 Wp Half Cut Bifacial PV modules. These PV modules will be grouped into 2084 tables, each with 32 modules-1string. These strings will transmit the direct current generated by the solar panels to the inverters. 300 kWe inverters will be used in the project and these inverters will convert the incoming energy into alternating current at 800 Volts and transmit it to 4 main distribution panels. The main distribution panels will be positioned near the transformers and connected to 4 each 3750 kVA transformers. The voltage of 0.8 kV will be stepped up to 13.8 kV and the system will be connected to the distribution center.

Bifacial PV modules that have transparent backsheets produce additional energy from the backside thanks to reflected solar irradiance. The PV Modules will be mounted with the optimum azimuth and tilt angles to maximize efficiency.

The system can be monitored instantly via Data Logger devices and any faults in the field can be detected quickly.

The solar plant is to be located closer to the base load plant in order to minimize the electrical cabling costs. According to the layout studies the allocated area is sufficient to provide 15MWp solar power plant.

Battery Storage System

Solar and Battery system will be connecting to the same busbar. AC coupling will be considered for the MV connection

Batteries and its relevant Transformers and MV cubicles are to be manufactured in containerized skids. Via the integrated battery and energy management system, grid frequency control will be established for Solar and baseload side

Features of the skid solution is provided below;

- Renewable Power Plant Integration (Ramp rate control, energy shifting)
- Grid Ancillary Control (Frequency regulation, peak shaving)
- Distributed Network and Micro-grid (Peak shaving, autonomous operation)

Performance

- Advanced three-level technology, max. efficiency reaches 98.8%
- Effective forced air cooling
- High DC voltage up to 1500V
- Support two independent DC inputs
- Bidirectional power conversion system
- Battery charge & dis-charge management and black start function integrated

EASY O&M

- Integrated monitoring function and fast trouble shooting
- Integrated auxiliary power supply panels for external devices
- Low transportation and installation cost
- GRID SUPPORT
- Compliant with UL1741, IEEE1547
- L/HVRT, L/HFRT, specified power factor control and reactive power support

LNG Supply and Gasification System

LNG supply will be performed with LNG trucks and/or LNG ISO containers. The Project will be occupied with LNG unloading station (pump requirement details will be also verified with LNG supplier) and truck scale

Gas consumption amounts to approximately 20.4 million m3 of gas corresponds to 34.000 m3 of LNG. By considering that figure and ISO and/or LNG tanker capacity as 44m3, yearly 760 trucks to be dispatched to the power plant for covering the electricity demand which corresponds to almost twice times filling in a day. In order to keep the continuous supply of LNG to the Plant.

Remaining regasification system will consist of liquid natural gas storage tanks, atmospheric vaporizers, electric heater and regulation station.

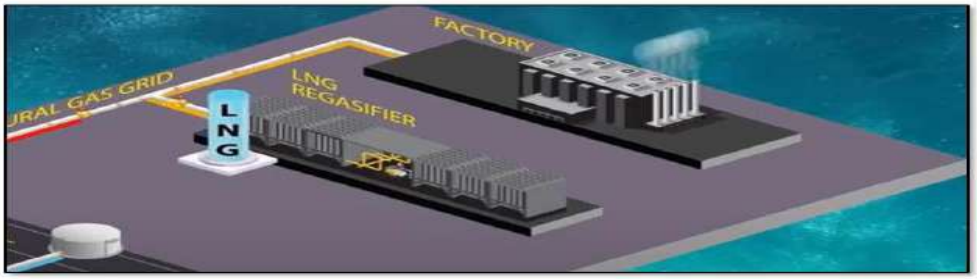


***Figure 2.3**: 3D View of Gasification System*

LNG Storage Tanks

For LNG storage tanks, the capacity selection is not increased to 120,000MWh, instead of this initial data of BPL considered.

Based on the yearly production data, 10 days storage tank with total volume of 1000m³ is to be used (4 each 250m³).

2.2 Description of Alternatives

2.2.1 The "No-action" Alternative

With these type developments, there is always the "No Action" Alternative. In these circumstances, the "No Action" alternative would keep Wilson City in the same undeveloped position currently, unless sold to another buyer. With no new constructions under consideration, this would eliminate the intended purpose for acquiring the property. Any economic activity, employment opportunities on the Island and mainland of Gt. Abaco Island gained through construction jobs, permanent jobs, investment injections, economic opportunities would be missed and lost.

2.2.2 Proposed Alternative

The site is crown lands with minimal development footprint.

The site selection was based on:

- the land was available for the purpose.
- the size of the project made it ideal to accommodate the project components.
- The area is ideally located just 30 minutes by road from the mainland Settlement of Marsh Harbor, Abaco, and is a fair distance away from commercial and residential areas.

3.0 Agency Consultation and Public Involvement

3.1 Agency consultation activities and results

An important consideration that must be factored into the planning process for the Wilson City Power Station project is to have in place an effective public relations/communication strategy. This is necessary to adequately inform, and to gather feedback from residents living in proximity to the power plant. To advise them on the socio-economic and environmental impacts, and how any adverse impacts will be mitigated.
Discussion have been held with the DEPP with respect to the Public Consultation process. A public meeting will be held on the Island of Abaco at a date and time facilitated by the DEPP, to provide the public with the opportunity to review the project activities and associated environmental impacts and mitigation strategies.

4.0 Baseline Description of Affected Environment

4.1. Geographical Location and Boundaries

Great Abaco, The Bahamas is located about 55 miles (90 km) north of Nassau, the capital, on New Providence Island and about 193 miles (167.7 nautical miles or 310.6 km) east of Miami, Florida, US ***(Figure - 4.1a)***.

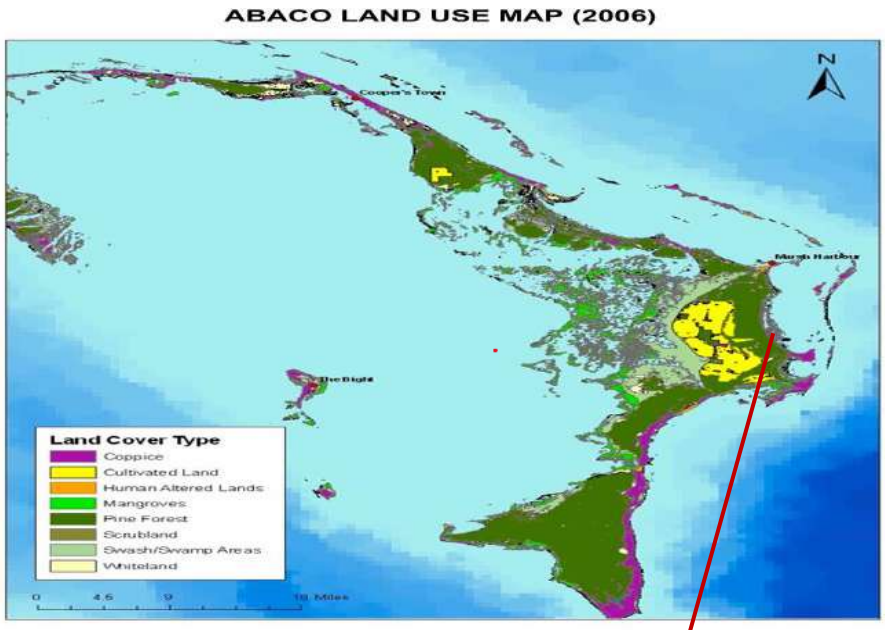


Figure 4.1a: *General Map of Gt & Little Abaco showing land cover types*

Figure 4.1b*: Map Imagery of existing BPL power plan at Wilson City and by extension the new power plant, circle in red outliner*

4.2 Physical Environment

4.2.1 Climate

The Bahamas' climate is classified as subtropical, influenced by the sea, particularly the Gulf Stream to the West. Cooler winters and higher amounts of rainfall are experienced more in the Northern Islands compared to the Southern islands, with drier conditions. According to Sealy (2006), temperatures are mild throughout the year and the average varies from the low 70s ^{o}F during the winter to the low and high 80s ^{o}F during the summer. Prevailing winds come from the Northwest in winter and from the Southeast in Summer, lending a cooler influence, with average wind speed recorded at eight (8) knots.

Like the other Bahama Islands, Abaco enjoys a subtropical climate, with relatively warm, wet summers and drier, cooler winters. Persistent easterly trade winds predominate in the summer, which brings warm humid air to the island. The influence of a high-pressure cell in the winter produces drier continental air and is marked by the presence of cold fronts, which can bring occasional rainfall. The island is not subjected to freezing temperatures.

The Bahama Islands lie within the North Atlantic Hurricane Belt, where hurricanes pose a significant threat during the period 1st June to 31 November and can result in catastrophic damages to the natural and built environments and human mortality. The islands of New Providence, Andros and Grand Bahama were impacted by Hurricane Matthew in 2006 causing severe damage to coastal areas. In 2017, Hurricane Erma impacted the islands of Great Inagua and Crooked Island. No hurricanes impacted the islands in 2018. However, in 2019 significant areas of Abaco and Grand Bahama were devastated by Hurricane Dorian, with estimated damages amounting to US$3.4 Billion (IDB, 2019), significantly impacting the economy of those islands, and by extension the Bahamian economy. Based on these datasets, there is the possibility that the Island of Abaco and its cays experience a direct hit from a hurricane event in any given year.

4.2.2 Topography

The Geology of the Bahamas and the Turks and Caicos Islands is unique. Down to a depth of approximately 6,096-meter (20,000-feet), the platform comprises a continuous sequence of carbonate/evaporite rocks, and this is what makes it unique. Topographically, the islands of The Bahamas are typically flat with elevations of less than 32 feet (9.75-meter). 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 Bahamas. The islands are usually long and narrow oriented from northwest to southeast with central ridges extending to a maximum height of 200-feet (60.96-meter). The geologic formations composed of rocks that can dissolve (karstic - aquifers composed predominantly of carbonate and evaporite rocks); that tend to have subsurface formations that are highly permeable, and vast volumes of water can easily be abstracted from / injected to this source. Typical geological conditions prevail, where there is "late Holocene carbonate deposition and sea-level effects on development and spatial distribution of coastal environments. Three lithofacies occur here, as elsewhere in the Bahamas, and represent foreshore, backshore, and dune environments. Pro gradational beach-ridge strand plains, composed of eolian rather than wave-formed ridges, are common and are particularly well developed throughout the region."

4.2.3 Hydrogeology and soils

The Geological, hydrological and water resources of the Bahamas are directly linked, due to the lack of any rivers. Consequently, the only natural means of recharge for the underlying freshwater resources is via rainfall. For The Bahamas, all freshwater is by way of rainfall, which percolates and collects as groundwater. The general movement of the groundwater is toward the coastline (typically during a falling tide), with very gradual movement inland (during rising tide conditions). 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. The total concentration of dissolved solids or salts (TDS, expressed in mg/L or ppm) is utilized as a water quality indicator. The three main classes of water distinguished are: fresh, brackish and saline (salt | saline) water.

Bahamas Water Resources

For The Bahamas, all freshwater is by way of rainfall, which percolates and collects as groundwater. The general movement of the groundwater is toward the coastline (typically during a falling tide), with very gradual movement inland (during rising tide conditions). 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. The total concentration of dissolved solids or salts (TDS, expressed in mg/L or ppm) is utilized as a water quality indicator.

For the purposes of the particular site(s), the conservative range of salinity follows:

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

Thus, the groundwater resources of the Bahamas comprise fresh, brackish, saline, and hypersaline waters, located in the subsurface, in lakes, ponds that intercept the land surface. In the Bahamas, the physical geology, hydrogeology, water resources, and coastal zone are diametrically linked, as there are no true rivers in The Bahamas. From the perspective of Wilson City (project site), there are only three potential sources of water: groundwater (aquifers), collected rainwater, and manufactured water from reverse osmosis. Any changes to the island hydrology, pollution or contamination of groundwater sources, or introduction of pathogens, nutrients or excessive organic matter can have irreversible environmental impacts. ***(Bowleg, 2025)***

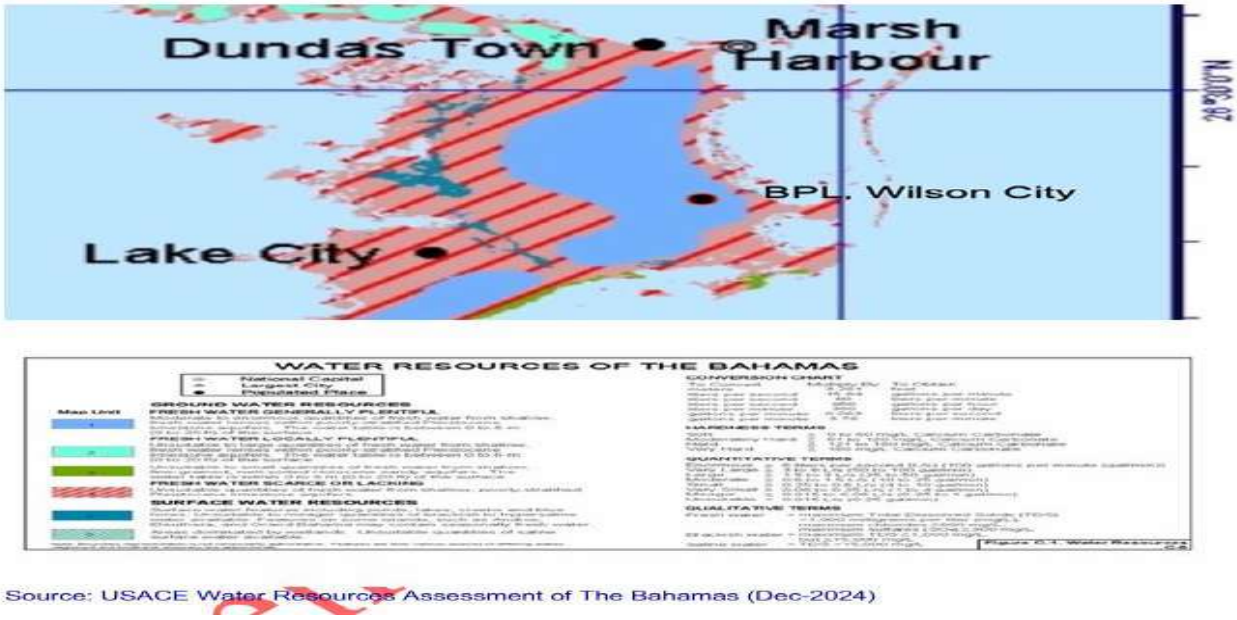
Surface Water

Per the 'USACE Water Resources Assessment of the Bahamas, 2004' - "One of the northernmost islands, Abaco is located approximately 184 km (114 miles) north of Nassau and 282 km (175 miles) east of Palm Beach, FL. Grand Bahama Island, the closest Bahamian island, is approximately 135 km (84 miles) east of Abaco." Surface Water "Nearly three quarters of the average annual rainfall occurs during the rainy season,

which extends from May through October. Average annual precipitation is approximately 1,010 mm (40 inches). The terrain of Abaco Island is largely flat and rocky. Surface water bodies cover less than 2% of the island and include blue holes, man-made lakes, and ponds. Six blue holes were discovered on Abaco. A blue hole near Treasure Cay airport measured 57 m (186 ft) in depth and has a 15 m (50 ft) column of freshwater overlying saline water. The depth of this blue hole is comparable to a large freshwater lens and may provide meager yields of water. It should not be considered a primary source of freshwater. The depths of the remaining blue holes on Abaco range from 10.4 to greater than 46 m (34 to greater than150 ft). In the mid 1970's, man-made ponds resulted from the removal of limestone to provide material for road construction. Many of the pools penetrate a couple meters below the water table and may be 30 m (100 ft) or so in diameter. These surface water bodies should not be used as primary water sources. Large-scale chemical or biological contamination of the surface water has not been reported."

Ground Water

"Abaco Island possesses good freshwater resources from the Lucayan Limestone aquifer lenses. Very large to large quantities of water are available from four relatively large freshwater lenses: (a) Normans Castle, (b) Marsh Harbour – Lake City, (c) Lake City – Crossing Rocks, and (d) Crossing Rocks – Hole in the Wall. The lenses vary in thickness and the water table is between 0.6 and 6 m (2 to 20 ft) below the surface. The lens at Norman's Castle reaches a maximum thickness of 16.8 m (55 ft) and one borehole can produce a maximum yield of 3.8 L/s (60 gpm). The area between Marsh Harbour to Lake City Lake is well developed with regards to ground water resources, as this lens serves the population of Marsh Harbour and its surrounding communities. The lens also reaches a maximum thickness over 15 m (50 ft) and each borehole can produce yields between 2 – 3 L/s (30 – 45 gpm). The lens extending from Lake City Lake to Crossing Rocks has a maximum thickness of 13.7 m (45 ft) and thins southward where the water becomes brackish near Guinea Schooner Bay. Maximum yields in this area are 2 L/s (30 gpm). The area between Crossing Rocks and Hole in the Wall contains a thick (12 – 18 m) and extensive freshwater lens that may produce yields greater than 2.5 L/s (40 gpm). This unit, which covers approximately 33% of the total island area, is suitable for hand pumps. Given the geological conditions, uncased boreholes should be used to abstract water from the limestone aquifer. Also, abstraction should be spread over many boreholes**. *(Bowleg, 2025)***



Source: USACE Water Resources Assessment of The Bahamas (Dec-2024)

4.2.4 Air Quality

No issues or sources of air pollution, or air quality presently on the project site was identified, as the site is currently undeveloped. With the development of a new power plant air quality parameters would require constant monitoring.

4.2.5 Noise

Presently there is no issue of noise pollution. The only source of noise pollution is that of existing power plant activities (i.e., diesel generator) which is located at a reasonable distance away from any resident or commercial establishments. Once construction activities commence, noise levels are expected to be raised, hence the need for constant monitoring to ensure acceptable standards are maintained, albeit temporarily as construction commences. Noise levels will return to pre-construction levels once development activities cease.

4.2.6 Geotechnical Findings

Subsurface Soil Conditions

The subsurface soil profile consists of approximately 3 inches of relatively loose sand TOPSOIL underlain by the LIMESTONE formation to the explored depths. Based on the experienced rate of excavation (i.e. 30 minutes/foot of depth), the encountered LIMESTONE formation is sound and hard. In addition, the pocket soil penetrometer test results indicated values in excess of the instrument's highest measurable compressive strength of +5.0 ton/ft2 at each tested location. ***(see Appendix – B).***

Key Geotechnical Evaluations and Recommendations

Building Structure

The encountered subsurface soil conditions are suitable to support the structures on a system of shallow foundations bearing on the existing LIMESTONE or engineered fill material.

Site preparation should consist of the entire removal of vegetation/TOPSOIL and subsequent placement of approved fill material to raise/level the resulting grades to the elevations, if required. Inspection of the entire site, by our geotechnical engineer or a representative, is advisable after the removal of vegetation/TOPSOIL and prior to raising/leveling the resulting grades to assure sound, competent subgrade conditions are attained (i.e. removal of surficial weak, weathered LIMESTONE might be required).

Design the footings using a maximum allowable bearing pressure of 5,000 lb/ft2 and sliding coefficient of 0.35 (0-4 if bearing on LIMESTONE).

The approved fill material should consist of granular soil with a maximum nominal size of 3 inches, no more than 12% of fines and no organic matter placed in 12-in thick lifts compacted to at least 95% of the material's Maximum Dry Density (ASTM Dl557) is expected to be 120 lbs/ft3. An active earth pressure coefficient of 0.35 and a passive earth pressure coefficient of 3.0 shall be used. ***(See Appendix – B).***

Slab on Grade

The slabs can be supported on-grade on either competent LIMESTONE or approved engineered fill with the upper 12 inches compacted to the materials' Maximum Dry Density (ASTM Dl557). A modulus of subgrade reaction of 250 lb/in3 can be used for design of the slab-on-grade.
For unyielding walls (i.e. restrained retaining walls), an at-rest earth pressure coefficient of 0.5 should be used.

Care should be exercised when placing fill and performing compaction in proximity to retaining walls. Fill compaction in proximity to the walls should be performed with small vibratory plates and to at least 92% of the material's Maximum Dry Density (ASTM D1557).

4.3 Natural Environment

Studies with respect to botanical, avian and biodiversity was undertaken over an initial five-day period (13 – 17 January 2025). The objective, to map and assess the flora diversity, (inclusive of a protective tree species survey), identify any invasive species, fauna and abundance and identify associated biodiversity.

4.3.1 Terrestrial Surveys Methodology

The entire project site acreage (60 acres) was ground truced (walking) along the entire boundary, and trails within the interior upland vegetation areas. Using Areces et al. (1990), all vegetation types were recorded and used to compile a species list. Corell and Corell (1982) and the website for the Leon Levy Plant Preserve

(Eleuthera) http://www.levypreserve.org/_m1810/Plants-Scientific-Name was used for Plant taxonomy. Invasive species encountered was referenced and identified, in accordance with the National Invasive Species Strategy (2013) for control or eradication. The presence and abundance of protected trees was undertaken, listed in accordance with the Forestry (Declaration of Protected Trees) Order 2021.

Using survey plan of proposed property, a systematic grid approach was adopted. A total of six (6) computer generated sample plots were established with (4) quadrants sampled in each plot for the purposes of botanical data collection and analysis. Each sample plot center chosen for data collection was georeferenced (GPS coordinates), with a fixed radius of 8 meters established. Tally counts were made of all flora species identified (diversity) and categorized as trees, shrubs, and herbs. Overall estimation of species abundance of protected trees was determined (an expansion factor was used with calculations extrapolation over the 60 acres). Firstly, the tally count for each plant species was totaled per plot, then averaged over the four plots for an overall plot average per acre, next the plot average per species was extrapolated to the property acreage. **Figures 4.3 through Figure 4.26** depicts the location of the sample plots from which field data was collected, along with a summary of the findings for the plant species identified, with summary totals.

4.3.1.2 Terrestrial Ecosystems

One distinct categories of terrestrial ecosystem were identified, and this was the Interior Upland (IU)

4.3.1.2.3 Interior Upland

The Upland Interior was of the Dry Pine Forest Ecosystem with homogenous species composition and height. The main Dominant species was the Caribbean Pine.

The entirety of the property is comprised of pine trees between 20 and 30 feet in height and dominated by coppice understorey species. The area has presence of Karst sink holes in places.

4.3.2 Vegetation Map

A Vegetation map at ***Figure 4.26*** below highlights the one distinct vegetation types found on the project site. The most dominant type is the Dry Pine Forest ecotype.

***Figure 4.2**: Map depicting distinctive vegetation types found on the project site (Dry Pine Evergreen Forest)*

4.3.3 Vascular Plant Diversity

Based on survey analysis, a total of fifty-three (53) species was identified from the site ***(Table 4.1).*** There is a high probability that this number represents all the species on site. One can conclude, that the list is a fair representation of the extent of the diversity on the property.

TABLE KEY:	
Nativity	**Regulation**
N = Native	P = Protected
I = Invasive	U = Unprotected by local legislation
E = Established or common non-invasive	
L = Landscaping species	

Table – 4.1: Vascular plant species recorded on property

Botanical Name	Common Name	N	NN	P	I
Heliotropium curassavicum	Pond bush	√			
Anemia adiantifolia	Pineland fern	√			
Bidens alba	Shepherd needle		√		
Bromeliaceae	Bromeliad				
Bursera simaruba	Gum Elemi			√	
Caladium bicolor	White spindle flower		√		
Cassytha filformis	Love vine	√			
Colubrina arborescens	Soap bush	√			
Jacquinia keyensis	Joewood			√	
Leucaena leucocephala	White leadtree (jumbay)	√			
Lysiloma latisiliquum	Wild tamarind			√	
Alkali sacaton	Donkey grass		√		
Pinus caribaea	Pine Tree			√	
Rhynhcospora floridensis	White-top sedge				
Sabal palmetto	Sabal palm			√	
Salvia greggii	Native sedge	√			
Schinus terebinthifolia	Brazilian pepper				√
Sideroxylon salicifolium	Willowbustic	√			
Sphagneticola trilobata	Creeping Oxeye	√			
Turnera ulmifolia	Buttercup		√		
Bidens alba	Shepherd's Needle		√		
Casuarina equisetifolia	Causarina				√
Ipomoea indica	Morning Glory		√		

Leucanthemum vulgare	Wild Oxe-Eye Daisy	√			
Mucuna pruriens	Monkey Tamarind		√		
Ricinus communis	Castor Bean Plant		√		
Senna bicapsularis	Sennas (Christmas Bush)		√		
Bletilla striata	Bletia Orchid			√	
Toxicodendron radicans	Poison Ivy	√			
Petitia domingensis	Wild Guava	√			
Trema lamarckiana	Pain-in-the-back	√			
Priva lappulacea	Cats Tongue	√			
Lantana involucrata	White Sage	√			
Carex polystachya	Caribbean Sedge		√		
Urochloa mutica	California Bay Grass		√		
Adiantum capillus	Maiden Hair Fern		√		
Eugenia axillaris	White Stopper		√		
Tabebuia bahamensis	Five Finger	√			
Coccoloba uvifera	Hawaiian Sea Grape				√
Simarouba glauca	Paradise Tree			√	
Pteridium aquilinum	Bracken Fern	√			
Pithecellobium keyense	Rahms Horn	√			
Pilocereus millspaughii	Wild Fig		√		
Chrysobalanus icaco	Cocoa Plum	√			
Passiflora edulis	Passionflower Vine	√			

Smilax havanensis	Chainey Briar		√		
Vachellia choriophylla	Cinnecord	√			
Strumpfia maritima	Mosquito Bush	√			
Senna occidentalis	Wild Coffee	√			
Stachytarpheta jamaicensis	Rats Tail	√			
Guapira discolor	Short Leaf Blolly			√	
Echites umbellatus	Devils Potato		√		
Baccharis halimifolia	Groundsel Bush		√		

4.3.4 Protected Tree Species Identified

A total of eight (8) protected species were identified from field surveys, including endemic or endangered, threatened, cultural. Historical and economic significance. ***(Table 4.2).***

Table – 4.2: Protected Species Recorded on Property

Botanical Name	Common Name	Status
Bursera simaruba	Gum Elemi	CHE
Cocothrinax argentata	Silver Thatch palm	CHE
Jacquinia keyensis	Joewood	EET
Lysiloma latisiliquum	Wild Tamarind	CHE
Pseudophoenix sargentii	Buccaneer palm	CHE
Simarouba glauca	Paradise Tree	CHE
Guapira discolor	Short Leaf Blolly	CHE
Pinus caribaea	Pine Tree	CHE

Key: EET = Endemic, Endangered or Threatened. CHE = Cultural, Historical and Economic

SUMMARY OF PLOT DATA

KEY:

A **DAFO** score method **(D=dominants, A=abundant, F=frequent, O=occasional, R=rare)** was recorded for each species presence. Species cover (%) were recorded within each quadrat (plot).

Plot 1 (26°21'46"N 77°02'40"W) Consisted of a Dry Pine Forest ecosystem with dominant tall pine upper story and understory consisting of significant pine regeneration, along with bracken fern and shrubs.

Figure 4.3: *Location of Plot 1*

Species Name	Species Presence	Species Cover
Pine	D	80%
Silver Thatch Palm	F	20%

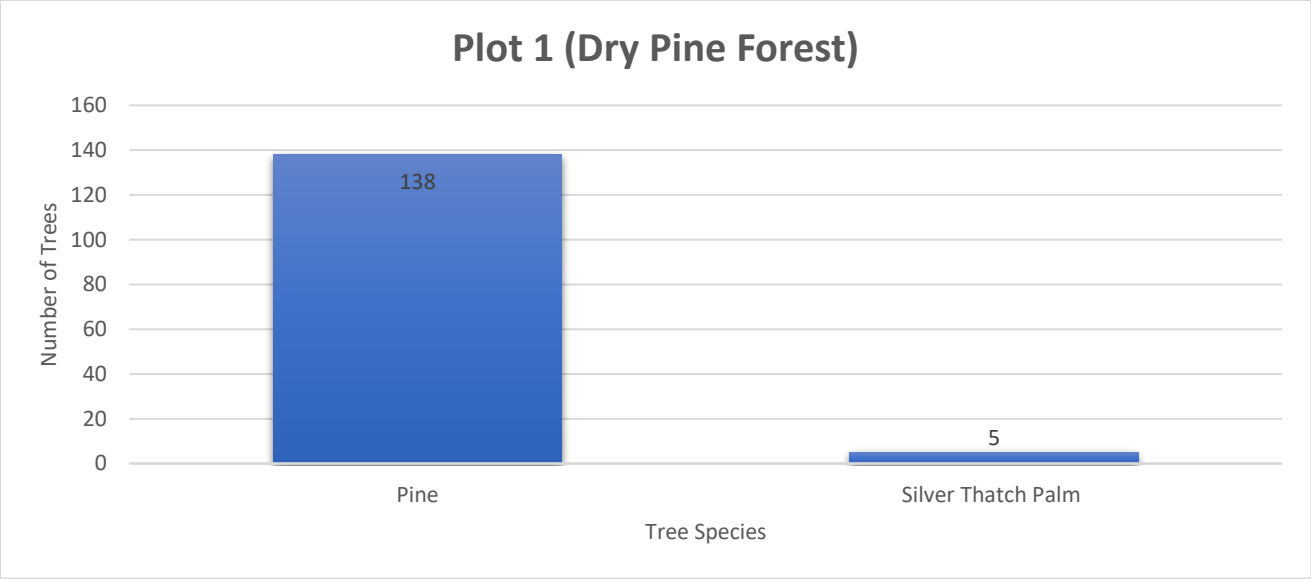


***Figure 4.4**: Graph Figures for Plot 1*

***Figures 4.5 & 4.6:** Showing Pine Tree Canopy*

***Figures 4.7 & 4.8**: Showing topography (left) and pine forest(right)*

Plot 2 (26°21'46"N 77°02'49"W), Consisting of a Dry Pine Forest ecosystem with dominant tall pine upper story and understory consisting of significant pine regeneration, along with bracken fern and shrubs.

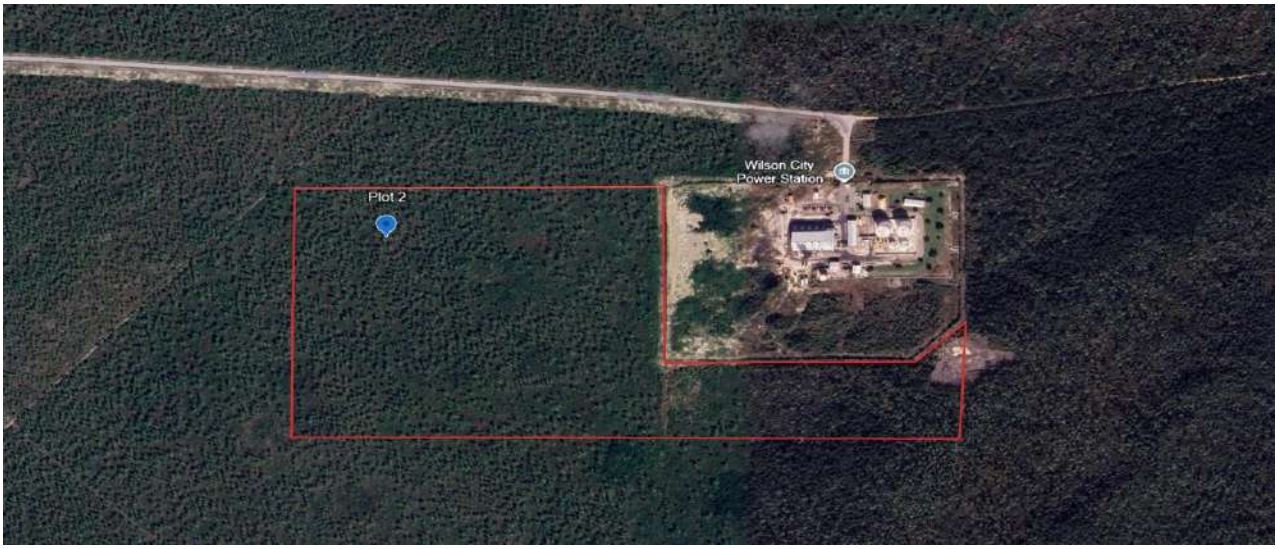


***Figure 4.9**: Location of Plot 2*

Species Name	Species Presence	Species Cover
Pine	D	80%
Silver Thatch Palm	O	10%
Joe Wood	R	10%

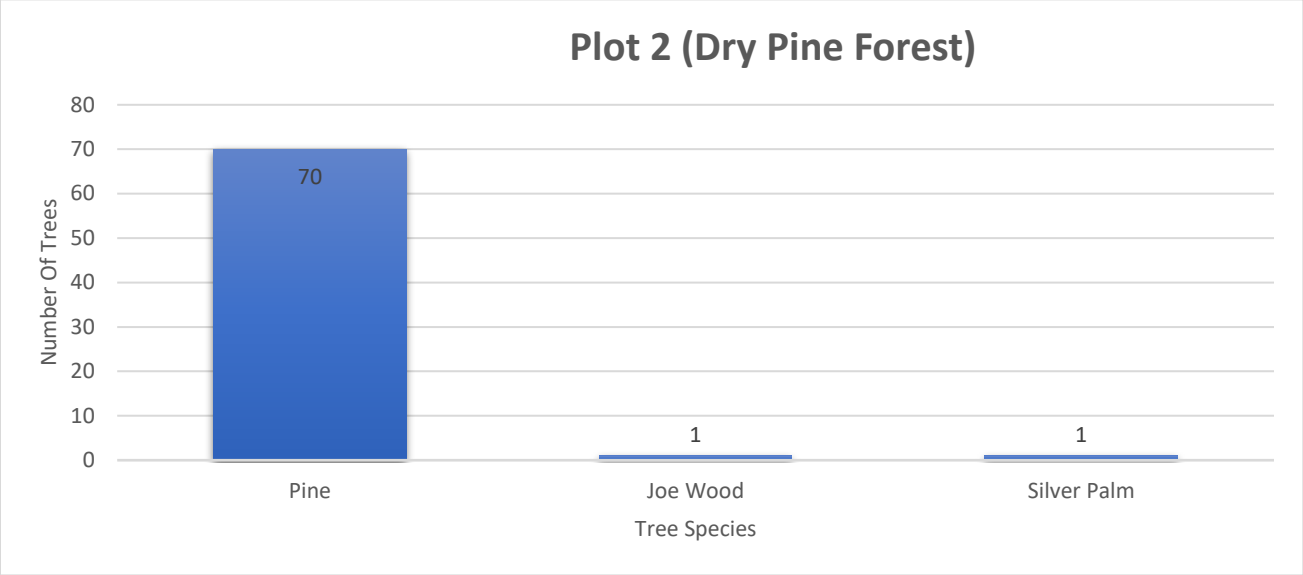


***Figure 4.10**: Graph Figures for plot 2*

***Figures 4.11 & 4.12:** Showing Pine Forest*


Figures 4.13 & 4.14: *Showing juvenile pine (left) and understory broadleaves (right)*

Plot 3 (26°21'40"N 77°02'49"W) consisted of a Dry Pine Forest ecosystem with dominant tall pine upper story and understory consisting of significant pine regeneration, along with bracken fern and shrubs.

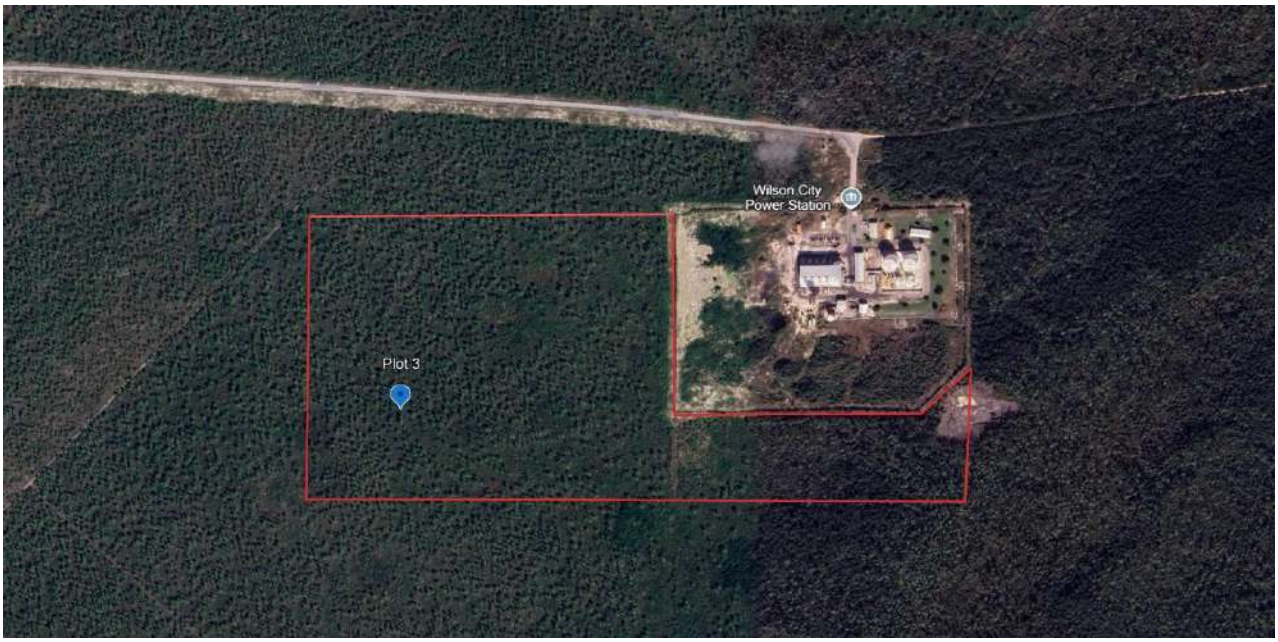


Figure 4.15*: Location of Plot 3*

Species Name	Species Presence	Species Cover
Pine	D	75%
Silver Palm	O	10%
Joe Wood	F	10%
Thatch Palm	F	5%

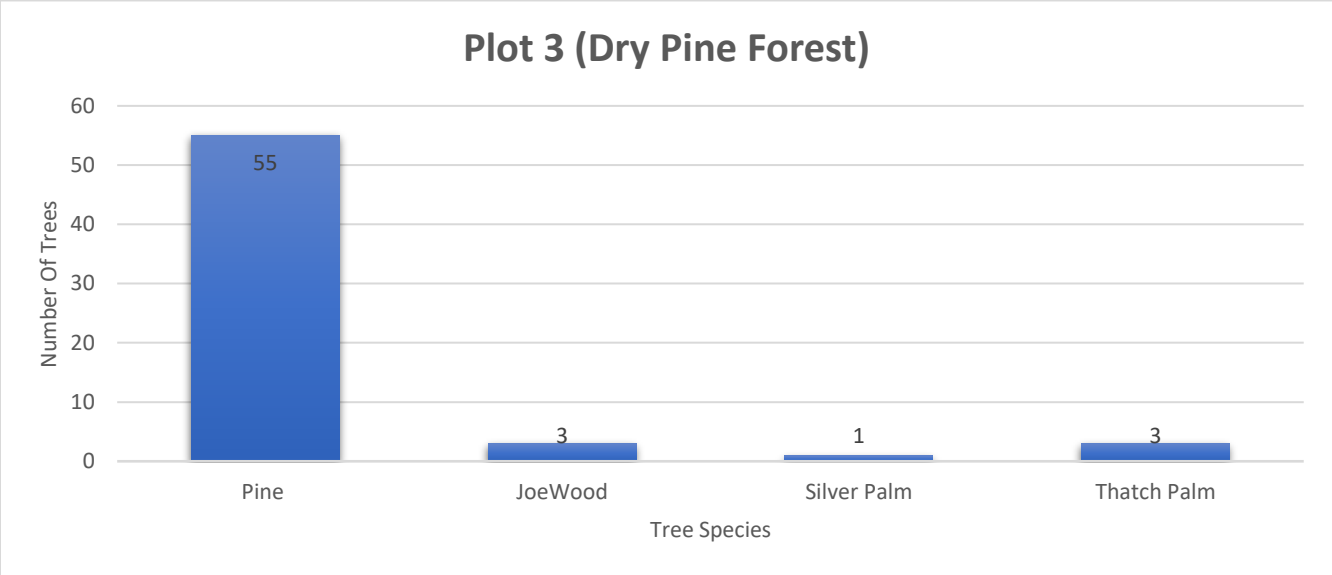


Figure 4.16: *Graph Figures for plot 3*

Figures 4.17 & 4.18: *Showing Pine forest diversity*


***Figures 4.19 & 4.20**: Showing understory canopy (left) and upper storey pine tree canopy (right)*

Plot 4 (26°21'41"N 77°02'40"W) Consisted of a Dry Pine Forest ecosystem with pine being dominant in the upper story and heavy pine regeneration in the understory associated with bracken fern and shrubs.

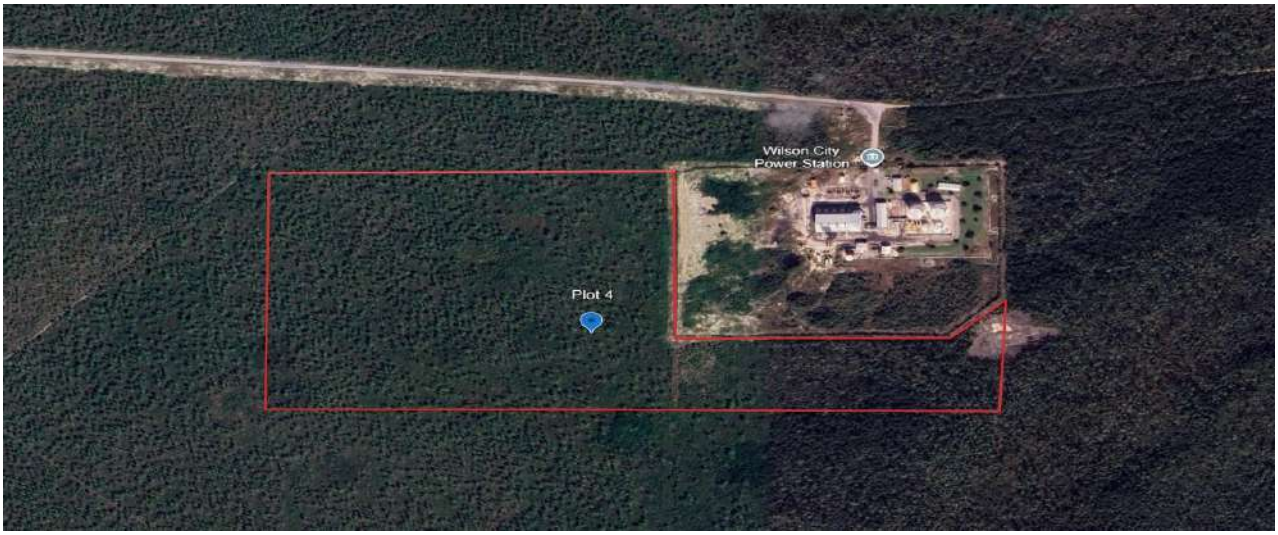


***Figure 4.21**: Location of Plot 4*

Species Name	Species Presence	Species Cover
Pine	D	100%

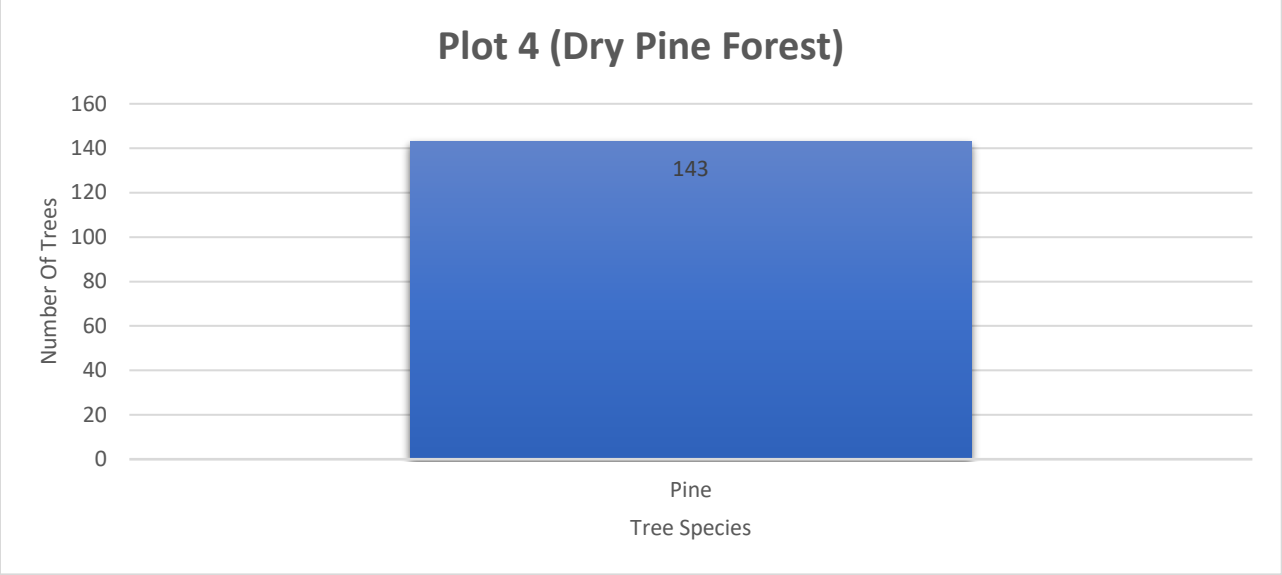


***Figure 4.22**: Graph Figures for Plot 4*

***Figure 4.23 & 4.24**: Showing juvenile pines*

***Figure 4.25**: Showing Pine regeneration and understory*

Plot 5 (26°21'38"N 77°02'33"W) Consisted of a Dry Pine Forest ecosystem with dominant tall pine upper story and understory consisting of pine regeneration, along with bracken fern and shrubs.

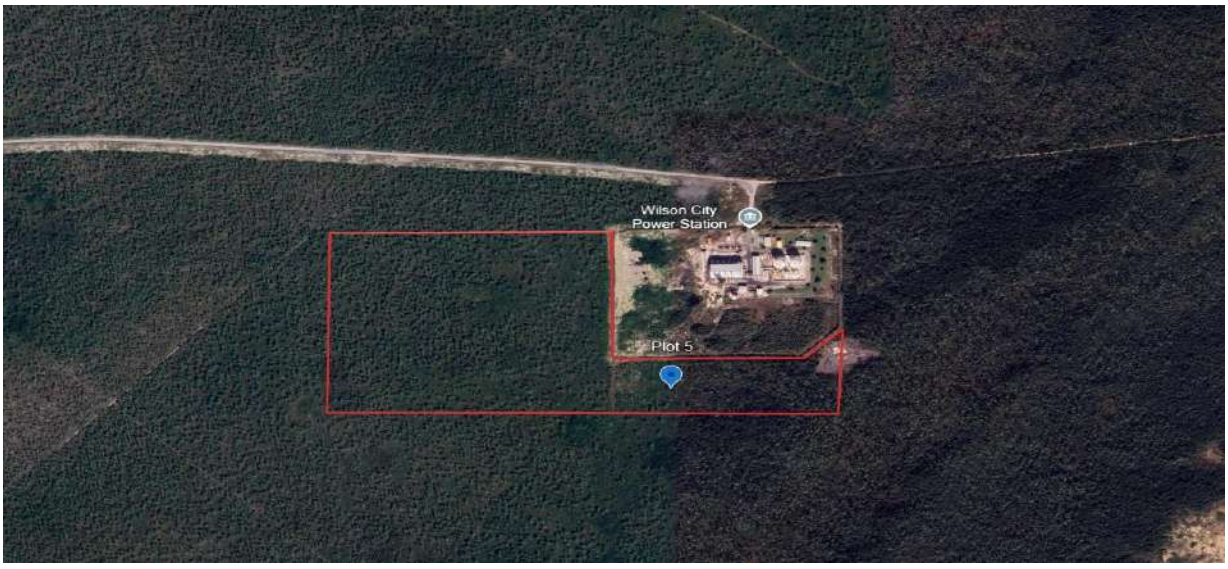


***Figure 4.26:** Location of Plot 5*

Species Name	Species Presence	Species Cover
Pine	D	90%
Silver Palm	F	10%

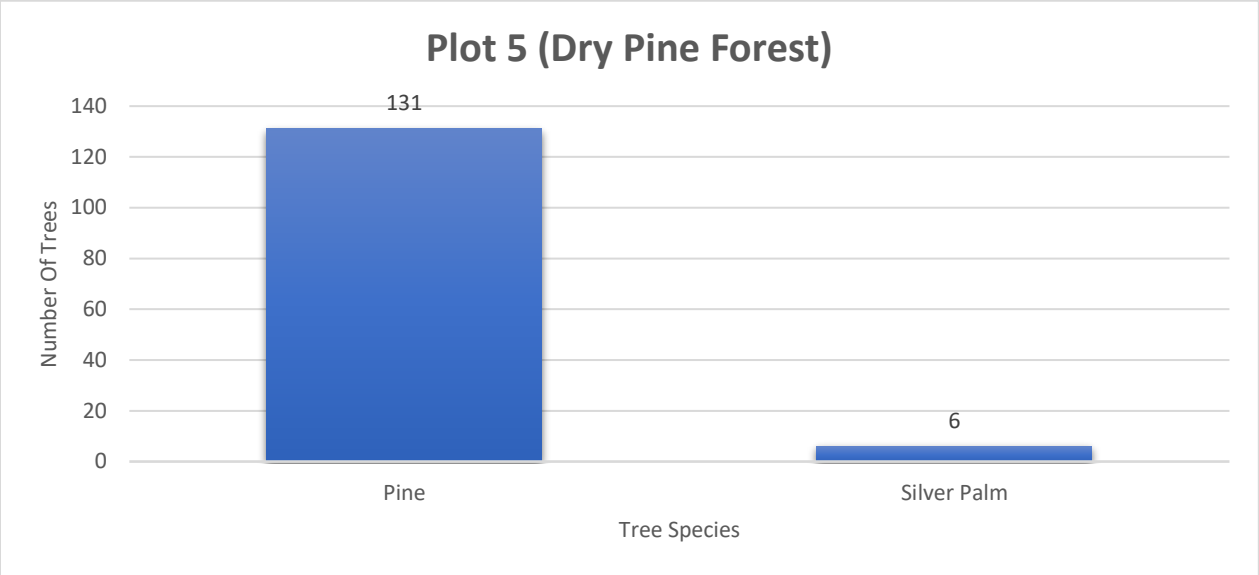


Figure 4.27: *Graph Figures for Plot 5*

Figures 4.28 & 4.29*: Showing Pine tree canopy and regeneration*

***Figure 4.30**: Showing topography of shrubs and ferns.*

Plot 6 (26°21'38"N 77°02'27"W), Consisting of a Dry Pine Forest Formation

***Figure 4.31:** Location of Plot 6*

Species Name	Species Presence	Species Cover
Pine	D	50%
Silver Palm	F	25%
Sabel Palm	O	5%
Mahogany	O	5%
Rough Velvet	O	5%
Gum Elemi	O	5%
Paradise Tree	O	5%

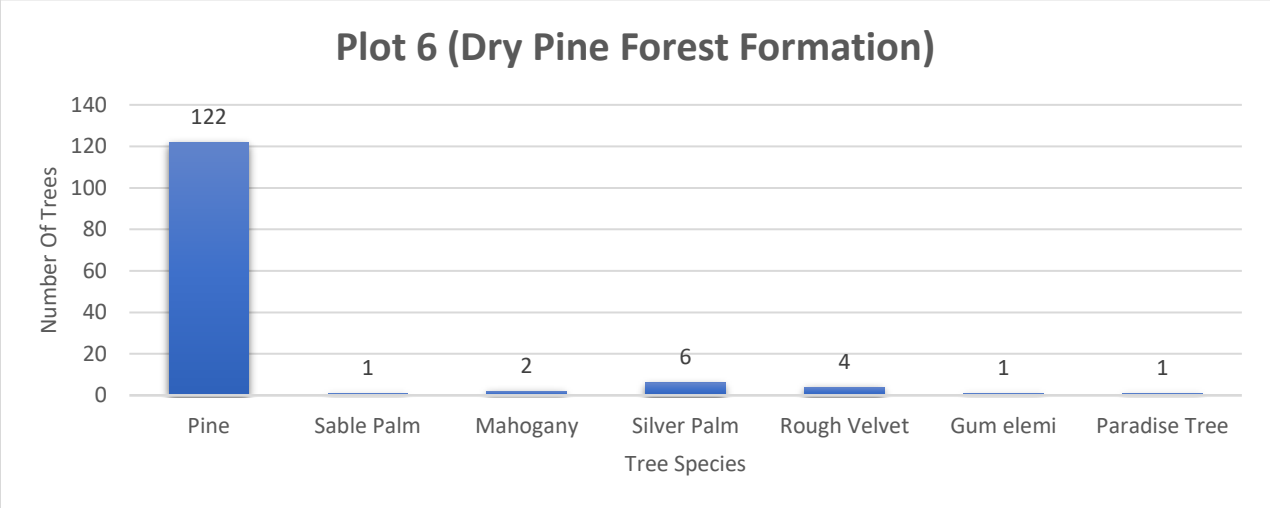


***Figure 4.32**: Graph Figures for Plot 6*

***Figures 4.33 & 4.34:** Showing Thatch Palm (left) and pine regeneration (right)*

Figures 4.35 and 4.36: *Showing Paradise tree (left) and coppice understory (right)*

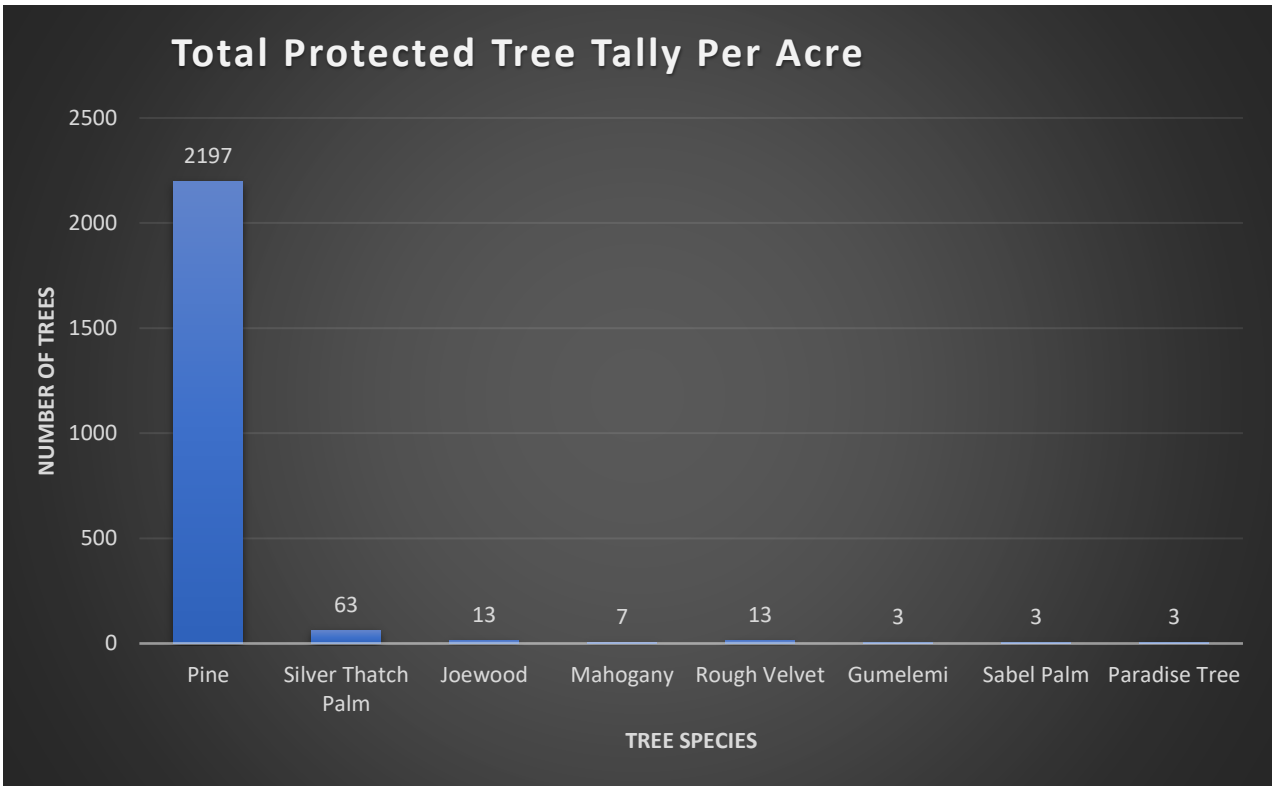


Figure 4.37: Graph Showing Total Protected Tree Tally Per Acre

Conclusion

Based on the data collected, the **total** number of protected trees for the total 60 acres is **138,100**.

	Total Trees Per Acre		Total Protected Trees for 60 acres
Pine tree	2197		131800
Silver Thatch Palm	63		3780
Joewood	13		780
Mahogany	7		420
Rough Velvet	13		780
Gumelemi	3		180
Sabel Palm	3		180
Paradise Tree	3		180
Total	**2302**		**138100**

4.3.5 Invasive Species

A total of two (2) invasive species was observed and listed ***(Table 4.3)***. The National Invasive Species Strategy (2013) outlines recommendation for effective management of all invasive species.

Table 4.3: Invasive species listed and found on the project site

Botanical Name	Common Name	Presence on Site	Recommendations for Control *
Casuarina equisetifolia	Australian Pine	A few individuals within the parcel.	Control
Schinus terebinthifolia	Brazilian Pepper	Found along the northern perimeter of the parcel.	Eradication

4.4 Avian Assessment

Five avian surveys were conducted on 13 – 17th January 2025 to identify the presence, abundance and habitat utilization of the avian species found within the boundaries of the project site.

4.4.1 Methodology

The assessment comprised five days of active avian observations, commencing at 7am to 4pm on each day. The number of species were recorded in the abundance categories, Single (1), Few (2 – 10) and Many (11 – 100). Final abundance estimates were compiled. The IUCN categories were used to determine the Status of each species identified. **Table 4.4** below shows the comparison of species observed for the Winter survey sessions period, respectively.

4.4.1.1 Avian Survey Results

A total of eighteen (18) species was recorded during the sessions. **(Table – 4.4)**

Table – 4.4: Avian observations – (Winter Session)

TABLE KEY		
Range	**Status**	**Habitat**
PRB = Permanent Resident Breeding	**LC** = Least Concern (Conservation – IUCN)	**FW** = Freshwater
WRN = Winter Resident Non-Breeding	**NT** = Near Threatened (Conservation – IUCN)	**IU** = Interior Upland
SRB = Summer Resident Breeding	**E** = Endemic	**HA** = Human Altered
	I = Introduced	**FO** = Fly Over
		CS = Coastal Shore
		RS = Rocky Shore
		SS = Sandy Shore
		TF = Tidal Flats

		W = Wetlands
		S = Saline

Common Name	Scientific Name	**Range**	**Status**	**Observation** Winter Session – 13-17th January2025	**Habitat Utilization**	
American Kestrel	*Falco sparverius*	PRB	LC	F	IU	
Cat bird (Gray)	*Dumetella carolinensi*	PRB	LC	M	IU	
Ground dove	*Colombina passerine*	PRB	LC	M	FO	
Bahama Mocking bird	*Mimus gundlachii*	PRB	LC	M	IU	
Palm warbler	*Dendroica palarum*	PRB	LC	M	IU	
Prarie Warbler	*Setophaga discolor*	PRB	LC	-	IU	
Pine warbler	*Setophaga pinus*	PRB	LC	F	IU	
Smooth billed Annie	*Crotophaga ani*	PRB		F	IU	
Thick billed Vireo	*Vireo crassirostris*	PRB	LC	M	IU	
Cuban Pee wee	*Contopus caribaeus*	PRB	LC	-	IU	
American Redstart	*Setophaga ruticilla*	PRB	LC	F	IU	
Loggerhead Kingbird	*Tyrannus caudifasciatus*	PRB	LC	F	FO	
Black-face Grassquit	*Melanospiza bicolor*	PRB	LC	M	IU	
Ground Dove	*Columbina passerina*	PRB	LC	F	FO	
Eurasian Dove	*Streptopelia decaocto*	PRB	LC	F	FO/HA	
Olive Cap	*Setophaga pityophila*	PRB	LC	M	IU	

Western Spindalis	*Spindalis zena*	PRB	LC	F	FO
Turkey Vulture	*Cathartes aura*	PRB	LC	F	FO
TOTAL SPECIES				**18**	

***Figure 4.38**: Showing Cuban Pee Wee*

***Figure 4.39**: Showing Loggerhead Kingbird*

***Figure 4.40**: Showing Thick Billed Vireo on Branch*

Figure 4.41*: Showing Cuban Pee wee on Boundary fence*

4.4.1.1.1 Range

The geographical area where birds are consistently found is referred to as its Range. Birds classified as Migrant have seasonal range, whereas restricted species on some islands or in a region year-round.

- **Permanent Resident Breeding (PRB)**: refers to resident refers to species that live and breed all year round throughout the Bahamas. On the project site the predominant avian species identified included the Blackface Grassquit (*Melanospiza bicolor),* Palm Warbler (*Dendroica palarum),* and Cat Bird (*Dumetella carolinensi*). All of the species found on property were PRB.

- **Winter Resident Non-breeding (WRN):** refers to the annual non-breeding fall/winter (generally October to April) migrants to the Bahamas from North America. The majority of the WRN birds leave by the end of April to their home states during spring or summer. No specie (Belted King Fisher) was observed during winter session survey.
  .
- **Summer Resident Breeding (SRB)**: refers to species that breed in the Bahamas during the summer months (April to October) then return to other regions the rest of the year. SRB include both land and the sea birds. No Summer Resident Breeding birds were found during survey

4.4.1.1.2 Endemic Species

Birds found in the Bahamas are referred to as Endemic. The Bahama Mockingbird (*Mimus gundlachii)* was the only endemic species that was observed.

4.4.1.1.3 Conservation Status

a. **Protected species**: All species observed are protected under the Wild Birds Protection Act Chapter 249 (Statue Law of The Bahamas).
b. **Endangered:** None of the species recorded are classified as endangered.
c. **Species of Concern**: Near Threatened (NT) by the IUCN classifies a species that may be considered threatened with extinction in the near future, although presently not qualified for the threatened status. None of the species recorded were listed as a species of special concern.

4.4.2 Habitat Utilization

a. Interior Upland

Most land birds were recorded in the upland vegetation, where food sources appear to be more in abundance, including bird species that are insectivore species, fruits, and seed eaters.

4.4.2.1 General Discussion

The dominance of the PRB species during Avian surveys confirms the adaptation of the species to sites of high biodiversity, abundance of food resources and varied vegetation types for roasting and breeding purposes. Species abundance is correlated with size of the site, where on larger sites greater abundance of species is likely, versus small sites. Given the homogenous nature of the dry pine forest ecosystem, along with open canopies that mature pine trees provide, fruiting coppice trees that develop in the understory provide plenty of food for fruit and insectivore eating birds. Besides the Turkey Vulture, no birds of prey were seen within the parcel. Bird Surveys should be carried out in the summer months and winter months to have a representative sample of species associated with the seasons. The avian species found on the project site is indicative to what was expected, and typical of the natural dry pine forests found in Abaco.

4.5 Biodiversity Assessment

In addition to the Botanical and Avian studies, any animals, insects, reptiles, amphibians, and other living creatures observed, were recorded as either Single (1), Few (2 – 10) or Many (11 – 100). **Table 4.5** provides a summary of the observations. **Figures 4.35 to Figures 4.38** below depicts photos captured of observed species.

Table 4.5: Summary of observed wildlife from project site

Common Name	Scientific Name	Abundance
Yellow Butterfly	*Colias sp.*	M
Monarch Butterfly	*Danaus phexippus*	M
Black Dragon Fly	*Trames sp.*	M
Blue Tailed Lizard	*Leiocephalus sp.*	M
Brown anole	*Anolis* distichus	M
Brown Moth	*Cissusa asp.*	F
Wild boar	*Sus scrofa*	F
Common Snail	*Cornu aspersum*	M
Ladybug	*Coccinellidae septempunctata*	M
Paper Wasp	*Polistes dominula*	M
Feral Cat	*Felis catus*	F
Abaco Island Boa	*Chilabothrus exsul*	M
Termite	*Isoptera spp.*	M

Figures 4.42 & 4.43: *Showing Hog scat with tree bark (left) and eaten tree bark during feeding (right)*

***Figure 4.44**: Showing common snail*

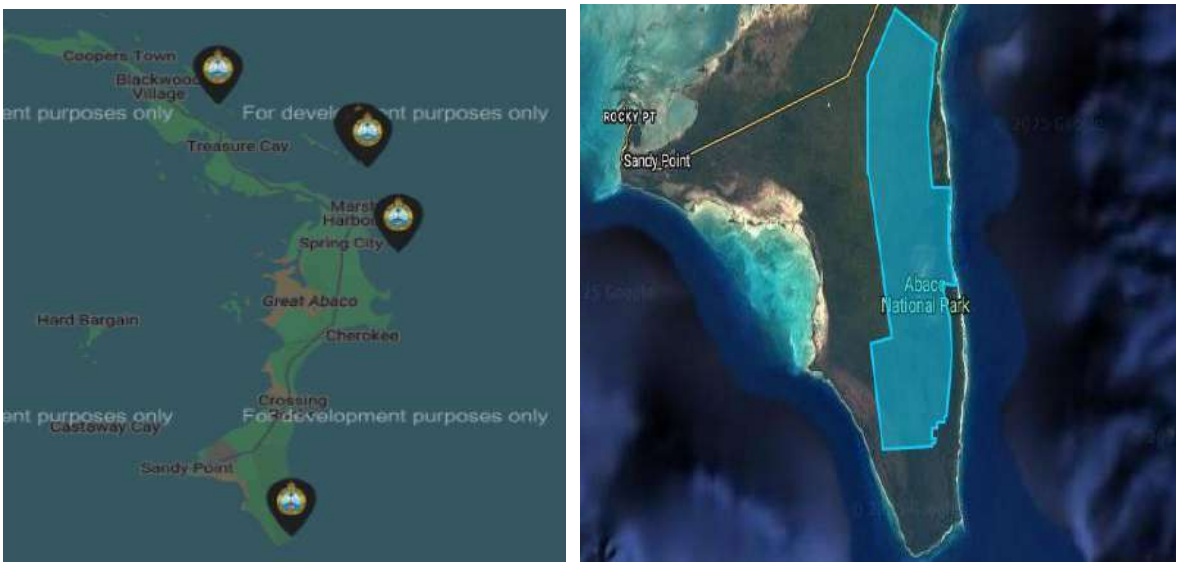
***Figure 4.45:** Showing ladybug*

***Figure 4.46**: Showing Abaco Boa*

***Figure 4.47:** Showing Paper Wasp*

4.6 National Parks and Protected Areas

There are numerous and highly significant National Parks and Protected areas within Abaco and the surrounding cays.



Figures 4.48 & 4.49: *Showing the locations of National Parks of Abaco and the surrounding cays (left) and the Abaco National Park (right)*

4.6.1 Abaco National Park

Key elements of the Abaco National Park were to protect the northern habitat of the Caribbean Pine. However, along with the parrots, these majestic forests support a wide array of native plants and animals. Four endemic birds, The Bahama Yellowthroat, Bahama Warbler, Bahama Swallow and Bahama Woodstar can be found here Also, Abaco specialty birds such as the West Indian Pecker are often found here.

The Abaco National Park comprising some 20,500 acres, was established on May 9, 1994. The Bahamas Government signed a 99-year lease with the Bahamas National Trust declaring some 20,500 acres in South Abaco a national park.

Other notable National Parks and Protected areas situated in Abaco are summarized in **Table 4.6.**

Table 4.6: Protected Areas within Abaco, and their extent.

Name	Island	Acres	Type	Managing Entity
Abaco National Park	Abaco	20,500	Terrestrial	Bahamas National Trust
Black Sound Cay National Reserve	Green Turtle Cay	2	Marine and Terrestrial	Bahamas National Trust
Fowl Cays National Park	North Abaco	3200	Marine and Terrestrial	Bahamas National Trust
Pelican Cays Land and Sea Park	Central Abaco	2100	Marine and Terrestrial	Bahamas National Trust
Tiloo Cay Reserve	Central Abaco	11	Terrestrial	Bahamas National Trust

Walkers Cay National Park	North Abaco	3800	Coral Formations and Marine Life	Bahamas National Trust

4.7 Socio-economic Aspects

4.7.1 Land Use

The Wilson City power plant project site is currently undeveloped property consisting of a natural dry pine forest ecosystem. Access to the property is by land transportation (motor vehicle) to the Wilson City Power Plant, and by foot to the existing location. The existing road network is of gravel construction. The remainder of the site is in its original natural vegetative state.

4.7.2 Population

According to the Bahamas (2022) Census, the population of Abaco is approximately 16,695, with Marsh Harbor Settlement being the nearest entry point to Wilson City, has a population of 5,730 persons.

4.7.3. Economy

Abaco's economy is based on a combination of industries, including agriculture, tourism, and rebuilding efforts. Abaco is the third largest contributor to the GDP of The Bahamas.

4.7.4 Transportation

To move around in Abaco and its many cays there are multiple taxi services, and water taxis for tourist attraction sites. Abaco is also served by various air carriers, such as Bahamas air, Western Airlines, and other charters services. Residents may also have access to their own cars and tourists can rent a car to drive. Transport to Abaco is by airplane or water taxi.

4.8 Cultural Resources

Cultural resources represent the national patrimony and are of interest, and include:

- Archaeological sites of pre-European native people
- Archaeological sites of European and recent cultures
- Ruins
- Historic structures
- Cemeteries and any human burial sites
- Landscape features and sites of traditional cultural importance

There are significant cultural aspects of the Bahamas that resident of Abaco can enjoy. Of note, one of these cultural landmarks includes the Hope Town Lighthouse which was completed in 1835. This site has a historical significance that builds the culture of the Bahamas as we now know today.

The Lucayan Indians, the indigenous people of the Bahamas, left behind their presence in the form of living sites (villages), and sacred burial grounds (including caves). There was no evidence that these types of sites existed or were observed during site surveys to Wilson City (project site).

4.9 Touristic and Recreational Areas

The major tourist attraction that occurs in Abaco is the annual Family Island Regatta where locals and visitors migrate into Green Turtle Cay, for a few days during the last week of June to watch the boat races, socialize and have a good time with friends and family.

4.10. Waste Streams

It is important to reference the fact that the sustainable management of waste requires an understanding of all sources of waste (i.e., solid and liquid).

4.10.1 Solid Waste streams

Project waste streams must be identified, and provisions made for timely removal. Work areas should be free from litter and construction debris. This will call for the erection of a designated dumpster or bin, with fixed schedules for disposal at a facility designated by the Department of Environmental Health Services (DEHS).

Sanitary receptacles should be emptied at regular intervals by a reputable sewage disposal company. Any hazardous waste, if identified, to be stored and disposed of in accordance with DEHS standards. All solid waste streams are directed to the Great Abaco Sanitary landfill located on Snake Cay Road, Abaco, The Bahamas.

4.10.2 Liquid Waste streams

All Liquid Waste Streams are collected via sewage and is directly managed by the Water and Sewage Corporation (WSC), located in Marsh Harbor, Abaco

4.11 Utilities

4.11.1 Potable water

Potable water in Abaco is distributed and maintained by the Bahamas Water and Sewerage Corporation. It is anticipated that water supply for the power plant will be derived from ground water resources via deep wells.

4.11.2 Electricity

Overhead electrical lines will be erected to provide for tie into the main electrical grid system, with electrical supply by the Bahamas Power & Light Company. Once constructed and commissioned, the new power station will provide electricity onsite.

4.11.3 Fuel storage and distribution

There will be LNG storage, even where SPP is in use.

4.11.4 Construction & Material Sources

Whereas building materials (sand, limestone, etc.) are available in Wilson City, to a limited extent, it is anticipated that most of the construction materials will be imported from the USA, China and stored and brought in by 40 - 80ft containers, and finally assembly on site.

5. Legal Aspects

All projects developed within the boundaries of the Commonwealth of the Bahamas are subject to compliance with national laws, regulations, international conventions, and guidelines. Additionally, Developers must consider, when relevant, mitigation measures, international financial guidelines, and world bank environmental, health and safety (EHS) guidelines

5.1 Local Legislation and Policies

Tables 5.1 and 5.2 depict the local legislations and policies that are relevant to the physical and natural environment and may apply to the project.

Table 5.1 highlights local legislations

Environmental Law, Regulation and Policy	Summary
Antiquities, Monuments and Museum Act, 1998	"An Act to provides for the preservation, conservation, restoration, documentation, study and presentation of sites and objects of historical, anthropological, archaeological and paleontological interest, to establish a national Museum, and for matters related therewith…"
Disaster Preparedness and Response Act, 2006	"An Act to provide for the effective organization of the mitigation of, preparedness for, response to and recovery from emergencies and disasters…"
Road Traffic Act, 1962	"An Act to declare, amend and codify the law relating to motor vehicles, and to provide for the regulation of traffic on roads and of motor vehicles…"
Agriculture and Fisheries Act, 1964	"An Act to provide for the supervision and development of agriculture and fisheries in the Bahamas…"
Fisheries Resources (Jurisdiction and Conservation) Act	An Act to make provision with respect to the conservation and management of the fishery resources of the Bahamas and to extend the limits of the jurisdiction of the Bahamas over such fisheries resources and for matters connected therewith…"
Water and Sewerage Corporation Act, 1976	An Act to establish a Water and Sewerage Corporation for the grant and control of water rights, the protection of water resources, regulating the extraction, use and supply of water, the disposal of sewage and for connected purposes…"

Building Regulations, 1971	An Act to regulate the construction, altercation and repair of buildings, provide for the re-instatement or removal of dangerous or dilapidated buildings, to authorize the publication of a building code and for purposes connected therewith…"
Environmental Planning and Protection Act, 2019	An Act to establish the department of environmental planning and protection; to provide for the prevention or control of pollution, the regulation of activities, and the administration, conservation, and sustainable use of the environment; and for connected purposes"
Environmental Planning and Protection (Extension of Application) Order, 2020	An Order to extend the Environmental Planning and Protection Act, 209 throughout the territory of the Bahamas, including every island and cay and to define procedures for proposed projects, monitoring and compliance, and the certificate of environmental clearance.
Environmental Impact Assessment Regulations, 2020	The regulations describe the procedure for proposed projects and requirements to apply and receive a Certificate of Environmental Clearance from the Department of Environmental Planning and Protections.
Bahamas Protected Areas Fund Act 2014	The Act establishes the BPAF as a Fund to ensure sustainable financing for protected areas in the Bahamas. The Fund allows for the solicitation of funds and donations from the Caribbean Biodiversity Fund, to fund protected areas in the country.
Conservation and Protection of the Physical Landscape of the Bahamas Act, 1997	An Act to make provision for the conservation and protection of the physical landscape of the Bahamas. The Act contains pats regarding administration, regulation of excavation and landfill operations, provisions governing dangerous excavations, landfill operations, quarries or mines, zoning of the Bahamas for the purposes of quarrying and mining operations, and general entries.
Environmental Health Service Act, 1987	"An Act to promote the conservation and maintenance of the environment in the interest of health, for proper sanitation in matters of food and drink and generally, for the provision and control of services, activities and other matters connected therewith…"
Environmental Health Services (Collection and Disposal of Waste) Regulations, 2004	Section 18 speaks to removal of construction waste and section 19 speaks to industrial waste disposal.
Forestry Act, 2010	An Act to provide for the conservation and control of forests and for matters related thereto;
Forestry Regulations, 2014	Provides for the application for a permit to harvest protected trees
Forestry (Amendment) Regulations, 2021	Amends the Forestry Regulations, 2014 to provide for reduced to be payable for royalties for the granting of licences, permits for the salvaging of damaged forest due to natural disasters, hurricane, or tornados.
Forestry (Declaration of Protected Trees) Order, 2021	An Order which increase the list of trees protected from a previous eleven (11) to some one hundred and twenty seven (127) trees/plants.
Planning and Subdivision Act 2010	The Act governs development and planning, both from a terrestrial and marine landscapes. It applies to both New

	Providence and the Family Islands and the Port area of Grand Bahama. While the Act is comprehensive, no formal land use plans have been developed
Wild Animals Protection Act 1968	The Act prohibits the taking, capturing, or hunting of any wild animal without a permit.
Bahamas Public Parks and Public Beaches Authority 2014	The Act allows the authority to control, plan, design, develop, administer, manage and maintain public parks and public beaches; to conserve their natural beauty and topography, propagate, protect, and preserve animals, plants and other organisms in those areas.
Bahamas National Trust Act 1959	The Act provides the BNT the mandate to promote the preservation of lands, buildings, underwater areas, and areas of natural interest. The Act also empowers the BNT to identify sites for protection and to administer areas declared protected; and manages national parks.
Wild Birds Protection Act 1959	The Act prohibits the taking, capturing, and hunting of any wild bird without a permit. It protects birds and eggs during the closed season. The Act also permits the Minister to establish wild bird reserves.

Table - 5.2. National Environmental Policies

Relevant National Environmental Policies	Summary
National Policy for Adaptation to Climate Change 2005	The policy outlines a framework to meet the goals and objectives of the United Nations Framework Convention on Climate Change (UNFCCC). Where the Bahamas committed itself to reducing greenhouse gases and address the impacts of climate change
National Invasive Species Strategy for the Bahamas, 2013	The initial policy was drafted in 2003, but subsequently updated in 2013, as part of a GEF funded project (MITIASIC) Mitigation the Threats of Invasive Alien Species in the Insular Caribbean; and sets out a management strategy for the control and eradication of invasive species
National Biodiversity Strategy and Action Plan, 1999	The Action plan calls the Bahamas to conserve biodiversity and pursue sustainable development. It further highlights the role of biodiversity in the social and environmental context and recommends measures to ensure its compatibility with future developments.

5.2 International legislation and Conventions of relevance

Table 5.3 depicts international conventions that are of relevance to the project, and regards must be made.

Table 5.3 International Conventions enforced in the Bahamas

International Convention/Organization	Summary
Cartagena Convention. Ratified: June 24, 2010	The Convention provides for the legal framework for cooperation in the wider Caribbean region. Three technical agreements apply: ● Protocol for co-operation in combating oil spills. ● Protocols for specially protected areas and wildlife (SPAW); ● Protocol concerning pollution from land-based sources and activities (LBS).
Convention on Biological Diversity. Signed: June 12, 1992	The convention has three main goals: ● Conservation of biodiversity. ● Sustainable use of components of biodiversity. ● The fair and equitable sharing of the benefits arising out of the utilization of genetic resources (ABS)
Convention on Wetlands of International Importance (RAMSAR Convention) Signed: June 7, 1997	Known as the RAMSAR convention. The convention provides the framework for the international protection of wetlands as contributors for avifauna which do not adhere to international borders.
Convention to Combat Desertification and Drought. Signed November 10, 2000	The Convention provides for sustainable development by addressing social and economic issues that directly impact land degradation.
United Nations Framework Convention on Climate Change. Signed: June 1992 Kyoto Protocol Signed: April 9, 1999 Paris Agreement Ratified: August 22, 2016	The Bahamas is a signatory to this convention. It establishes a framework with the aim to stabilize atmospheric greenhouse gases. The Kyoto Protocol was developed under the UNFCCC to provide emissions targets and timelines for developed countries. The Paris Agreement is a legally binding international treaty on climate change. It was adopted by 196 Parties at COP 21 in Paris, on 12 December 2015 and entered into force on 4 November 2016. Its goal is to limit global warming to well below 2, preferably to 1.5 degrees Celsius, compared to pre-industrial levels.

5.3 Government Institutions

Table 5.4 summarizes the key government and non-government policy and statutory agencies, their responsibilities relevant to the project with respect to aspects of approvals and permitting, and the EIA Process.

Table - 5.4: Key Governmental and Non-governmental Agencies with responsibilities

AGENCY	SUMMARY OF RESPONSIBILITIES
Bahamas Investment Authority (BIA)	● A "one-stop shop" agency to reduce bureaucratic delays for domestic and international investors, seeking Government approval for development projects in the Bahamas
Ministry of the Environment and Natural Resources (MTENR)	● To manage, protect and conserve all land, water, and other tangible resources of the Bahamas, and have regard to the environmental, economic, and social benefits that may confer on the Bahamas. ● Give advice on proposals from the private and public sectors that would significantly affect the Bahamas. ● Overseas conservation of wild animals, birds and plants, and forests. ● It administers the Wild Birds and Wild Animals Protection Acts.
Department of Environmental Planning and Protection (DEPP)	● To promote best practices in environmental management and to minimize harm to the environment. ● Administer the EIA process, coordinate the public review of EIAs, and various national plans for natural resource management. ● Promoting and enforcing compliance with the Environmental Planning and Protection Act, 2019
Forestry Unit (FU)	● The sustainable management, conservation, control, and development of the natural forest resources on state lands. ● Promotion and regulation of forest industries. ● Regulate the commercial utilization of the natural forest resources.

	● Protection of trees that are rare and of historical significance.
Department of Environmental Health Services (DEHS)	● Environmental control, solid waste collection and disposal of domestic, commercial and construction waste ● enforcement of industrial regulation, public health guidelines, enforcing public sanitation. ● Evaluate the effectiveness of pollution control measures to protect the health and safety of workers. ● Issuance of effluent discharges and emission permits
Department of Fisheries (DOF)	● Oversees and enforces fisheries regulations and the establishment of Marine Reserves and Marine Protected Areas (MPAs)
Department of Local Government (DLG)	● Implements the provisions of the local government Act, thus ensuring sound and sustainable family island development
Ministry of Tourism and Aviation (MTA)	● Promotion of the tourism industry of the Bahamas ● Encourage visitor arrivals by air and by sea throughout the Bahamas
Ministry of Public Works and Utilities (MPW)	● Overseas and maintains physical infrastructure in the country. ● Responsible for building controls and Regulations
National Emergency Management Agency (NEMA)	● "Ensures that adequate preparedness and mitigation measures and response and recovery mechanisms are established to counteract the impact of natural, man-made and technological hazards…"
Department of Physical Planning (DPP)	● Administers the Planning and Subdivision Act, 2010, which includes the preparation of land use plans for the islands.

	● Controls development of the natural and built environments, via zoning.
Water and Sewerage Corporation (WSC)	● optimizes the development of the country's water resources and the water quality control. It shares with DEHS the responsibility for monitoring water quality. ● Issue water supply franchises to developers, especially where the supply of water is impractical for the government or its agencies
Department of Labour	● Regulates Health and Safety under the Health and Safety at Work Act, 2002. ● conducts inspections at workplaces to ensure adequate worker safety and regulations compliance
Bahamas National Trust (BNT)	● Established as a non-government entity (non-profit) by the BNT Act 1959. ● To manage national parks and protected areas, historic preservation, public awareness, and environmental outreach

6. 0 Anticipated Environmental Impacts of the Proposed Project

6.1. Impact Assessment Methodology

It is important to recognize that development on small islands requires a process of risk and impact assessment that is standardized and objective. These tools are accepted for impacts that involve:

- degradation of terrestrial and marine species
- Where land-based sources of pollutants are introduced, and
- freshwater and nutrients are introduced to the island hydrology

The appropriate tool in this circumstance will involve a series of questions and appraisal, ranking and then prioritizing the potential risks and hazards.

6.1.1 Assessment Criteria Tool

Qualitative Assessment Criteria will be used to rank a source of activity for its environmental impact. With each phase and component described, evaluated for impacts, then mitigation measures are outlined **(Tables 6.1, 6.2 and 6.3)**. Significance level overall will be measured as:

- **Significant** – high impact, sufficient intensity, and duration to generate significant change(s), predominantly irreversible naturally. Site affected in the long term.
- **Moderate** – an effect for a limited time over the affected area, site condition is temporary altered, naturally reversible in the medium term.
- **Negligible** – effect is barely evident, short duration, site not altered, naturally reversible in the short term.

6.1.2 Severity Criteria Tool

Severity of an environmental impact is another tool used to measure the magnitude of impact an event has on the environment. Severity is usually given the numerical rating of 1 for low impact, 3 for medium impact and 5 for high impact. Factors that are measured for severity would include negative effect on flora and fauna, impact on wildlife, effects on air and water, noise, visual, and short-term vs long term recovery of the environment, among others **(Table 6. 4).**

Table 6.1 Qualitative Assessment Criteria for Impact Assessment

Qualitative Criteria	Choices	Description
Nature	• Direct • Indirect	Does origin/source activity Directly or Indirectly act on the environmental target (species or natural community)
Type	• Positive • Negative	Positive implies species or natural community will have a higher likelihood of persistence with increase viability Negative implies the opposite
Likelihood	• Not Likely • Potential • Certainly	Not Likely – 10% chance of impact occurring. Potential – 10 to 70%. Certainty – impact has greater than 70% chance of occurring.
Scale	• Specific habitats • Island environs • Regional • National or internationally	Restricted to specific habitats. Impact that impacts the entire GT Abaco Island. Regional Impacts (Abaco & Cays) International Impacts refer to CITIES species

Duration	• Temporary • Long-term	Temporary – impacts that last less than three years. Long-term – more than three years
Reversibility	• Reversible or • Irreversible	Reversible – impacted species or natural communities will recover. Irreversible – species or natural communities lost to project site, and impact should be mitigated

6.2. Impacts to the Physical Environment

Pre-construction/construction activities and project operation activities being reviewed as part of the impacts are outlined below:

1.0 *Pre-Construction/Construction Phase*:
- Site preparation and construction of Infrastructure:
  - Clearing of vegetation
  - Basic infrastructure for electricity generation
  - Installation of water and sewerage infrastructure
- Construction of building foundations, walls structure, etc.

2.0 Project Operation Phase:
- Property Management
  - Landscaping maintenance
  - Invasive species management
  - Pest control

6.2.1. Impact Assessment for Site Preparation, Infrastructure Development and Plant Assembly

Table 6.2: Summary of impact matrix developed for site preparation and infrastructure development (Wilson City Project, Wilson City, Abaco)

Qualitative Criteria	Choices	Description
Nature	Direct	Direct impact on 60 acres for new road building infrastructure, solar panels erection construction.
TYPE	Positive	With loss of some protected species, overall impact of site preparation will be negative ➢ Application for permit waiver to harvest protected trees will be made to the Forestry Unit, Ministry of the Environment and Natural Resources.

	Negative	Significant areas of natural upland vegetation will be lost during site preparation and construction of plant infrastructure
Likelihood	Certainty	Impacts and benefits will be the result once actions outlined are completed
Scale	Habitat – Dry Pine Forest Island Environs	Restricted to local area of power plant. Pine trees and other protected tree species will be loss. Relocation of protected species is recommended, where practicable. Removal of Invasive Species (Australian Pine – casuarina, and, will reduce seed sources on the island
Duration	Long Term	It is anticipated native plant communities will be stabilized in the upland areas outside area of impact
Reversibility	Irreversible	Natural ecological processes will not be restored. Mitigation measures will be necessary
Overall Significance	Significant	Site conditions are altered to great extent due to extensive natural vegetation removals

Table 6.3 summarizes the environmental impacts that are likely to occur for the Wilson City project, based on the Severity of Impact Criteria

Table - 6.3: Summary of Environmental Impacts based on Severity

Factor	Severity of Impact	Impact Description
Terrestrial	5	Removal of 90% of existing vegetation, inclusive of eight protected trees species for infrastructure, building footprint, will impact the natural landscape, resulting in the loss of existing vegetation.
Biodiversity (wildlife)	5	Due to the high footprint of the project development, the associated biodiversity (i.e., land animals, birds nesting sites) displacement impact is high. Hence biodiversity impact is expected to be high, given the significant change in land use for construction footprint of building, solar panels and other related infrastructures.
Avifuana	3	Noise levels generated by project activities may deter birds from utilizing sites temporarily, and birds and animals may return once construction activities are completed.
Visual and Aesthetics	3	Construction of the power plant will enhance the visual and aesthetics of the power plant project, given the low density of the residence locations, and eventual removal of all construction waste. Debris not removed adequately and timely, impairs the visual and aesthetics of the site for extended periods.
Hydrological	3	Fuel, chemical spills, improper use of hazardous waste on project site can pollute groundwater resources. Proper spill management procedures are to be put in place to remediate this likelihood.

		The completed structures are not expected to have an adverse impact to the water resources. Based on the projected land use, the impact of the project on the groundwater resources is determined to be LOW | LONG TERM.
Erosion/Sedimentation	3	Whereas there will be foundational footing for the power plant and associated structures there is the potential for some soil erosion and sedimentation at these footings. However, the risk of higher levels of erosion will be minimized, as such, the current drainage and runoff characteristics will not be changed. Retention of vegetation buffers around periphery of site will reduce likelihood of soil erosion and sedimentation.
Air Quality	3	Construction activities and use of associated equipment can generate significant volumes of dust that impair the air quality, and impact human health. There will be need to employ adequate management techniques to reduce impact to human health.
Noise	3	Noise levels tend to rise during construction activities, that disturb birds and animal species. Birds are likely to be displaced and leave the area, particularly where there nesting sites are disturbed. Human health is impacted by elevated noise levels. According to the CDC (2019), prolonged loud noise level exposure above 70dB may cause hearing damages.
Solid & Hazardous Waste	3	Solid waste that is not adequately disposed of can be an eyesore. In the case of hazardous waste, these can pose a threat to wildlife, and human health through attracting pests which are disease vectors. Hazardous waste not properly managed can also result in penetration into the soil, groundwater resources and marine environment (pollution).
Occupational Health and Safety	5	There are the risks of workers not wearing protective personal equipment (PPE). Additionally, the risk is high for the improper use of equipment and materials and non-compliance to standard safety protocols and procedures. Consequently, there could be physically damages and potential loss of human lives.
Fire & Hurricane	5	Wilson City (project site) comprises predominantly of dry pine forest ecosystem with undergrowth that consists of mature pine trees and undergrowth that are dominant with shrubs and other vascular plants such as silver thatch palms, which naturally shed leaves. Hence the forest floor can be covered with leaf litter and provide fuel in the event of a fire. Further, once humans are introduced to uninhabited areas, the risk for fires is likely to increase, especially when fires are intentionally lit, not

		controlled, or managed properly. As the Bahamas falls within the North Atlantic Hurricane Belt, with the season commencing June 1 to November 31. The risk of the Wilson City project being affected by a hurricane in any given year is relatively high. Hence the need for a Hurricane Preparedness and Recovery Plan.

6.3 Socio-economic Impacts

Table 6.5 below summarizes the socio-economic impacts that are likely to occur from the Wilson City project, based on the Severity of Impact Criteria

Table - 6.5: Summary of Socio-economic Impacts based on Severity Criteria

Factor	Severity of Impact	Impact Description
Land Use	5	Any development that brings change to the natural landscape will impact that landscape to a certain degree. The existing land use for the project site is undisturbed. The development of the Wilson City Power Plant project will require the removal of 90% of the natural vegetation.
Economic (beneficial)	3	EA Energy Limited through the Wilson City Power Plant Project anticipates contributing to the revitalization of Abaco as one of the world's top touristic destinations, as a place for vacation, but also a conduit for economic growth and development. They will do this by prioritizing local job creation through employment and indirect services to be retained and skill development with Bahamian talent central to long term operations. Projected investment in the Wilson City project is pegged at forty-five million dollars ($45,000,000.00). Employment of 45 to 60 Bahamian construction workers for three to four years. The overall economic impact to Abaco will be significantly positive and will contribute to a positive turn around in the tourism sector.
Cultural	1	No cultural resources were identified during field studies, and hence no impacts.

7. Proposed Mitigation Measures

Mitigation is how negative impacts identified are minimized, offset, or averted. This can be achieved through project design, restoration of disturbed areas, operational techniques, preventative management plans, and compensation for unavoidable impacts.

Table 7.1 below summarizes the mitigation measures recommended to minimize or eliminate any negative environmental impacts that may arise during the project development cycle.

Table - 7.1: Summary of Environmental Mitigation Measures

Factor	Mitigation Measures
Terrestrial	➢ Establish a buffer 25 to 50 feet wide of natural vegetation along the boundary of site to serve a windbreak (in the event of a tropical storm/Hurriane event) ➢ Removal of all the invasive casuarina species Australian Pine (*Casuarina equisetifolia*). ➢ In areas where landscaping is being undertaken to plant native and endemic species. ➢ Staff will be trained in the identification of protected trees.
Biodiversity	➢ Retention of vegetation buffer zone to serve as biodiversity corridor for wildlife species. This action will minimize negative impacts to adjacent vegetation and associated biodiversity.
Avifuana	➢ Once all construction activities are completed, with reduced noise levels, it is expected that birds will return. ➢ Adequate natural vegetation areas exist whereby birds can forage and roast. ➢ Staff will be trained in the importance of birds, and not to interfere or harm the species in their natural environment.
Visual and Aesthetics	➢ Proper management and timely disposal of solid waste. ➢ Ensure land clearing is keep to a minimum (footprint of buildings). ➢ Use only native and endemic plant and tree species within landscaped areas of the development. No invasive plant species to be established on property.
Hydrological	➢ Adequate fuel and chemical management practices on site would ensure ground water resources are not negatively impacted. ➢ Baseload plant requires treated water for the closed cycle water cooling system. Water for this cycle will be gathered from artesian wells on site or from the connection point of existing power plant border. ➢ Water treatment capacity will not be higher than 2m3/h. Regarding

	any required drainage well structures: standard 150-foot drainage wells may be utilized, once sufficient hydraulic head is present to transfer flows down the well. The depth to the water table is typically 12 to 15-Ft below ground level (BGL), and minimal hydraulic head is required for the flows down the cased well. Sufficient hydraulic head should exist for natural drainage purposes, using 8 to 10-Inch well casing***. (Bowleg, 2025***) ➢ Storm surge effect to the solar structures is considered to be LOW - MODERATE | LONG TERM. All structures proposed to be set at a minimum elevation of +20Ft above the existing high sea water elevation. However, design calculations should confirm both the minimum wind load exposure, and orientation for all structures.
Erosion/Sedimentation	➢ Retention of vegetation buffer around the site boundaries would limit risks of soil erosion and sediment washout once land clearing activities commences. ➢ Flooding due to extreme rainfall events | excessive surface runoff, along with storm surge can be deemed a minor concern for the project area(s) [LOW – MODERATE | LONG TERM]. An optional mitigation mechanism for the potential flood hazard / to minimize surface runoff, is to maintain a natural vegetative cover – thus, assisting to prevent runoff to the marine zone.
Air Quality	➢ Employment of BEST practices with regards to construction methods, to minimize emission of dust that can impair air quality. ➢ Maintain construction equipment to ensure air quality is not impaired. ➢ Parameters for air quality monitoring will need to be determined, once plant is up and running, to ensure air quality meets national and internation standards.
Noise	➢ Construction workers will wear appropriate PPE (i.e., earplugs or earmuffs). ➢ High Noise levels will cause animals and birds to migrate elsewhere, however once construction activities are completed the animals and birds will return.
Solid and Hazardous Waste	➢ Solid waste generation will be limited to construction waste, and vegetation removal from road and residence footprint. ➢ Vegetation removed will be reused/mulched for landscaping purposes ➢ Solid and hazardous waste will be placed in containers and properly disposed of (removed to the mainland of Abaco Landfill Site) in accordance with Department of Environmental Health Services

	(DEHS) regulations and standards. ➢ Invasive species debris along with construction waste to be disposed to avoid inadvertent spread to other parts of Abaco.
Fire and Hurricane	➢ Prepare a Fire Control and Prevention Plan, with detail steps to prevent, contain and control fires during construction and operation the residential resort (to include firebreaks and no smoking areas). ➢ All residences and associated buildings will follow fire requirements of the Bahamas Building Code. ➢ A Hurricane Preparedness and Contingency Plan will be developed in the event the island is impacted by a storm or hurricane (to include evacuation protocols, emergency and health provisions and recovery strategies).
Occupational Health and Safety	➢ All workers will be provided appropriate Protective Personal Equipment (PPE). ➢ All workers will receive training in the proper handling of equipment, before starting work on property. ➢ There will be regular enforcement of occupational health and safety protocols on a weekly basis.

8.0 Public Consultation Process

Public Consultation exercise will be conducted under the auspices of the Department of Environmental Planning and Protection, and in accordance with the EIA Regulations, 2024

9.0 Environmental Management Plan (EMP)

An EMP will be prepared for the project (drafted as a Standalone Document) and will cover the mitigation measures and monitoring. A draft outline and components are cited below. The EMP will be fully developed following No Objection to the EBA. Upon receipt of the No Objection to the EMP, the project will be issued a Certificate of Environmental Clearance (CEC) by the Department of Environmental Planning and Protection (DEPP). The CEC issuance would allow construction activities for the project to commence.

Executive Summary

A summary of the development project and proposed mitigation measures outlined

1.0 Introduction

Overview of project and location. Objectives of the EMP and scope with respect to mitigation measures

2.0 Project Description

Project is described, with location, inclusive of project master plan

3.0 Organization Chart and Communication Plan

4.0 Register of Significant Environmental Aspects

5.0 Environmental Legislation

6.0 Proposed Mitigation Measures

Mitigation measures are detailed as in project EIA, specifically in relation to the following:

6.1 Coastal

6.2 Hydrological

6.3 Erosion/Sedimentation

6.4 Air Quality

6.5 Noise

6.6 Solid and Hazardous Waste

6.7 Fire and Hurricane

6.8 Terrestrial

6.9 Ecology & Biodiversity

6.10 Occupational Health and Safety

7.0 Environmental Monitoring

7.1. Environmental Monitoring Checklist

7.2. Environmental Reporting

8.0 Conclusions

Conclusions remarks on implementing recommended mitigation measures

9.0 References

Citation of reference materials used in EMP preparation

10.0 Emergency Response Plans

10.1. Hurricane Preparedness and Recovery Plan

10.2 Health and Safety Plan

10.3. Fire Control Plan

10.4. Invasive Species Control Plan

11.0 Appendices

10.0 Conclusions Regarding Environmental Acceptability of the Proposed Project

Detailed and comprehensive baseline studies were undertaken in the assessment of the existing botanical, avian and biological resources of the Wilson City Power Plant Project site on Abaco. The result is an environmental baseline assessment (EBA) document which details the impacts that the development of a power plant and associated infrastructure will likely have on the natural pristine environment.

With a projected capital investment of $45,000,000, it is anticipated that the economic impact for Abaco will be boosted significantly. This boost will include new construction jobs, new entrepreneurial opportunities to provide goods and services, and new permanent jobs on the Island. The long-term sustainable effect will be a positive impact for the economy of Abaco.

It is anticipated that with proper planning, application of BEST management practices, and Mitigation Measures outlined in the EBA, incorporated within a comprehensive Environmental Management Plan (EMP), if conscientiously implemented, will minimize in the short-term any negative impacts identified from project development through to operations.

11. Recommendations

The following recommendations are highlighted below to underscore and reinforce the significance of understanding the measures necessary at minimizing the negative impacts on the existing environment, from the project development stages on to the operational phase.

a) Ensure that BEST management practices are employed during the construction phases, including practices that prevent soil erosion and sediment runoff.

b) The water resources (and groundwater lens configuration) in the vicinity of the project site(s) can best be described as fresh to brackish water. Additional hydrological assessments may be required for the varied phases of the development, to ensure that no possible contaminants from the existing (adjacent) fossil fuel generation sites can possibly migrate to the proposed solar sites (via conduits, trenches, pipelines, etc.).

c) Flooding due to extreme rainfall events | excessive surface runoff, along with storm surge can be deemed a minor concern for the project area(s) [LOW – MODERATE |

LONG TERM]. An optional mitigation mechanism for the potential flood hazard / to minimize surface runoff, is to maintain a natural vegetative buffer – thus, assisting to prevent runoff to the marine zone.

d) Ensure permit/waiver to harvest protected tree species is applied for and received from the Forestry Unit (Ministry of the Environment and Natural Resources), prior to any on site land clearing activities.
e) Remove invasive species (Australian pine), in accordance with the National Invasive Species Strategy.
f) Planting and establishment of only native species within new landscape areas.
g) Maintenance of the 25 – 50 feet natural vegetation buffer around property boundary thus ensuring continued biodiversity conservation and enhancement.

12. References

Arkema, et al., (2017). Economic valuation of ecosystem services in Bahamian marine protected areas. Prepared for BREEF by The National Capital Project, Stanford University.

Assessment of the Effects and Impacts of Hurricane Dorian. Inter-American Development Bank, Nassau Bahamas. November 2019.

AEES Consultant Report, CHEC North Abaco Port Tidal Gauge Hydrological Assessment Report (April/May-2016). AEES Consulting Group, LLC Report(s) Tidal Gauge Hydrological Assessments within the Western District of New Providence (2023 thru 2024).

Bowleg, J. 2025: Hydrogeological Reference Data.

Brown, W. S. W. 2025: Geotechnical Engineering Exploration Report, Wilson City Power Plant, Gt. Abaco

Cant, R.V. and Weech, P.S., 1986, A review of the factors affecting the development of Ghyben Hertzberg Lenses in the Bahamas, Journal of Hydrology.

Cant, R.V., 1996, Water Supply & Sewerage in a Small Island Environment. “The Bahamian Experience” Small Islands: Marine Science and Sustainable Development. Coastal and Estuarine Studies.

Laymans’s Guide to Wetlands in The Bahamas, BEST Commission (2007)

Martin H.C. and Weech P.S., Climate Change in the Bahamas – Evidence in the Meteorological Records (1999).

Savarese, Michael, 2016, Origin of Late Halocene Stranplains in the Southern Exuma Islands, Bahamas.

Sealey K. and Bowleg J., 2015, UNESCO Ecohydrology - Ecosystem Change & Management Response on Tropical Island Systems: Case Study of Great Exuma linking Land Use Change, Coastal Wetlands & Marine Fisheries.

Sealey, Neil E. Bahamian Landscapes: An Introduction to the Geography of the Bahamas. Second Edition. Nassau, Bahamas: Media Publishing, 1994.

The National Oceanic and Atmospheric Administration (NOAA), National Weather Service (NWS), National Hurricane Center (NHC), North Atlantic Hurricanes (1851-2019) | Tides & Currents Water Level & Tide Predictions Data (2023 – 2024)

United States Army Corp's of Engineers (USACE) Water Resources Assessment of the Bahamas (2004).

Watson D., Relating Wellfield Lens Level to Shattuck Datum, UNDP Project BHA 150-2-001, Water Abstraction Transportation & Supply Project, October 1983.

Whitaker Fiona F. and Smart Peter L., Geology and Hydrogeology of Carbonate Islands, Developments in Sedimentology, "Chapter 4: Hydrogeology of the Bahamian Archipelago." Amsterdam, The Netherlands: Elsevier Science B.V., 1997.

Areces, et. al., 1999. *A Guide to Caribbean Vegetation Types: Preliminary Classification Systems and Descriptions*. The Nature Conservancy, Arlington VA. USA.

Bahamas National Trust et al. (2018). 20 by 20 White Paper: Marine Protection Plan for expanding the Bahamas Marine Protected Area Network to meet the Bahamas 2020 Declaration. Nassau, The Bahamas.

Bahamas National Trust (2019). Abaco National Park, Abaco, The Bahamas. General Management Plan 2019 – 2029.

BEST Commission, 2013. *National Invasive Species Strategy for the Bahamas.*

Center for Disease Control and Prevention (2019). *What noises cause hearing loss?* Retrieve from https//www/cdc/gov.nceh/hearing_loss/what noises cause hearing loss.html

Government of the Bahamas, 1998. *National Forest Policy for the Bahamas*

Government of the Bahamas, 1959. *Wild Birds Protection Act*

Government of the Bahamas, 2010. *Forestry Act.*

Government of the Bahamas, 2014. *Forestry Regulations*

Government of the Bahamas, 2021. *Forestry (Declaration of Protected Trees) Order.*

Government of the Bahamas, 2010. *Planning and Subdivision Act*

Government of the Bahamas, 2014. *Bahamas Public Park and Public Beaches Authority Act*

Department of Statistics, Government of the Bahamas, 2020. *Census Report*

InterAmerican Development Bank (2020). *Impact of Hurricane Dorian: A view from the Sky*. Inter-American Development Bank, Nassau Bahamas.

IUCN, 2012. *IUCN Red List Categories and criteria: version 3.1.* Second Edition, IUCN Species Survival Commission, Gland, Switzerland.

Gillison, A. N., 2006. *A Field Manual for Rapid Vegetation Classification and Survey for general purposes.* Center for International Forestry Research, Jakarta, Indonesia.

Raffaele, H. 2003. *Birds of the West Indies*, Princeton University Press. Princeton, NJ, USA.

Correll, D. S. and H. B. *Flora of the Bahama Archipelago*. A. R. Ganter Verlag KG, FL, USA.

Sealy, Neil. 2006. *Bahamian Landscapes.* 3rd Edition. Macmillan Caribbean.

White, Anthony W. A. *Birders Guide to the Bahama Islands (including Turks and Caicos).* American Birding Association, Inc. Colorado, USA.

Little, et. al., 1977. *Land Resources of the Bahamas: a summary.* Land Resources Division, Ministry of Overseas Development, Tolworth Tower, Surrey, England.

IFC 2007. *Environmental, Health and Safety (EHS) Guidelines, Noise Management*.

US Army Corps of Engineers, 2004. *Water Resources Assessment of the Bahamas.*

World Health Organization, 2018. Ambient (Outdoor) *Air Quality and Health Fact Sheet No 313.*

APPENDICES

Appendix – A: Abaco Island Concept Design for Wilson City Power Plant

iLTEKNO ADVANCED TECHNOLOGY - POSITIVE ENERGY	Bahamas Family Islands PPA	CONSUS	
PROJECT CODE: ENGG24007	Abaco Island Concept Design Report	Rev.: 04	Page 1 of 29

TABLE OF CONTENTS

1	PROJECT AIM AND INTRODUCTION	2
1.1	Project Location	2
1.2	Selected Project Area	2
1.3	Water Resource and Soil Conditions	3
1.4	Grid Connection	3
1.5	LNG Supply	4
1.6	Emission Requirements	4
1.7	Noise Requirements	5
1.8	Fire-Fighting Requirements	5
1.9	Waste Water System	5
2	PROJECT CAPACITY SELECTION	5
3	PROJECT TECHNOLOGY SELECTIONS	9
3.1	Gas Engines	9
3.1.1	Main Benefits of MAN Gensets	9
3.1.2	Part Load Flexibility	10
3.1.3	Maintenance Periods of Gensets	10
3.1.4	References of MAN 35-44 Engines	11
3.2	Solar Plant	11
3.3	Battery Storage System	15
3.4	LNG Supply and Gasification System	17
3.5	List of Major Equipment and Suppliers for Base Load Plant	20
4	MAIN FLOW DIAGRAM OF PROJECT	21
5	MAIN SINGLE LINE DIAGRAM OF PROJECT	22
6	SYSTEM AUTOMATION TOPOLOGY	24
7	BASELINE TIME SCHEDULE OF PROJECT	25

Appendix A: Abaco Three Year Loads.xlsx file

Appendix B: General Layout of the Plant

Appendix C: Layout of Baseload Power Plant and Section View

Appendix D: General Flow Diagram of the Plant

Appendix E: Electrical Single Line Diagram of the Plant (Abaco Power Plant SLD)

Appendix F: Automation Topology

Appendix G: The Bahamas Family Islands Grid Code-1-29-25

Appendix H: Grid Code Deviation List (including Grid Code Simulation of Genset)

Appendix I: Detailed Single Line Diagram of BESS

1 PROJECT AIM AND INTRODUCTION

This report outlines the concept design of Abaco Island for provision of a baseline for the Power Purchase Agreement between Consus Energy and The Government of the Commonwealth of the Bahamas the Ministry Energy & Transport ("MoE") and Bahamas Power and Light Company ("BPL").

1.1 Project Location

Project to be performed on Abaco Island belonging to Commonwealth of the Bahamas which lies about 193 miles (167.7 nautical miles or 310.6 km) east of Miami, Florida.

1.2 Selected Project Area

There are three alternative locations provided by BPL for the Abaco site location which are located in Marsh Harbour, Moores Island and Wilson City. As the main electric production activities are performed in Wilson City Power Station and the main load demand in the island is met from this location, Wilson City has been selected as the Project area.

Reference Document BPL Site Report dated 27 May 2024

The Project area is next to the existing Wilson City power station and this is also evaluated that the operational flexibility would be higher compared to Rock Sound area.

For the Wilson City area, total area of 60 acres is provided by BPL. The project location has been shown as below;

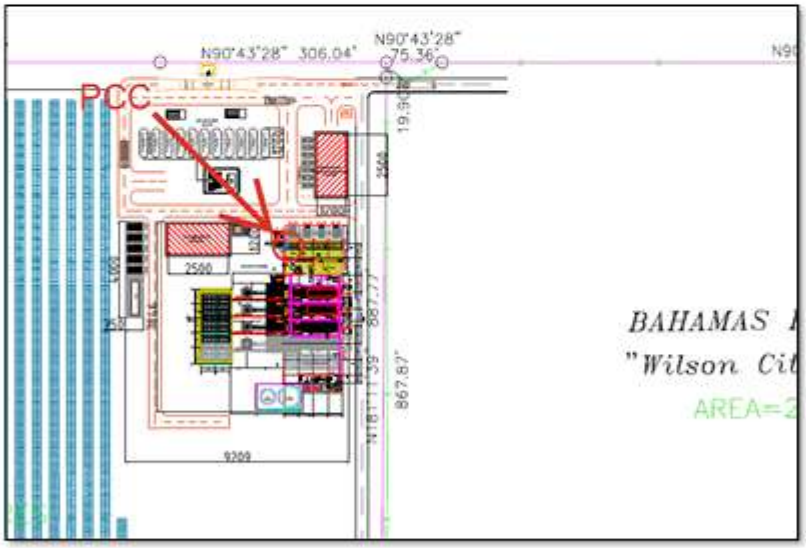
1.3 Water Resource and Soil Conditions

According to the existing information by Consus Energy, the water would be supplied to the Power Plant by artesian wells to be drilled within Project location or the water could be supplied BPL from the existing power plant. The supply of water and the terminal point with the water parameters shall be discussed with MoE during the PPA signature stage.

Soil investigation study will be performed together with the topographical survey in order to verify the soil condition.

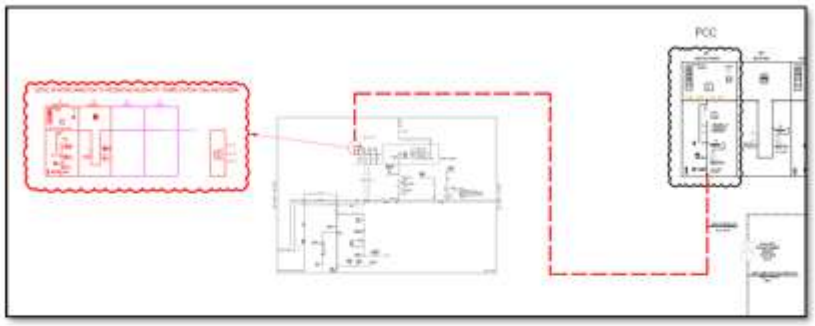
1.4 Grid Connection

The Project's Point of Common Coupling (PCC) will be the outgoing cubicle of the Plant, where the location of the PCC is shown in below figure;



Plant's measuring will be done in the measuring MV cubicle located in the PCC and protection systems will also be in the same location.

Point of Interconnection (POI) to the existing Wilson City Power station to be performed by others where the connection is shown in red below.



Gensets design to follow BPL Grid Code 2019 (reference Appendix G) except for the grid code deviations specified in the "Grid Code Deviation List" document Appendix H.

1.5 LNG Supply

Based on the decision by Consus Energy for operational health and safety considerations, LNG storage will not be performed on Project area with ISO containers. Instead of ISO containers storage, permanent LNG storage tanks is to be considered on the concept design with 10 days stock capacity according to the daily average electricity supply requirement.

However, as this is a concept design, the details of LNG supply shall be further discussed with LNG supplier. The supply and storage of the LNG shall be further clarified and subject to change based on the health and safety regulations and/or CAPEX and OPEX costs.

1.6 Emission Requirements

Specification provided by Consus Energy does not contain the requirements for the exhaust gas and effluents.

Reference Document : RFP Micro Grids Family Island FINAL Draft 4 Dec 23

As per the information by Consus Energy, the Environmental Impact Assessment report to be performed for the Project based on the approval of concept design. In this regard, exhaust and effluent emissions to be evaluated in later stage.

However selected Genset's exhaust gas emissions are in accordance to the World Bank 2007/2008 guidelines issued by IFC / World Bank with the "Environmental, Health, and Safety

General Guidelines" in April 2007 and "Environmental, Health, and Safety Guidelines for Thermal Power Plants" in December 2008.

1.7 Noise Requirements

Together with the EIA report, noise requirements will also be established.

1.8 Fire-Fighting Requirements

Local fire-fighting requirements will be checked during the implementation stage of the Project. For the existing concept design, 250m³ fire water tank considered together with one diesel and one electrical fire-fighting pumps with redundancy.

1.9 Waste Water System

The following waste water systems are to be treated on-site before discharged;

a. Oily Water – After separation collected oil & waste sediments to be discharged and/or treated by Others

b. Domestic Water (Sewage) Treatment – After biological treatment waste sludge to be discharged and/or treated by Others

2 PROJECT CAPACITY SELECTION

Capacity selection studies have been performed based on the hourly production rates provided by MoE.

Reference Document Abaco 2023 Three Year Loads dated 13 June 2024

For the capacity selection one year hourly data is considered to be evaluated. In this regard, according to the load profile provided by MoE, 2023 year has been studied. In the 2023 year data, there were 709 hours without any production which may be due to planned and/or unplanned outages of Marsh Harbord plant and the total production was 78,669 MWh. Considering the demand will continue during the outages of existing plant, the out of operation hours demand has been correlated to average production and total demand has been correlated to 85,597 MWh. After the latest information by Consus Energy, total demand has been correlated to 120,000MWh yearly.

According to that study, demand rates are as below;

Abaco Hourly Demand Analysis (MW)	
Average Generation (MW)	13.7
Maximum Generation (MW)	52.5
Total Generation Hours smaller than 1 MW	2
Total Generation Hours between 1-4 MW	25
Total Generation Hours between 4-8 MW	766
Total Generation Hours between 8-10 MW	1402
Total Generation Hours between 10-12 MW	1542
Total Generation Hours between 12-14 MW	2041
Total Generation Hours between 14-18 MW	1598
Total Generation Hours between 18-22 MW	784
Total Generation Hours between 22-30 MW	391
Total Generation Hours greater than 30MW	209

For the initial configuration studies, the requirement from MoE specification outlined below considered;

"Renewable Energy Component: Each proposed system must incorporate a renewable energy component of 30% to 50% or more."

Reference Document : RFP Micro Grids Family Island

For the selection of configuration, analysis performed according to below operation criteria;

a. MAN Gensets low load operation is taken as the 10% of the capacity
b. In case Solar production available, the produced energy will supply the grid
c. In case the Solar production is not sufficient for covering the demand, the Gensets will start to operate to supply grid. After having the load on one Genset, if the demand is higher than one Genset's 90% load, second Genset will start to operate and these Gensets will be operated on load sharing mode.
d. In case the Gensets and Solar Plant's capacity is not enough to support the grid, existing battery capacity will be utilized for supporting the grid for emergency cases.
e. Based on the selected configuration and hourly demand, the required battery running hours and capacity selection performed.

f. Under normal operation, batteries will be utilized as spinning reserve in order to keep the frequency of the Gensets constant.

The primary reason for selecting a baseload power plant is that, as the sole power producer on Abaco Island, it must ensure that the baseload capacity can meet the demand even during both planned and unplanned outages of the generators.

In this regard the baseload plant has been selected with 3 x 9,976kWe net output MAN 20V35-44 G model with total capacity 29.9kWe.

As per the requirement by the MoE specification for the renewable energy, following configuration selected;

1. 15 MWp Solar PV selected with AC output of 13.05 MWe
2. 1 x 7.5MWe (settable) AC usable power @ POI and 15.564 MWh AC usable power capacity @ POI Battery System

Battery storage system has been selected in 15MWe 0.5C (7.5MWe/15MWh) due to below reasons;

i. During any unplanned outage of any genset at baseload plant, in order to cover the response time of gas engines

ii. For covering the 5MWe of island demand alone for approximately two hours in case of any unplanned outage at the baseload plant

iii. In order to cover load steps of Genset due to the instant load profile change in the Island

In this regard the Plant configuration studied as follows;

29.9MWe Baseload + 15MWp Solar + 15 MWe Battery Storage Eluethera Power Plant

Via PVsyst software, hourly generation study performed for Solar Plant and according to the load profile provided by MoE for the 85,597MWh yearly production value, below results have been gathered;

i. Solar Power → 25,188 MWh production directly to the grid and capacity usage 19.31% whereas the surplus amount of energy to be utilized for filling the batteries depending on the load demand and forecast

ii. Gensets → 93,953 MWh production with 35.84% capacity usage

iii. Remaining 860 MWh demand will be covered with batteries where the demand is lower than the Gensets' low load limit

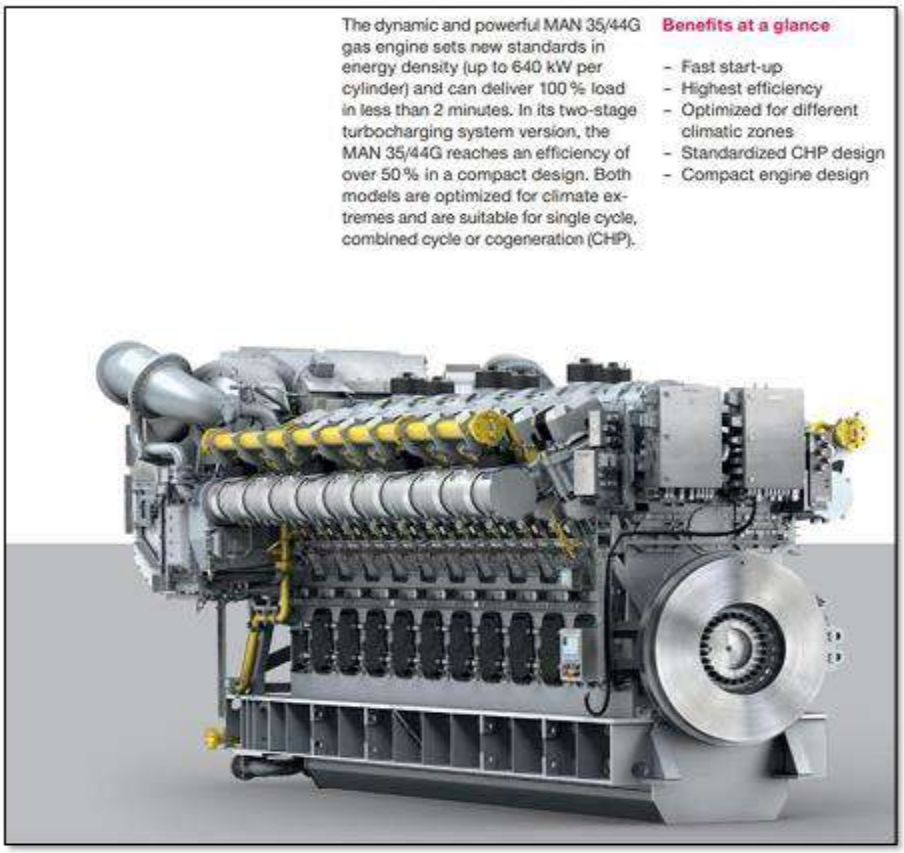
iv. Running hours of batteries is calculated as 307 hours

Based on the hourly production values provided by MoE, the selected capacity will be sufficient to provide reliable and constant electricity to the Island.

On top of that, to be able to meet the demand in future years, an additional two reserve Genset area will be considered in the layout studies together with its electrical and mechanical auxiliaries.

3 PROJECT TECHNOLOGY SELECTIONS

3.1 Gas Engines



According to the site-specific study of the MAN 35/44 Gensets' efficiency will be 48.5% at full load.

3.1.1 Main Benefits of MAN Gensets

- ✓ Higher efficiency compared to most Gensets
- ✓ Higher reliability and lower maintenance due to the medium speed operation
- ✓ Via lean burn concept low NOx production and higher output with avoiding knocking

- ✓ Short power ramp up time 100% load within 8 minutes
- ✓ Continuous low load operation allowance up to 10% load
- ✓ High part load flexibility

3.1.2 Part Load Flexibility

Gensets are occupied with part load flexibility which can increase/decrease the load up to 30% within 5 seconds allowing operational flexibility in distributed power plants. Before an additional load step will be applied, at least 20 seconds waiting time after initiation of the previous load step needs to be considered.

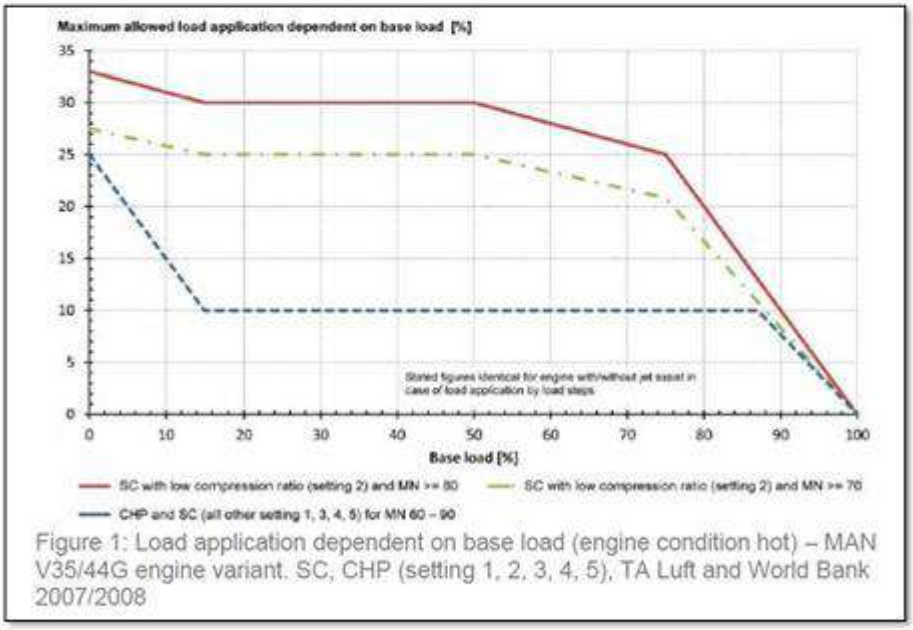


Figure 1: Load application dependent on base load (engine condition hot) – MAN V35/44G engine variant. SC, CHP (setting 1, 2, 3, 4, 5), TA Luft and World Bank 2007/2008

3.1.3 Maintenance Periods of Gensets

Gensets' stoppage periods for planned outages are as follows;

Maintenance Interval	No of maintenance until 48k	No of maintenance until 90k	No. of scheduled maintenance in the period	Maintenance duration in days	
				- engine - 1 shift work	- TC - 1 shift work
3,000			27	1	-
6,000	3	10	13	1	-
9,000	3	5	13	3	-
12,000	2	4	10	2	-
18,000	1	2	6	18	8
36,000	1	1	2	31	8
48,000	1	1	4	2	-
72,000		1	2	35	8
90,000		1	1	22	8
144,000			1	44	8
180,000			1	35	8

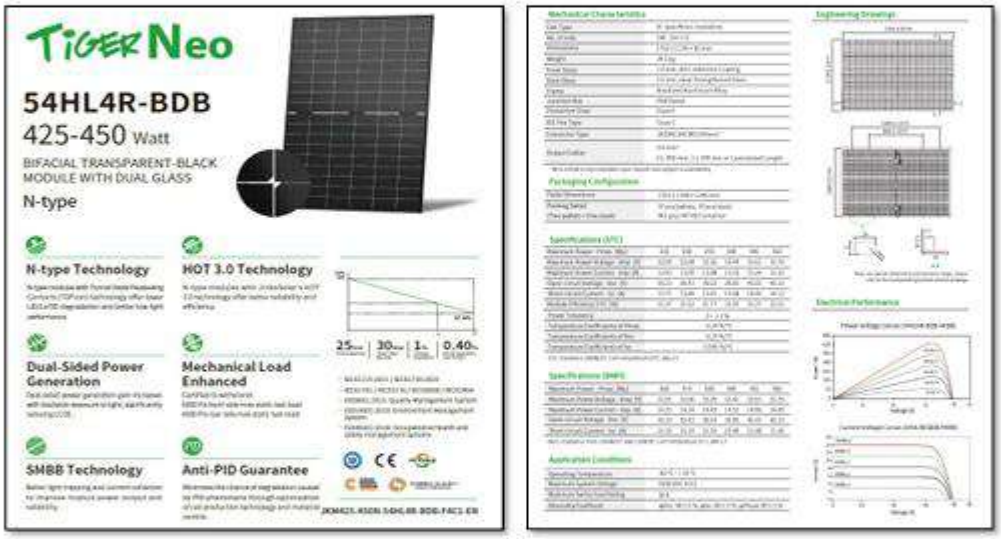
3.1.4 References of MAN 35-44 Engines

MAN Order Name	Power by installation total MW	kW nom. per engine	No. of Engines	No. of cylinders	Engine Version	Engine Type	Fuel	Country of installation	Order year
ARMENIA	51.20	12,800	4	20	V	35/44GTS	Gas	Armenia	2022
SIPITANG	74.20	10,600	7	20	V	35/44G	Gas	Malaysia	2022
HI STEEL	81.60	10,200	8	20	V	35/44G	Gas	Iraq	2022
SEKUPANG	53.00	10,600	5	20	V	35/44G	Gas	Indonesia	2022
HKW KREUZSCHLAG	7.68	7,680	1	12	V	35/44G TS	Gas	Germany	2020
BORGO	25.60	12,800	2	20	V	35/44GTS	Gas	Italy	2022
STADTWERKE SCHWÄBISCH HALL 2	7.68	7,680	1	12	V	35/44G TS	Gas	Germany	2020
EL MUTUN	106.00	10,600	10	20	V	35/44G	Gas	Bolivia	2019
HKW FRANKFURT (ODER)	53.00	10,600	5	20	V	35/44G	Gas	Germany	2019
MHKW CHEMNITZ NORD	25.80	12,900	2	20	V	35/44G TS	Gas	Germany	2019
MHKW CHEMNITZ NORD	64.50	12,900	5	20	V	35/44GTS	Gas	Germany	2019
MHKW ALTCHEMNITZ	25.80	12,900	2	20	V	35/44G TS	Gas	Germany	2019
MHKW ALTCHEMNITZ	38.70	12,900	3	20	V	35/44GTS	Gas	Germany	2019
MHKW JENA siehe auch 5305046 -LT	12.90	12,900	1	20	V	35/44G TS	Gas	Germany	2019
MHKW JENA siehe auch 5305046 -LT	51.60	12,900	4	20	V	35/44GTS	Gas	Germany	2019
STATERA SALTHOLME SITE I	51.60	12,900	4	20	V	35/44GTS	Gas	United Kingdom	2019
STATERA SALTHOLME SITE II	51.20	12,800	4	20	V	35/44GTS	Gas	United Kingdom	2019
NUTRIEN	77.40	12,900	6	20	V	35/44GTS	Gas	Canada	2019
STADTWERKE SCHWÄBISCH HALL	7.68	7,680	1	12	V	35/44GTS	Gas	Germany	2019
PRONAL	10.20	10,200	1	20	V	35/44G	Gas	Mexico	2017
ENSW GAUSBURG	31.80	10,600	3	20	V	35/44G	Gas	Germany	2016
WYKES EXTENSION	10.60	10,600	1	20	V	35/44G	Gas	United Kingdom	2016
VW BRAUNSCHWEIG	10.60	10,600	1	20	V	35/44G	Gas	Germany	2012

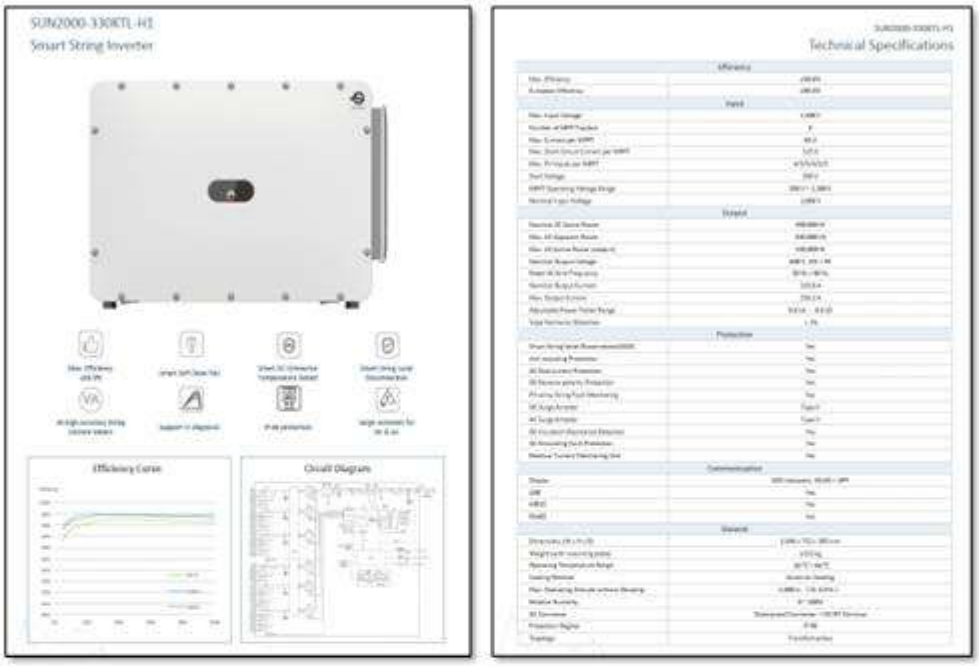
3.2 Solar Plant

The Solar Power Plant will consist of 33,344 x 450 Wp Half Cut Bifacial PV modules. These PV modules will be grouped into 2084 tables, each with 32 modules-1string. These strings will transmit the direct current generated by the solar panels to the inverters. 300 kWe inverters will be used in the project and these inverters will convert the incoming energy into alternating current at 800 Volts and transmit it to 4 main distribution panels. The main distribution panels will be positioned near the transformers and connected to 4 each 3750 kVA transformers. The voltage of 0.8 kV will be stepped up to 13.8 kV and the system will be connected to the distribution center.

"PV panels can be updated in the detailed design phase according to the detailed design of the SPP according to the structural analysis to be performed."



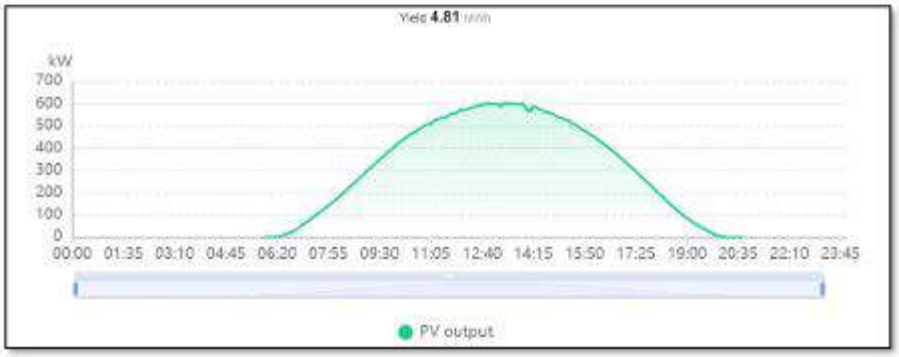
PV Modules: 33,344 x 450 Wp Half-Cut Bifacial PV Modules



Inverters: 42 x 300 kWe String Inverters

Bifacial PV modules that have transparent backsheets produce additional energy from the backside thanks to reflected solar irradiance. The PV Modules will be mounted with the optimum azimuth and tilt angles to maximize efficiency.

The system can be monitored instantly via Data Logger devices and any faults in the field can be detected quickly.



Daily Production Graph

- Maximum strength resistance with double columns
- Suitable for vertical and horizontal design
- Applicable to all types of surfaces
- All connection elements are stainless

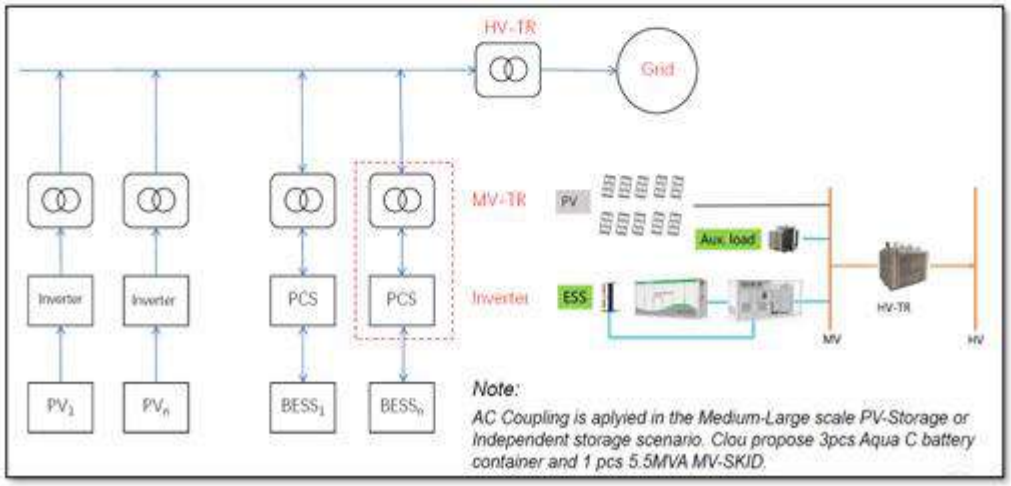
No	Product	Brand	Model	Quantity	Unit
1	PV Module	Jinko/JA/HT	450 Wp	33344	pcs
2	Inverter	Huawei/Sungrow	300 kW	42	pcs
3	Solar Mounting System	ISOTEC/STA/GMR	Ground Type - Steel	900	tons
4	Main Distribution Panel	ABB/Schneider/Siemens	800V	4	pcs
5	Transformer	Astor/Best/Europower	13.8/0.8 kV, 60Hz, 3750 kVA	4	pcs
6	DC Cable	Prysmian/Nexans/HES	1x6 mm2, 1x10 mm2 H1Z2Z2	180000	m
7	AC Cable	HES/Öznur/Hasçelik	1x150 N2XH	11340	m
8	AC Cable	HES/Öznur/Hasçelik	1x240 N2XH	864	m
9	AC Cable	HES/Öznur/Hasçelik	1x150/25 N2XSY	2550	m
10	AC Cable	HES/Öznur/Hasçelik	1x95/16 N2XSY	180	m

The solar plant is to be located closer to the base load plant in order to minimize the electrical cabling costs. According to the layout studies the allocated area is sufficient to provide 15MWp solar power plant.

General Area Allocation of Solar Plant

3.3 Battery Storage System

Solar and Battery system will be connecting to the same busbar. AC coupling will be considered for the MV connection.



BESS Connection

Batteries and its relevant Transformers and MV cubicles are to be manufactured in containerized skids. Via the integrated battery and energy management system, grid frequency control will be established for Solar and baseload side.

Features

- Varied protection functions, enabling 100% three-phase unbalanced load Operation
- Real-time active/reactive power scheduling & LVRT/HVRT function
- Advanced droop control method
- 20' HQ Skid solution easy for transportation and installation

System Type	NEPCSH-4000-MV
DC Voltage	1000-1500 V
Max. DC Current	2000 A x 2
NO. of DC Inputs	1
Nominal AC Voltage	4000 kVA
Max. AC Current	1674 A x 2
Nominal AC Voltage	690 V
MV	33 kV
Dimensions (W*H*D)	6058 *2896*2438 mm
Weight	18000 kg
Operating Ambient Temperature Range	-30 to 60 ℃ (> 45 ℃ derating)
Communication	Standard: RS485, CAN, Ethernet, Optical fiber
Codes and standards compliance	UL1741, UL1741SA, IEEE1547

BES Datasheet

Features of the skid solution is provided below;

- ✓ Renewable Power Plant Integration (Ramp rate control, energy shifting)
- ✓ Grid Ancillary Control (Frequency regulation, peak shaving)
- ✓ Distributed Network and Micro-grid (Peak shaving, autonomous operation)

Performance

- ✓ Advanced three-level technology, max. efficiency reaches 98.8%
- ✓ Effective forced air cooling
- ✓ High DC voltage up to 1500V
- ✓ Support two independent DC inputs
- ✓ Bidirectional power conversion system
- ✓ Battery charge & dis-charge management and black start function integrated

EASY O&M

- ✓ Integrated monitoring function and fast trouble shooting

- ✓ Integrated auxiliary power supply panels for external devices
- ✓ Low transportation and installation cost
- ✓ GRID SUPPORT
- ✓ Compliant with UL1741, IEEE1547
- ✓ L/HVRT, L/HFRT, specified power factor control and reactive power support

Augmentation chart of the battery is as follows;

3.4 LNG Supply and Gasification System

LNG supply will be performed with LNG trucks and/or LNG ISO containers. The Project will be occupied with LNG unloading station (pump requirement details will be also verified with LNG supplier) and truck scale.

According to the hourly data provided by MoE, below gas consumptions calculated yearly;

The above figure of gas consumption in the amount of approximately 20.4 million m3 of gas corresponds to 34.000 m3 of LNG. By considering that figure and ISO and/or LNG tanker capacity as 44m3, yearly 760 trucks to be dispatched to the power plant for covering the electricity

demand which corresponds to almost twice times filling in a day. In order to keep the continuous supply of LNG to the Plant, Government should take necessary precautions to keep the roads available for dispatch.

Remaining regasification system will consist of liquid natural gas storage tanks, atmospheric vaporizers, electric heater and regulation station.

LNG Storage Tanks

For LNG storage tanks, the capacity selection is not increased to 120,000MWh, instead of this initial data of BPL considered.

Based on the yearly production data, 10 days storage tank with total volume of 1000m³ is to be used (4 each 250m³). Calculation is as follows;

	Yearly Gas Consumption	Daily Gas Consumption	Daily Lng Consumption	10 Days' Storage Capacity	Selected Tank Capacity
Abaco	19,985,071	54,754	91.26	912.56	1000

LHV kWh/Nm3	10.17
LHV kCal/Nm3	8,746

Vaporizers

The liquid natural gas transferred to the plant will be gasified in atmospheric vaporizers and then heated using an electric heater to achieve the required gas temperature at the point of consumption. The gasified and heated gas will be regulated to the required pressure levels of 150 mbar in the pressure conditioning station.

For the system atmospheric vaporizers with capacity of 750kW is to be considered. In order to prevent performance losses due to snow formation on atmospheric evaporators, atmospheric evaporators will be supplied redundantly and operated with the principle of co-aging.

Electrical Heaters

In order to prevent the natural gas temperature at the requested flow rate from the atmospheric vaporizers from falling below +5°C at the point of use, an electric heater with appropriate thermal capacity, certified according to Atex and PED directives, will be supplied. The heater inlet-outlet temperatures will be monitored and operated by the control system with on/off, stepped or analogue control principles. The electrical heaters in the design is mostly considered for redundancy since the ambient temperature is not expected to fall below +15°C in Eluethera island.

Gas Regulation Units

Production and supply of a regulation station with an inlet pressure of 6 bar and an outlet pressure of 150 mbar with a backup line to meet the technical requirements of the plant. All radiographic welding and pressure tests will be carried out under the supervision of a third party authorised body, and personnel certificates and equipment certificates will be submitted to the relevant quality document. Directives and standards such as 2014/68/EU (Pressure Equipment Directive PED), 2006/42/EC (Machinery Directive), EN 13480 (Metallic industrial piping), ISO 15614 (Specification and qualification of welding procedures for metallic materials), ISO 9606 (Qualification testing of welders) will be taken as reference for mechanical design criteria and post-production quality tests.

Piping and Equipment

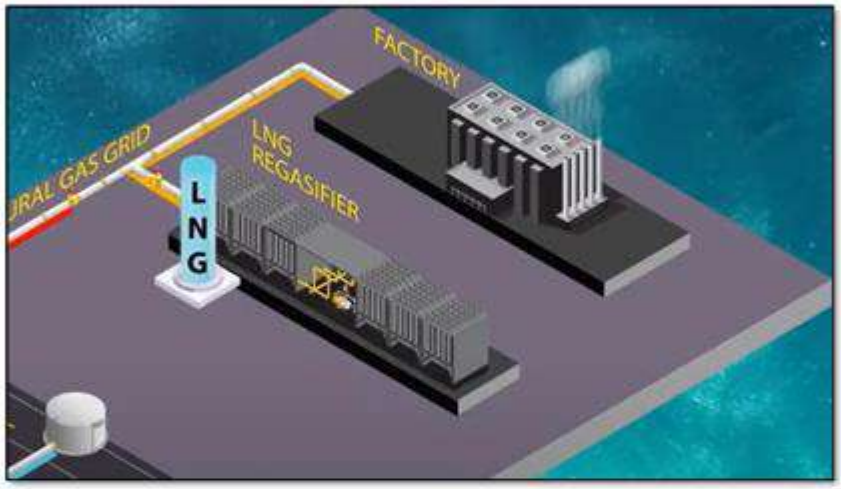
Technical calculations will ensure that the equipment and installation elements to be used meet the system requirements and comply with safety standards. Directives and standards such as 2014/68/EU (Pressure Equipment Directive PED), 2006/42/EC (Machinery Directive), EN 13480 (Metallic industrial piping), EN 10216 (Seamless Steel Tubes for Pressure Purposes), ISO 15614 (Specification and qualification of welding procedures for metallic materials), ISO 9606 (Qualification testing of welders) will be taken as reference for mechanical design, production and tests. Control valves will be certified in API standard. All electrical equipment and connection elements will be in Atex class in accordance with Atex zone standards determined according to 2014/34/EU (Atex directive) and EN 60079 (Explosive atmospheres) directives and standards.

Safety equipment and functions

Precautions to be taken for environmental and personnel health will be provided throughout the facility. Gas emission will be monitored with gas detectors to be installed at locations to be determined after site exploration. Personnel safety will be ensured with manual emergency buttons to be mounted.

The temperature and pressure values of the liquid to be transferred at low temperature throughout the facility and the gas to be pressurised in the closed system will be monitored instantaneously. Within the scope of equipment and personnel safety, possible anomalies will be automatically prevented and relevant audible and visual notifications will be made.

The equipment will be evaluated within the scope of IEC 61508 (Functional safety of electrical/electronic/programmable electronic safety-related systems) according to functional safety verification and function-logic structures will be established.



3D View of Gasification System (Only for Reference)

3.5 List of Major Equipment and Suppliers for Base Load Plant

a. Gas Engine Sets MAN 35-45 G
b. Engine Cooling System with Friterm or equivalent brand
c. Starting Air System with Dalgakiran or equivalent brand
d. Ventilation System with Boreas or equivalent brand
e. Genset Lube Oil System with Fresh and Waste Oil Tanks
f. Firefighting System with 250m3 Capacity Fire Water Tank
g. Oily Water System with Veolia or equivalent brand
h. Water Treatment System Likya or equivalent brand
i. Domestic Water Treatment System
j. Waste Water Treatment System
k. Raw Water Supply System with 100m³ Capacity Storage Tank Capacity

l. Step-up Transformers with Astor or equivalent brand

m. MV Distribution system with ABB or equivalent brand

n. LV Distribution system

o. Fire detection system

p. Blackstart diesel generator

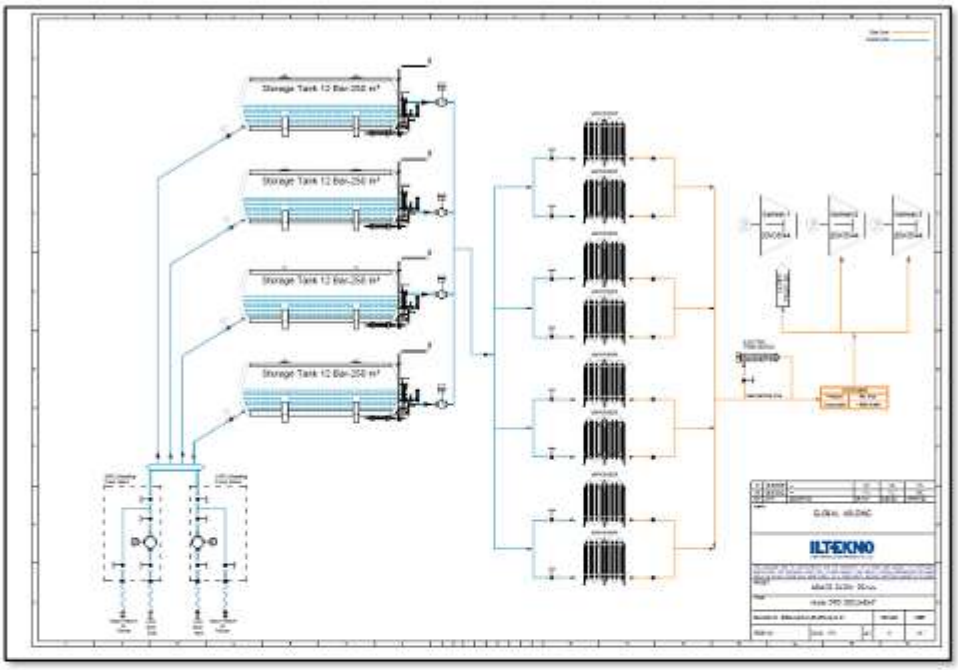
q. Plant control system

4 Main Flow Diagram of Project

Main considerations are as follows;

i. Eleven LNG 10 days storage tanks have been considered according to the average demand of the Island (11 each 115m3)

ii. By taking into account that the gas will be supplied with ISO containers and/or LNG tankers to the plant with 6 bars and the gas inlet pressure at MAN engines are 6 bars as well, pump skid will be considered at the inlet of vaporizers in order to ensure the pressure at the inlet of the gas regulating skids of Gensets as 6 bars.



Main Flow Diagram

5 MAIN SINGLE LINE DIAGRAM OF PROJECT

Two MV Switchgear Groups are foreseen, first is Main MV Switchgear which includes gas engine generator power plant and the second is Renewable MV Switchgear which includes solar power plant and battery energy storage system.

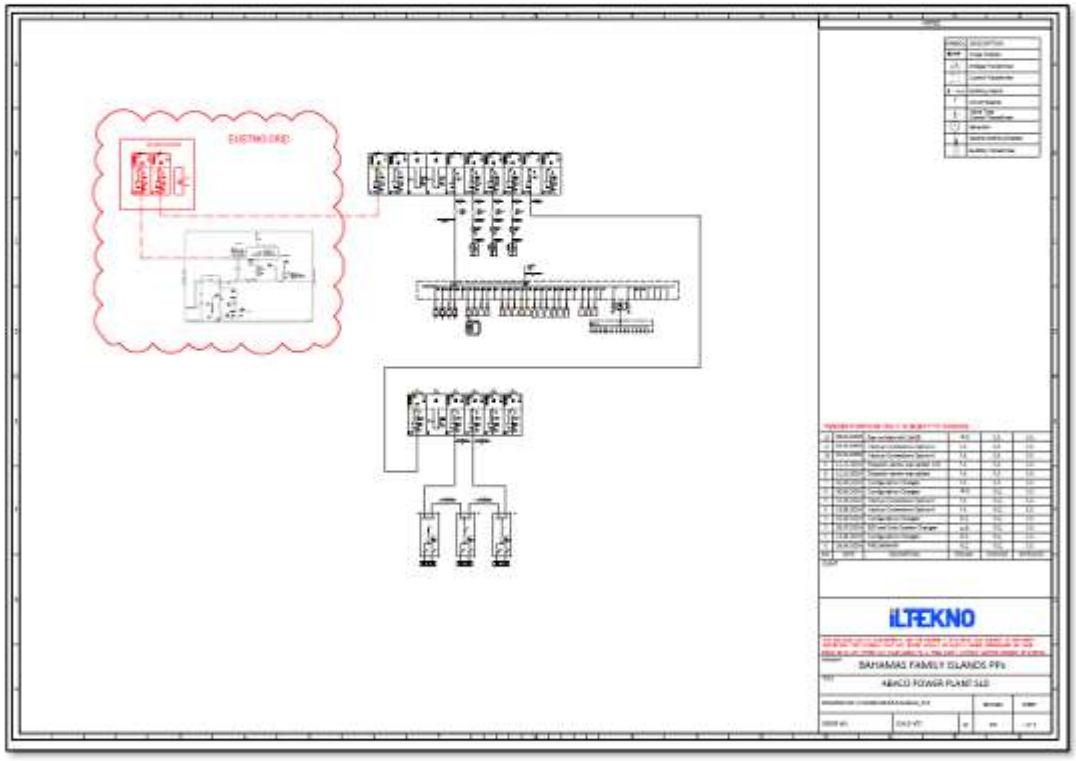
13,8kV gensets are connected directly to the Main MV Switchgear. Grid Outgoing Feeder is also considered in this MV Switchgear. Neutral point of the alternators are grounded via neutral earthing resistors which limits the earth fault short-circuit current to a specific value which will be determined by the local authorities and alternator capability

Solar PP inverters are connected via 13,8/0,8 kV step up transformers than to Local Solar MV Switchgear and BESS PCSs are connected via 13,8/0,63 kV MV System skids to the Renewable MV Switchgear. It is considered that the Main MV Switchgear and the Renewable MV Switchgear will be connected to each other via underground MV cable.

MV switchgears are going to be designed for an initial symmetrical short-circuit current according to the existing networks, new generator's and renewable power plant's short circuit power.

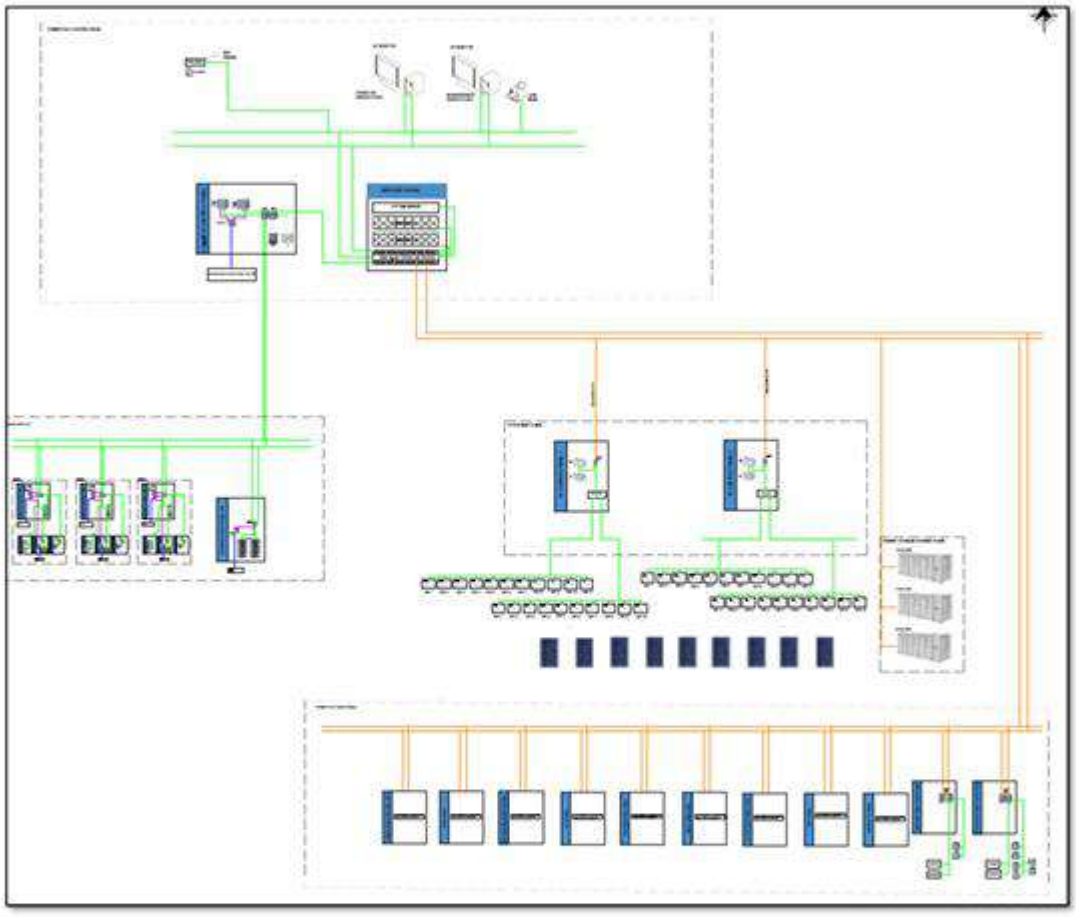
For the baseload plant, one auxiliary service transformer is designed and an emergency diesel generator is considered for black start operation.

Grid outgoing cubicle of the Main MV Switchgear is connected to the 13,8kV main busbar in the Wilson City Power Station which to be performed by others.



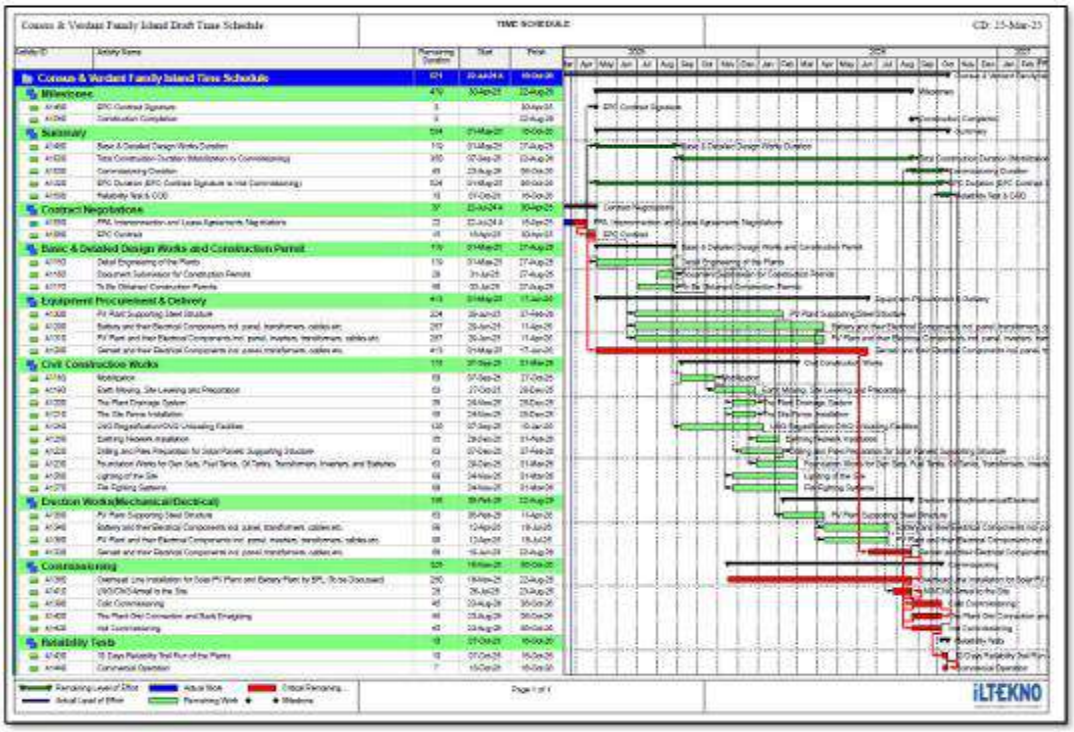
MV and LV Single Line Diagram Baseload Plant

6 System Automation Topology



System Automation Topology

7 BASELINE TIME SCHEDULE OF PROJECT



Baseline Schedule

Appendix – B: Geotechnical engineering Exploration Report

Certified Testing Laboratories International

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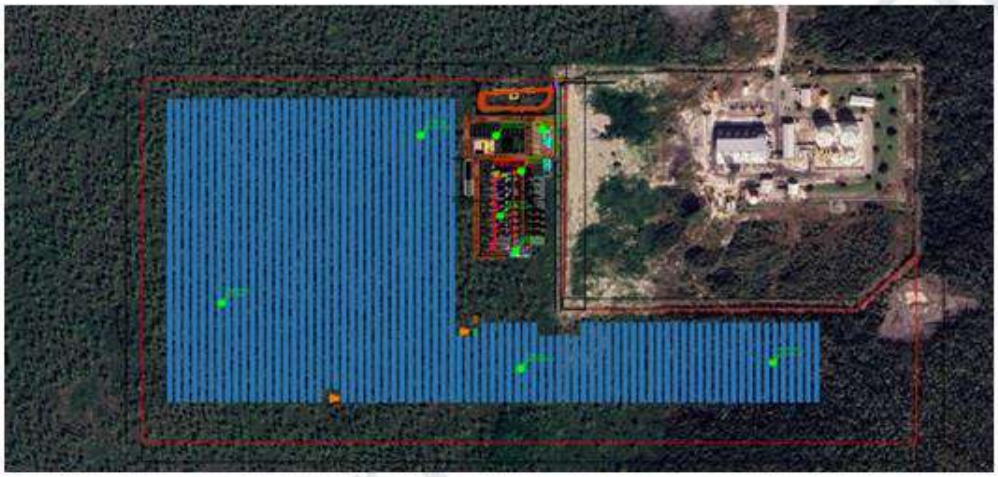
Geotechnical Engineering Exploration Report



Bahamas Power and Light Wilson City
Abaco, Bahamas

Prepared For:
Javon T. Rolle,MCSE,OSHA,SAP
Program Coordinator
IDDC Bahamas

Prepared By:
Certified Testing Laboratories International

Certified Testing Laboratories International

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EMAIL: certifiedtestinglabsbahamas@outlook.com

January 15th , 2025

Javon T. Rolle,MCSE,OSHA,SAP
Program Coordinator
IDDC Bahamas

Per your request, Certified Testing Laboratories International (CTLI) has completed the Geotechnical Engineering Exploration for Bahamas Power and Light Wilson City in Abaco, Bahamas.

This report presents the results of our subsurface soil exploration and provides geotechnical engineering recommendations in regards to the site preparation and foundation support required for design and construction of the proposed Bahamas Power and Light Wilson City.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we may be of further service, please feel free to contact us.

Sincerely
CTLI Bahamas Ltd.

CERTIFIED TESTING LABORATORIES INTERNATIONAL
COMMON SEAL OF

[redacted]
Whittington S. W. Brown
Chief Technologist
January 15th, 2025

Certified Testing Laboratories International
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1.0 SITE AND PROJECT INFORMATION

Based on information in the drawings you provided to us and observations during our field work, the project site consists of an approx. 60 acres portion of land within Abaco. The existing ground surface is covered with low-lying vegetation/bushes and pine trees elevations vary..
No drawings were available for preparation of this report.

2.0 FIELD EXPLORATION

Our field exploration was conducted from December 16, 2024 to January 10, 2025. determination of the soil compressive strength, at various depths with a pocket soil penetrometer and rock cores. In addition, a steel soil probe rod was used to do the probing of the soil resistance to penetrate throughout the acreage .

Representative samples of the excavated soils were stored in airtight containers and delivered to our laboratory in New Providence for further review and classification by our geotechnical engineer.

3.0 SUBSURFACE SOIL CONDITIONS

Subsurface Soil Profile

Based on the results of our soil probing and test pit excavations, the site subsurface soil profile consists of approximately 3 inches of relatively loose sand TOPSOIL underlain by the LIMESTONE formation to the explored depths.

Based on the experienced rate of excavation (i.e. 30 minutes/foot of depth), the encountered LIMESTONE formation is sound and hard. In addition, the pocket soil penetrometer test results indicated values in excess of the instrument's highest measurable compressive strength of +5.0 ton/ft² at each tested location. The following table provides the Soil Penetrometer test results:

Soil Penetrometer Table

Depth (ft) /Location	Spacing	Strength (ton/ft2)
1a	15ft/oc	+5.0
1b	15ft/oc	+5.0
1c	15ft/oc	+5.0
1d	15ft/oc	+5.0
1e	15ft/oc	+5.0
1f	15ft/oc	+5.0
1g	15ft/oc	+5.0

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Soil Penetrometer Table		
Depth (ft) /Location	Spacing	Strength (ton/ft2)
2a	15ft/oc	+5.0
2b	15ft/oc	+5.0
2c	15ft/oc	+5.0
2d	15ft/oc	+5.0
2e	15ft/oc	+5.0
2f	15ft/oc	+5.0
2g	15ft/oc	+5.0

Soil Penetrometer Table		
Depth (ft) /Location	Spacing	Strength (ton/ft2)
3a	15ft/oc	+5.0
3b	15ft/oc	+5.0
3c	15ft/oc	+5.0
3d	15ft/oc	+5.0
3e	15ft/oc	+5.0
3f	15ft/oc	+5.0
3g	15ft/oc	+5.0

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Soil Penetrometer Table		
Depth (ft) /Location	Spacing	Strength (ton/ft2)
4a	15ft/oc	+5.0
4b	15ft/oc	+5.0
4c	15ft/oc	+5.0
4d	15ft/oc	+5.0
4e	15ft/oc	+5.0
4f	15ft/oc	+5.0
4g	15ft/oc	+5.0

Soil Penetrometer Table		
Depth (ft) /Location	Spacing	Strength (ton/ft2)
5a	15ft/oc	+5.0
5b	15ft/oc	+5.0
5c	15ft/oc	+5.0
5d	15ft/oc	+5.0
5e	15ft/oc	+5.0
5f	15ft/oc	+5.0
5g	15ft/oc	+5.0

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Soil Penetrometer Table		
Depth (ft) /Location	Spacing	Strength (ton/ft2)
6a	15ft/oc	+5.0
6b	15ft/oc	+5.0
6c	15ft/oc	+5.0
6d	15ft/oc	+5.0
6e	15ft/oc	+5.0
6f	15ft/oc	+5.0
6g	15ft/oc	+5.0

Soil Penetrometer Table		
Depth (ft) /Location	Spacing	Strength (ton/ft2)
7a	15ft/oc	+5.0
7b	15ft/oc	+5.0
7c	15ft/oc	+5.0
7d	15ft/oc	+5.0
7e	15ft/oc	+5.0
7f	15ft/oc	+5.0
7g	15ft/oc	+5.0

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Soil Penetrometer Table		
Depth (ft) /Location	Spacing	Strength (ton/ft2)
8a	15ft/oc	+5.0
8b	15ft/oc	+5.0
8c	15ft/oc	+5.0
8d	15ft/oc	+5.0
8e	15ft/oc	+5.0
8f	15ft/oc	+5.0
8g	15ft/oc	+5.0

Soil Penetrometer Table		
Depth (ft) /Location	Spacing	Strength (ton/ft2)
9a	15ft/oc	+5.0
9b	15ft/oc	+5.0
9c	15ft/oc	+5.0
9d	15ft/oc	+5.0
9e	15ft/oc	+5.0
9f	15ft/oc	+5.0
9g	15ft/oc	+5.0

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Soil Penetrometer Table		
Depth (ft) /Location	Spacing	Strength (ton/ft2)
10a	15ft/oc	+5.0
10b	15ft/oc	+5.0
10c	15ft/oc	+5.0
10d	15ft/oc	+5.0
10e	15ft/oc	+5.0
10f	15ft/oc	+5.0
10g	15ft/oc	+5.0

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Groundwater
Groundwater was encountered during field exploration in the 15ft test pits. Water depth at low tide four inches and water depth at high tide thirty six inches.

4.0 GEOTECHNICAL EVALUATION & RECOMMENDATIONS

Building Structure
Based on the information obtained from our field exploration and the heavily loaded nature of the proposed engine foundation. and miscellaneous features, the encountered subsurface soil conditions are suitable to support the structures on a system of shallow foundations bearing on the existing LIMESTONE or engineered fill material.

As the dimension of foundation elements are expected to be controlled by providing adequate dead weight to resist wind pressures, the net bearing pressure under dead and live load is expected to be relatively low. Therefore, we recommend to design the footings using a maximum allowable bearing pressure of 5,000 lb/ft^2 and sliding coefficient of 0.35 (0-4 if bearing on LIMESTONE) after completion of a site preparation as recommended in the following paragraph.

The site preparation should consist of the entire removal of vegetation/TOPSOIL and subsequent placement of approved fill material to raise/level the resulting grades to the elevations, if required. Inspection of the entire site, by our geotechnical engineer or a representative, is advisable after the removal of vegetation/TOPSOIL and prior to raising/leveling the resulting grades to assure sound, competent subgrade conditions are attained (i.e. removal of surficial weak, weathered LIMESTONE might be required).

The approved fill material should consist of granular soil with a maximum nominal size of 3 inches, no more than 12% of fines and no organic matter placed in 12-in thick lifts compacted to at least 95% of the material's Maximum Dry Density (ASTM DI557) is expected to be 120 lbs/ft3. An active earth pressure coefficient of 0.35 and a passive earth pressure coefficient of 3.0 shall be used

The footings should be excavated to the depths specified in the structural drawings or deeper till sound competent limestone is encountered. Inspection of the footing subgrades by the geotechnical engineer or a representative prior to concrete placement is advisable.

Slab on grade
The slabs can be supported on-grade on either competent LIMESTONE or approved engineered fill with the upper 12 inches compacted to the materials' Maximum Dry Density (ASTM DI557).

A modulus of subgrade reaction of 250 lb/in^3 can be used for design of the slab-on-grade.

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The use of the full passive pressure should be done with caution as significant wall movements are necessary to mobilize the full passive resisting force. Also, any excavations for permanent utility installations performed in front of the retaining walls (i.e. on the passive soil resisting side) would prevent the use of passive pressures as utility damage would likely occur with excessive movement.

For unyielding walls (i.e. restrained retaining walls), an at-rest earth pressure coefficient of 0.5 should be used.

Relief of hydrostatic pressures by placement of appropriate drainage measures behind the walls should be provided if water pressure is not included in the design of the walls.

Care should be exercised when placing fill and performing compaction in proximity to retaining walls. Fill compaction in proximity to the walls should be performed with small vibratory plates and to at least 92% of the material's Maximum Dry Density (ASTM D1557).

Underground Utilities

All utilities should be installed per the Civil Engineer's design drawings and specifications as well as the manufacturer's recommendations. When backfilling over utility lines, the approved fill should be placed in maximum 12-in thick lifts compacted to at least 95% of the material's Maximum Dry Density (ASTM D 1557)

LIMITATIONS

Information on subsurface profile, groundwater level and Limestone strength represent conditions encountered only at the locations indicated and at the time of the exploration. If different conditions are encountered during construction, they should be immediately brought to our attention for evaluation as they may affect our recommendations.

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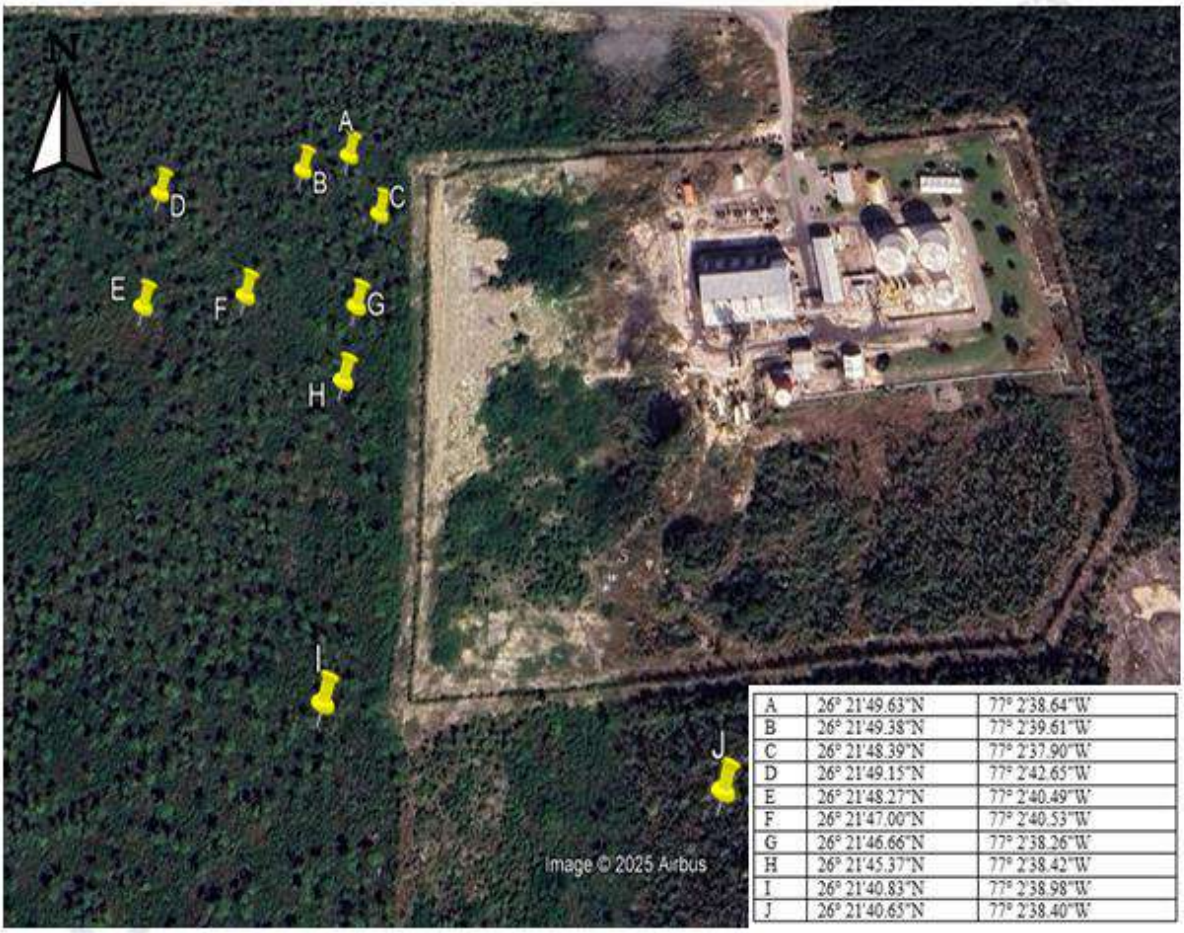
Test Pit Location



A	26° 21'49.63"N	77° 2'38.64"W
B	26° 21'49.38"N	77° 2'39.61"W
C	26° 21'48.39"N	77° 2'37.90"W
D	26° 21'49.15"N	77° 2'42.65"W
E	26° 21'48.27"N	77° 2'40.49"W
F	26° 21'47.00"N	77° 2'40.53"W
G	26° 21'46.66"N	77° 2'38.26"W
H	26° 21'45.37"N	77° 2'38.42"W
I	26° 21'40.83"N	77° 2'38.98"W
J	26° 21'40.65"N	77° 2'38.40"W

CERTIFIED TESTING LABORATORIES INTERNATIONAL
New Providence, Nassau

TEST PIT LOCATION
BPL Wilson City
Abaco, The Bahamas

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#313 BAILLOU HILL RD. P.O. BOX N-1813 PHONE 242-698-5204
EMAIL: certifiedtestinglabsbahamas@outlook.com

Certified Testing Laboratories International
#313 Baillou Hill Road
P.O. Box N1813
Nassau, Bahamas
Tel: (242) 698-5204

BPL Wilson City, Abaco

Core Location	Test Date	Cross Sectional Area of Core	Weight of Core (LBS)	Density of Core (PCF)	Max Load (LBS)	KSF	DIAMETER (In)	HEIGHT (IN)	PSI
A	1/14/2025	11.790	7.980	135.795	8790	107.36	3.875	7.50	745.55
B	1/14/2025	11.790	4.700	80.789	3040	37.13	3.875	7.00	257.85
C	1/14/2025	11.790	5.200	89.384	5800	70.84	3.875	6.00	491.94
D	1/14/2025	11.790	7.500	128.919	7490	91.48	3.875	7.00	635.28
E	1/14/2025	11.790	6.000	103.135	5650	69.01	3.875	7.00	479.22
F	1/14/2025	11.790	3.400	58.443	5405	66.02	3.875	3.00	458.44
G	1/14/2025	11.790	3.250	55.865	8025	98.02	3.875	3.00	680.66
H	1/14/2025	11.790	6.500	111.730	4340	53.01	3.875	7.00	368.11
I	1/14/2025	11.750	4.800	82.508	2100	25.74	3.875	5.50	178.72
J	1/14/2025	11.750	5.150	88.525	1675	22.98	3.875	5.00	159.57

Prepared By: L.Harris

Appendix – C: Hydrogeological Reference Data

ADDITIONAL HYDROGEOLOGICAL REFERENCE DATA

The rapid assessment aims to identify the potential impact to the island and surrounding coastal zone, either due to the natural (climatic) or construction (development) effects. Other environmental protection and mitigation measures are to also be detailed, per guidance of typical Environmental Impact Assessment | Environmental Management Plan (EIA/EMP). All site plans and maps to be referenced within the EIA/EMP documents.

GEOLOGICAL DATA REVIEW – THE BAHAMAS

The geology of the area is comprised of "Karst" (or soluble limestone / carbonate / evaporite) geologic features. In karst areas, the groundwater and surface water are highly interconnected - all aquatic coastal karst basins are open-systems with subterranean connection to the ocean, unless otherwise empirically proven in individual cases.

Topographically, the islands of The Bahamas are typically flat with elevations of less than 32-feet (9.75-meter). 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 Bahamas. The islands are usually long and narrow oriented from northwest to southeast with central ridges extending to a maximum height of 200-feet (60.96-meter).

Typical geological conditions prevail, where there is "late Holocene carbonate deposition and sea-level effects on development and spatial distribution of coastal environments. Three lithofacies occur here, as elsewhere in the Bahamas, and represent foreshore, backshore, and dune environments. Progradational beach-ridge strandplains, composed of eolian rather than wave-formed ridges, are common and are particularly well developed throughout the region." [Proceedings of the 16th Symposium on the Geology of the Bahamas & Other Carbonate Regions: San Salvador, Gerace Research Centre (Reprint), 'Origin of Late Holocene Strandplains in the Southern Exuma Islands, Bahamas: Progradation, Ephermeral Highstands, and Storminess', M. Savarese + H. Allen Curran, 2016]

Wilson City, Great Abaco | Hatchet Bay, Eleuthera

Typically, the site(s) geology consists of sandy soil conditions with a 'weathered to fractured hard limestone' rock subsurface, and further suggest that recharge of any freshwater resources is very limited. Site geological features further suggest that rainfall is quickly lost as runoff, due to combined elevation / general hard natural limestone surface / the sandy coastal erosion conditions of the landform.

CTLI Geotechnical Test Pits [@ 8 to 10-Total/Site], excavated to 15Feet (on Abaco) and 10Feet (on Eleuthera) in January-2025 reveal:

For Wilson City, Abaco – "Land parcel to the North has the largest bearing capacity. Average of 445.34-psi, Maximum of 745.55-psi (@ Test Pit 'A'), Minimum of 159.57-psi (@ 'J'); all with a Core Sectional Area of 11.75" **For Hatchet Bay, Eleuthera –** Bearing capacities range from 754.45 to 969.04-psi (varied depths to 10Ft). CTLI determined that "the dimension of foundation elements are expected to be controlled by providing adequate dead weight to resist wind pressures, the net bearing pressure under dead and live load is expected to be relatively

1 OF 8

Site Geotechnical Assessments by Certified Testing Laboratories International (CTLI), Bahamas.
Site Hydrological Assessments by AEES Consulting Group, LLC (AEES), Florida | Georgia

ADDITIONAL HYDROGEOLOGICAL REFERENCE DATA

low. Therefore, we recommend to design the footings using a maximum allowable bearing pressure of 6,000 lb/ft2 and sliding coefficient of 0.35 (0-4 if bearing on LIMESTONE) after completion of a site preparation as recommended" Source: CTLI – Bahamas, Hatchet Bay Eleuthera | Wilson City Abaco Geotechnical Reports, March 2025.

TEST PIT LOCATIONS
WILSON CITY, ABACO

Certified Testing Laboratories International

Test Pit Location

A	26° 21' 49.61"N	77° 2' 38.64"W
B	26° 21' 49.38"N	77° 2' 39.61"W
C	26° 21' 48.39"N	77° 2' 41.60"W
D	26° 21' 49.11"N	77° 2' 42.63"W
E	26° 21' 48.41"N	77° 2' 40.49"W
F	26° 21' 47.80"N	77° 2' 40.53"W
G	26° 21' 46.66"N	77° 2' 38.24"W
H	26° 21' 45.31"N	77° 2' 38.42"W
I	26° 21' 40.83"N	77° 2' 38.98"W
J	26° 21' 40.83"N	77° 2' 38.40"W

CERTIFIED TESTING LABORATORIES INTERNATIONAL
New Providence, Nassau

TEST PIT LOCATION
BPL Wilson City
Abaco, The Bahamas

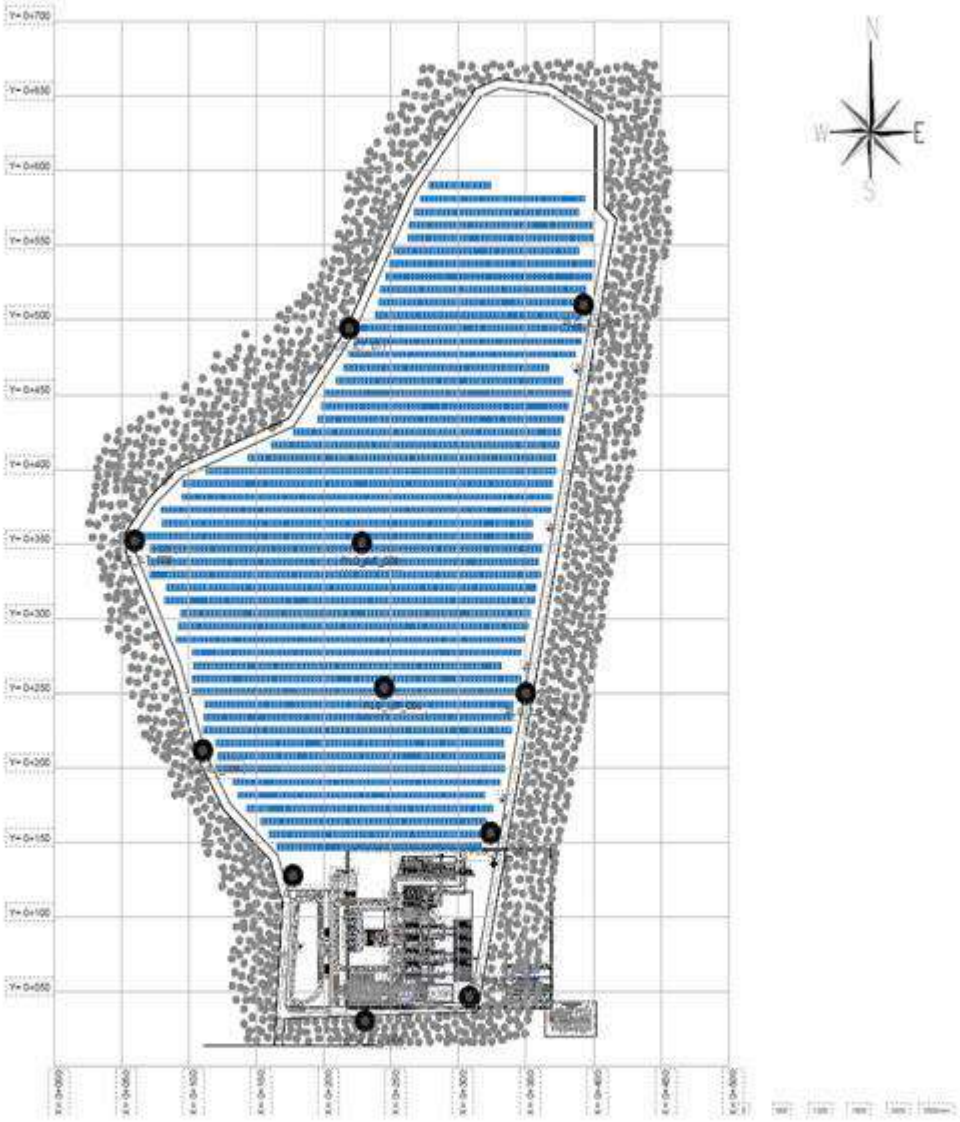
Geotechnical Engineering Exploration Report: BPL Wilson City in Abaco, Bahamas Page 11 of 12

2 OF 8

Site Geotechnical Assessments by Certified Testing Laboratories International (CTLI), Bahamas.
Site Hydrological Assessments by AEES Consulting Group, LLC (AEES), Florida | Georgia

ADDITIONAL HYDROGEOLOGICAL REFERENCE DATA

TEST PIT LOCATIONS
HATCHET BAY, ELEUTHERA



3 OF 8

Site Geotechnical Assessments by Certified Testing Laboratories International (CTLI), Bahamas.
Site Hydrological Assessments by AEES Consulting Group, LLC (AEES), Florida | Georgia

ADDITIONAL HYDROGEOLOGICAL REFERENCE DATA

HYDRO-GEOLOGICAL ASSESSMENT (TYPICAL FOR BOTH RIDGE SITES)

The physical baseline aspects for the hydrology/hydrogeology includes water resources, surface water, drainage, and any flood prone areas. A site hydrogeological (with geotechnical test pits conducted by CTLI) | water resources review (by AEES) was conducted to evaluate information & data achieves. Further assessment made for the limits of any possible freshwater lens, note any existing hydro-geological features, and also to determine influences between the landform and the marine environment.

Existing potential contamination of the upper soils and groundwater is a concern for both solar sites (on Abaco and Eleuthera), as both are adjacent to 'in service' generation facilities (operated by BPL). Additional hydrological (pump test) / geological (well drill logs) / water quality assessment(s) may be required for each of the BPL generation facilities.

The sites are elevated, so flooding is not particularly a concern. There is a relatively loose 3 to 5-inch top soil layer with underlying hard limestone. While low to medium porosity of the moderately dense limestone may not result in quick drainage; the typical karst geologic features (blue hole, caves, depressions, and solution features) all assist with the subsurface transit of flows. These voids/porous areas can serve for rapid movement of any surface water & contaminants into the subsurface. At site, there is rapid infiltration of surface water which results in the absence of surface streams and other permanent erosional features like channels.

Per geological test pits (by CTLI), the water table @ the Abaco site is 12 to 15Ft below ground level (bgl). The groundwater levels @ the Eleuthera site are >15Ft bgl. Given the permeability of the thin soils, underlying parent rock strata, and the general close proximity (<50Ft) of the aquifer to the land surface - the groundwater resources can be threatened by pollution from anthropogenic activities, such as industrial and urban runoff that affect the overall quality of the aquifer.

Specific threats to groundwater quality may include:

- Over-abstraction of groundwater (fresh-brackish supply, or saltwater chiller wells).
- Physical disturbance: This threat is caused by salt water invading areas, which were previously fresh through the construction of marinas, canals, waterways which are connected to the sea, by other pollution sources via subsurface connections.
- Point-source pollution: This category includes specific incidents or local sources of pollution - such as oil spills, generation facilities, leaks from underground storage tanks at gas stations, engineering workshops, chemical spills, etc.
- Solid waste disposal sites leachates / runoff.
- Disposal wells: This category includes pollution from disposal or drainage wells which have been poorly constructed, incorrectly sited, or not drilled to sufficient disposal depths (>100Ft bgl).
- Septic tanks: Pollution from septic tanks, cesspits and latrines which have been improperly constructed, built in the wrong place (e.g., below the water table), not emptied often enough, or not equipped with an accompanying disposal well.

4 OF 8

Site Geotechnical Assessments by Certified Testing Laboratories International (CTLI), Bahamas.
Site Hydrological Assessments by AEES Consulting Group, LLC (AEES), Florida | Georgia

ADDITIONAL HYDROGEOLOGICAL REFERENCE DATA

ADDITIONAL HYDROGEOLOGICAL FOR ABACO
ASSESSMENT FOR BEC WILSON CITY POWER PLANT (WSC-WRMU, 2008)

"Based on my combined review of the driller logs, geophysical (gamma) log, and pump test data: Confident that a consistent relative clean/cool source of water up to 800-USGPM is achievable from cavernous zones between 300 to 450-Ft below ground level (BGL), with minimal drawdown on the lens."

"Regarding supply and reinject for chiller water use (only). Suggested supply depth of 480 to 500-FT BGL, cased to 380-FT (+/- 20-FT). Suggested reinject depth of 350 to 400-FT BGL, cased to 250-FT (+/- 20-FT). Abstraction/Injection zone of 50 to 100-FT BGL per well, based on final size of casing. A minimum horizontal separation of 100-FT between any wells recommended. Minimal vertical separation of 20-FT is recommended between the supply and reinjection wells. This vertical separation can be larger, based on the temperature of the reinjected water. Be advised that the recommended "shallow" reinjection depth is "only" for return from the chiller and not any effluent sources."

"Note: Recommendations based solely on given hydrological and geophysical data. No knowledge of water requirements or the specifications of proposed generation facility. Assumed that appropriate water temperature and not quality is desired for cooling purposes."

Source: John Bowleg – Hydrologist, WSC Water Resources Management Unit (WRMU), WRMU Memo to WESA, Inc (Canada), Hydrogeological Data Review, Aug-2008

WATER SUPPLY WELL RECOMMENDATIONS FOR DESIGN,
TESTING AND USE OF WELLS @ WILSON CITY POWER PLANT (JULY-2008)

Wells providing fresh water supply will be drilled, instrumented and tested on the site. The well has to provide a long-term source of fresh water. The design of well and its operational regime should prevent the up-coning of saline water, encountered in the deeper aquifer.

The following recommendations are proposed to provide a long-term fresh water supply for the power plant:

- 10" diameter open hole well will be drilled on site. Top 15' will be reamed to the diameter 15", 10" PVC Schedule 40 casing will be installed and grouted to provide the protection from surface impact.
- The depth of well would be 20', thus providing approximately 7' water column in the well. Water table was encountered at 13'.

5 OF 8

Site Geotechnical Assessments by Certified Testing Laboratories International (CTLI), Bahamas.
Site Hydrological Assessments by AEES Consulting Group, LLC (AEES), Florida | Georgia

ADDITIONAL HYDROGEOLOGICAL REFERENCE DATA

- Saline water was encountered on site at the depth of approximately 35' at well 'A' location.
- The location of the well will consider the location of an administrative building and location of power plant and tank farm. It is recommended to locate water supply well upgradient of the facility, to prevent the impact from potential oil spill. Assumed groundwater flow direction is toward southeast.
- Submersible pump with the pumping rate of 2 USGPM is proposed to be used for the operational period. Low-rate pumping should minimize the drawdown in the well and prevent the up-coning of the saline water at that location. Use of water storage tank is recommended.
- It is noted that drawdown in the well should never exceed 0.11 m (4.5").
- 6-hour pumping test is proposed to simulate long term use of water supply well. Pumping rate would be 2 USGPM.
- Proposed design of water supply well is attached.

Fresh water aquifer protection is paramount during the construction and operation of a power plant. Proposed design of water supply well and recommendations for the operation are aimed to minimize the impact on the fresh water aquifer.

Source: John Bowleg – Hydrologist, WSC Water Resources Management Unit (WRMU), WRMU Email exchanges with WESA, Inc (Canada) – Engineering Consultants, Per Hydrogeological Data Review, Aug-2008

All hydrogeological recommendations from 2008 for the BEC/BPL Wilson City Power Generation Facility are relevant to date for the Wilson City, Abaco Area. Comparably, the concerns for Wilson City - Abaco are also relevant to Hatchet Bay - Eleuthera (w/ exception of depth to water & water quality at each site). At Hatchet Bay, freshwater is not as readily available from the groundwater resources as they exist on the island of Abaco. Regardless, due care is required for any major abstraction of groundwater on Eleuthera (weather fresh, brackish, or salt).

Generally regarding total site stability: "(The Bahamas) earthquake hazard is classified as very low according to the information that is currently available. This means that there is less than a 2% chance of potentially-damaging earthquake shaking in your project area in the next 50 years. Based on this information, the impact of earthquake need not be considered in different phases of the project, in particular during design and construction." Source: https://thinkhazard.org/en/report/20-the-bahamas/EQ#:

Likened to all previous solarization projects (direct reference to the 2020 unicef | Water Mission Abaco Sunny Waters Project following Hurricane Dorian in 2019): clearing of vegetation should generally be kept to a minimum for both sites. {see the attached communication between unicef | Water Mission & WSC-WRMU Sr. Hydrologist, from 2/4/2020}

6 OF 8

Site Geotechnical Assessments by Certified Testing Laboratories International (CTLI), Bahamas.
Site Hydrological Assessments by AEES Consulting Group, LLC (AEES), Florida | Georgia

ADDITIONAL HYDROGEOLOGICAL REFERENCE DATA

Wilson City Power Plant

Well Logs

Hole A

0 - 40' - white, beige limestone, porous, with shell fragments up to 6 mm, moderate to weak. Cavities encountered at 27', 29', between 33' and 40'.

41' – 44' - layer of compact limestone, strong.

44' - 50' - white, beige limestone, porous, with shell fragments, moderate to weak. Cavities encountered at 27', 29', between 33' and 40'.
50' - 75' - brown-beige limestone, compact, strong.
75' - 174' - white, beige limestone, porous, moderate to weak. Cavities encountered between 94' and 100'.
174' – 180'- layer of white compact limestone, strong.

Hole B

0 - 5' - grey, white compact limestone, strong.
5' - 50' - white, beige limestone, porous, with shell fragments, moderate to weak Cavities encountered between 17' and 19', between 45' and 47'.
50' - 85' - more compact white limestone, moderate to strong.
85' - 205' - beige, white limestone, porous, weak to very weak.
205' - 250' - white limestone, competent, strong.
250 - 315' - beige, white, porous limestone, moderate to weak.
315' – 330' - yellow-brown, light brown limestone (dolomite) with cavities up to 1 mm, fragments of shells. Cavity at 327'.
330' – 380' – beige, light brown limestone with cavities, moderate to weak
380' – 385' – layer of compact limestone, strong
385' – 460' – beige, light brown limestone, moderate to weak. Below 400' abundant cavities encountered.

Source: John Bowleg – Hydrologist, WSC Water Resources Management Unit (WRMU), WRMU Email exchanges with WESA, Inc (Canada) – Engineering Consultants, Per Hydrogeological Data Review, Aug-2008

7 OF 8

Site Geotechnical Assessments by Certified Testing Laboratories International (CTLI), Bahamas.
Site Hydrological Assessments by AEES Consulting Group, LLC (AEES), Florida | Georgia

unite for children

unicef

2/4/2020

To:
Mr J. Bowleg
Senior Hydrologist
Water Resources Unit – Bahamas Water and Sewerage Corporation
#87 Thompson Blvd, Nassau, The Bahamas

Title: Abaco Sunny Waters - Request for clearing of forest area within the Abaco WSC Wellfield Area for the installation of solar fields

Attachments: A. Solar Site – Primary Wellfield
B. Solar Site – Pump Station

Dear Mr. J. Bowleg,

This is a letter to request the clearing of forest area within the Abaco WSC Wellfield Area for the implementation of Abaco Sunny Waters.

Abaco Sunny Waters is a solarization project to transform Abaco's water systems, damaged by Hurricane Dorian, and build back better in order to increase the resilience of the system in the future. The Bahamas now has the opportunity to set a new standard and positive example to the world in terms of building back better, building back resilient and climate proof.

Abaco Sunny Waters is an initiative of WSC, Water Mission and UNICEF. For the implementation of two solar fields, one at WSCs primary wellfield and one at WSCs pump station, forest land which lies within WSCs Wellfield Area is requested to be cleared. At the primary wellfield, a square footage of 30,000 ft^2 is required to be cleared for a solar site and at the pump station a square footage of 18,000 ft^2 is required to be cleared. Combined, this amounts to a square footage of 48,000 ft^2. In the attachment the exact locations are shown.

Should any further information be required, please do not hesitate to contact me.

Sincerely,

Marij Zwart
WASH Coordinator Bahamas
UNICEF

mzwart@unicef.org / +31 616296539 / +1 (242) 808 9325

unite for children

unicef


150'
200'
FENCING
(align eastern edge to service road)
GENERATOR BUILDING
SOLAR ARRAY
Solar Site | Primary Well Field
Marsh Harbour Pumping Station Solarization
Marsh Harbour, Abaco, Bahamas
1 of 1
water mission


150'
120'
FENCING
SOLAR ARRAY
Solar Site | Pump Station
Marsh Harbour Pumping Station Solarization
Marsh Harbour, Abaco, Bahamas
1 of 1
water mission

Appendix – D: CV of Environmental Consultant

CV - STATEMENT OF QUALIFICATIONS

Name: **Craig Christopher Russell**
B.Sc. (Hons), MRRP, MBSE, CIPM, FAAPM, FIMMM

Date of Birth: 24th April 1964

PRESENT EMPLOYMENT

2022 to present

Title: Managing Principal and Lead Environmental Consultant – Russell Craig and Associates Ltd (RCA)

- Business development
- Staff recruitment and training
- Delivery of client services
  - Environmental policy and legislation review
  - Environmental Impact Assessment
  - Environmental Baseline Assessment
  - Environmental Management Plan
  - Environmental Monitoring
  - Benthic and Bathymetric Surveys
  - Project Management, Advisory & Facilitation
  - Natural Resource Planning and Assessment
  - Forest Management and Inventory
  - Urban and Regional Planning
  - Land Use Planning
  - Trees Assessment and Valuations/Appraisals
  - Land Survey and GIS Mapping

EDUCATION:

1994-1995	University of Otago, Dunedin, New Zealand **Professional Master's degree in Regional and Resource Planning (MRRP.)**
1989-1992	Bangor University, (formerly University of Wales at Bangor), North Wales, United Kingdom. **B.Sc. (Hons.) Forestry and Wood Science**
1986-1988	Cyprus Forestry College, Republic of Cyprus **Diploma & Certificate in Forestry**

LECTURESHIPS, MEMBERSHIP AND ASSOCIATIONS

Past Adjunct Professor in Geography (100 level), Plant Biology (200 level), Comparative Geography of Small Island States (200 level), Environmental Impact Studies (EIA) (400 level) – (School of Environment and Life Sciences), University of the Bahamas (UB).
Past Council Member - Bahamas National Trust.
Past Board Member – Bahamas Public Park and Public Beaches Authority.
Past President (2005/06) – Rotary Club of New Providence – The Commonwealth of the Bahamas.

Paul Harris Fellow – Rotary International.
Member, Bahamas Society of Engineers (MBSE)
FELLOW Member: (FIMMM) – Institute of Materials, Mining and Minerals, UK
Certified International Project Management (CIPM)
Fellow, American Association of Project Management (FAAPM).

ONGOING CONSULTANCIES

- Land Use Planning Consultancy - GEF Pine Island Project, Department of Environmental Planning and Protection (DEPP), Ministry of the Environment and Natural Resources (2023 – present).
- Local Environmental Consultant Liaison for the Environmental Defense Fund (EDF) US based NGO in the Bahamas (2023 – present)
- Environmental Consultant – Cat Island Water and Road Improvement Project, Water and Sewerage Corporation (WSC - CDB), Cat ISLAND Development Company (CIDC Contractors).

Previous Employment History:

2010 – 2022 - **Director of Forestry** – Ministry of the Environment and Natural Resources

- Director and administrative head of the Forestry Unit.
- Provide technical advice to the Minister and Permanent Secretary on Forestry and Environmental matters.

2009 – 2010 - **Deputy Permanent Secretary** – Ministry of the Environment

- Assist the Minister of State for the Environment with portfolio responsibilities (i.e., policy matters relating to the management of Bahamas Electricity Corporation and Water and Sewerage Corporation)

2003 – 2009 - **Chief Housing Officer** – Department of Housing (Ministry of Housing and National Insurance).

- Administrative Head of the Department of Housing, managing the Government's affordable housing program.

1982 – 2003 **Trainee Surveyor, Assistant Forest Officer, Forest Officer, Senior Forest Officer** - Department of Lands and Surveys, Office of the Prime Minister

PUBLICATIONS, ARTICLES AND DISSERTATIONS

- Russell, Christopher. The Conservation of Biodiversity in the Natural Pine Forest of the Bahamas. *El Pitre – Journal of the Caribbean Ornithology Society.* 1993.
- Russell, Christopher. *Country Report on Forest Policy in the Bahamas.* Consultancy Report, GCP/RLA/132/EC TF No. 64335, FAO, Rome, Italy. 1997.
- Russell, Christopher. The Future of Forestry in the Bahamas. *Bahamas Journal of Science.* Volume 5, Number 3. June 1998.
- Russell, Christopher. *Forestry Policies in the Caribbean, Volume – 1: Proceedings of the Expert Consultation.* Contributing Consultant. FAO, Rome, Italy. 1998.
- Russell, Christopher. *Forestry Policies in the Caribbean – Volume – 2: Reports of 28 selected Countries and Territories.* Contributing Consultant. FAO, Rome, Italy. 1998.
- Russell, Christopher. *Bahamas Country Report: Forestry Outlook Study for the Caribbean.* FAO, Rome, Italy. 30pp. 2000.
- Russell, Christopher. *Bahamas Country Report: The use of Forest for Ecotourism.* Caribbean Regional Workshop on Forest for Ecotourism, FAO, Castries, St. Lucia, May 2003.
- Russell, Christopher. *Position Paper on Forestry Development in the Commonwealth of the Bahamas.* Department of Lands and Surveys, Office of the Prime Minister. Nassau Bahamas. 2007
- Russell, Christopher. *The Status of Forestry Development in the Commonwealth of the Bahamas.* TNC Pine Rockland Conference: "Rockland Forest in a Changing World", Miami, Florida and Andros Island, Bahamas, February 2008.
- Russell, Christopher, et. al. 2010. *Report on the production of the First Order Existing Land Use and Zoning Maps for the Island of New Providence,* Bahamas. Ministry of the Environment, Nassau Bahamas, 2010.
- Russell, Christopher; Miller, Ingeria; Daniels, Mark. *Cost Benefit Analysis of Casuarina Species Management at Governors Harbour, Eleuthera Island, Bahamas: A Case Study.* Proceedings from MTISAIC Conference. Policies Strategies and Best Practices for Managing Invasive Alien Species (IAS) in the Insular Caribbean, Trinidad and Tobago, 2014.
- Russell, Christopher; Miller, Ingeria. *Post Hurricane Dorian impact on the pine forest resources of Abaco and Grand Bahama Islands: A Rapid Resource Assessment Report.* Forestry Unit, Ministry of the Environment and Housing, Nassau, Bahamas. 2019.

- Russell, Christopher. *The Impact of Hurricane Dorian on the pine forest ecosystem on Abaco and Grand Bahama Islands.* TNC Pine Rockland Working Group Virtual Conference, Miami, Florida, USA, 2020.

- Russell, Christopher; Curry, Andrew; Rodgers, Terrance. *Environmental Baseline Study (EBS) for the Carmichael Village Subdivision,* Carmichael Road, Nassau Bahamas. Department of Housing, Ministry of the Environment and Housing. 2021

- Russell, Christopher; *Environmental Management Plan (EMP) for the Carmichael Village Subdivision,* Carmichael Road, Nassau Bahamas. Department of Housing, Ministry of Transport and Housing. 2022

- Russell, Christopher*; Environmental Baseline Assessment (EBA) for Proposed Paradise Island School Project*, Paradise Island. Atlantis Resort. Nassau Bahamas. 2022.

- Russell, Christopher. *Environmental Impact Assessment (EIA), Ki'ama Bahamas Project,* Elizabeth Island, Gt. Exuma Island. EcoIsland Elizabeth Ltd. 2022

- Russell, Christopher. *Environmental Management Plan (EMP). Ki'ama Bahamas Project,* Elizabeth Island, Gt. Exuma Island. EcoIsland Elizabeth Ltd, 2023

- Russell, Christopher. *Environmental Impact Assessment (EIA) for Goldwynn Penthouses – II Project*, Cable Beach, Nassau Bahamas. 2024.

- Russell, Christopher. *Environmental Management Plan (EMP) for Goldwyn Penthouses – II* Project, Cable Beach, Nassau Bahamas. 2024.

- Russell, Christopher. *Environmental Management Plan (EMP) RUBIS Fuel Tank Installation,* LPIA, Nassau Bahamas. 2024.

- Russell, Christopher, *Environmental Management Plan (EMP) RUBIS Big Game Fuel Station*, Bailey Town, Bimini, Bahamas. 2024

- Russell, Christopher. *Environmental Baseline Assessment (EBA) Pine Crest II Subdivision,* Department of Housing, Ministry of Housing and Urban Renewal. Nassau Bahamas. 2024

- Russell, Christopher. *Environmental Management Plan (EMP). RUBIS Fuel Station,* Mackey & Madeira Streets, Nassau Bahamas, 2024