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Prepared for:
The Ministry of Health and Wellness
Re:
The Bahamas Hospital
Environmental Impact Assessment
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EXECUTIVE SUMMARY

The Bahamas Hospital Project (The Project) is located in central New Providence. The site is located east of the New Providence Highway, west of Ardastra Gardens Estates Subdivision, and north of the Greater Chippingham community. The entire site consists of forest habitat and is relatively flat except for some areas in the southwest that have a high altitude. The property elevation is on average thirty feet (30 ft.) above sea level and there is a gentle upward slope on the south side of the property. The site is approximately fifty and three hundredths' acres (50.03 ac.).

Princess Margret Hospital (PMH) is the country's top public tertiary medical facility; however, PMH's ability to provide services could not meet the demand of the population at a level that would keep pace and maintain international standards. Due to the old equipment and facilities, renovation of PMH is required. There was a call for expansion to support maternal & infant and child services; a pre- and postpartum inpatient unit with nursery services; a special care baby unit and a pediatrics unit. Additionally, more space was required for laboratory services; diagnostic and interventional imaging services; the capacity to support day surgeries and minor procedures; and the capacity for intensive care units to support maternal and child health services. The property in which PMH currently sits has limited space for expansion therefore additional solutions were sort out.

The Ministry of Health and Wellness (MoHW) proposes to undertake the construction of a state-of-the-art medical facility with green spaces and a five hundred and ten (510)-slot parking lot able to service patients, visitors, and staff. The design of The Project will be based on the existing local industry specifications and standards but will also be guided by internationally accepted standards in areas where the Building Code may not currently cover. Of the fifty and three hundredths acre (50.03ac.) property the total floor area of the proposed Project is thirty-four thousand square meters (34,000 m^2).

Baseline Assessments

The vegetation and avian populations of the site were investigated to record the existing conditions for the proposed area for The Project infrastructure.

Terrestrial assessments conducted show that the site currently consist of one (1) major terrestrial ecosystem which is an Interior Upland ecosystem. There are two (2) vegetation classes on the site, Dry Broadleaf Evergreen Formation-Forest and Human Altered Environment. A total of eighty (80) species were recorded on the site, including fourteen (14) protected species and five (5) invasive species. This is expected of the combination of a relatively old-growth Dry Broadleaf Evergreen Formation-Forest and a Human Altered Environment.

A total of fifteen (15) avian species were recorded during the investigation including eight (8) permanent resident breeding and six (6) winter non-breeding migrant species. All

species observed are protected under the Wild Birds Protection Act of The Commonwealth of The Bahamas, 1952. All species observed are considered of Least Concern by the International Union for Conservation of Nature (IUCN) with the exception of the White crown pigeon (*Patagonias leucocephala*) that is listed as near threatened. No endangered birds were recorded, and five (5) endemic species were observed.

Water quality assessment showcase that the water quality at The Project site can be described as relatively bad and there is cause for concern. Water quality analysis displayed that each parameter tested exceeded the recommended range set in place by the regulatory agencies. A proper water quality management plan is required.

Anticipated Impacts and Mitigations

The anticipated physical impacts to the environment because of construction include groundwater quality, flooding, solid waste, noise pollution, light pollution, dust pollution, land clearing, landscaping, and wildlife. Socioeconomic impacts associated with The Project include traffic, land use, community impacts, job generation, material source and commissioning and utilization of hospital services. Impacts associated with operational phase of The Project include, air pollution, noise pollution, light pollution, electromagnetic pollution, traffic, sewage and waste refuse, solid waste, hazardous waste, terrestrial ecosystem impacts, and groundwater quality.

Long-term negative impacts to the natural resources in the area are not expected to occur because of the proposed construction work. Construction will be closely monitored to prevent contamination of the adjacent terrestrial habitats and disturbances to the nearby communities. Management Plans will detail mitigation measures that must adhered to by the contractor to ensure protection of the environment.

The purpose of The Bahamas Hospital Project Environmental Impact Assessment (EIA) is to assess and document existing conditions of The Project area and the potential impacts associated with the proposed Project. The EIA has been designed to assist with achieving the Health, Safety, Social and Environmental (HSSE) Policy to ensure that all its activities during the construction phase are conducted in a manner that results in minimum adverse impacts to the environment. It details mitigation measures to avoid, negate and minimize or mitigate potential impacts that will be employed by management, staff and subcontractors during construction and operation.

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1.0 INTRODUCTION

1.1 Authorization

This Environmental Impact Assessment (EIA) has been prepared by JSS Consulting LTD. on behalf of the Ministry of Health and Wellness (MoHW) for the proposed The Bahamas Hospital Project, hereafter referred to as 'The Project". The Project is intended to conform to the standards, legislation and regulations of the Bahamian Government, the Department of Environmental Planning and Protection (DEPP) and relative international communities.

1.2 Purpose and Objective of the EIA

The purpose of EIA is to assess and document existing conditions of The Project area and the potential impacts associated with the proposed Project. It provides recommendations to avoid, negate and minimize or mitigate potential impacts during construction and/or operational phases of The Project. This report will address factors that influence the development of The Project in this location including:

- Site conditions,
- Development designs,
- Existing terrestrial resources,
- Description of impacts and mitigations measures,
- Environmental Management Plan,
- Socio-Economic analysis, and
- Conclusions of the overall impacts from construction of the proposed Project.

Specific objectives of the EIA include:

- Prevent harm, damage and loss to personnel, the environment and community assets,
- Reduce to impact to surrounding vegetation types and wildlife,
- Prevention and mitigation of noise, dust and vibration impacts,
- Protection of groundwater resources,
- Minimize waste production and ensure correct waste management on site,
- Adhere to all environmental laws and regulations,
- Actively promote an environmentally responsible approach to The Project activities amongst the entire workforce,
- Involve and commit The Project Management as well as each employee to The Project,
- Maintain health and safety standards on site,
- Ensure Sub-contractors/Suppliers/Visitors apply the same or equivalent environmental practices as those defined by Employer and Contractor, and
- Document the existing biological environment of the site.

1.3 Scope of The Project

The Project consists of the development of a state-of-the-art medical facility with a green space and five hundred and ten (510) parking spaces. The construction of the new facility will facilitate an increase in efficiency and efficacy of the tertiary-level healthcare facilities across the country by:

- Maximizing the impact of clinical and other specialists in women's health and child health services;
- Increasing the number of beds at the specialty hospital to address the issues of chronic oversubscription of the services for women and children;
- Increase the number of accredited research facilities and teaching hospital facilities in-country;
- Expand treatment and management modalities available to female and paediatric populations, in the first instance through establishing facilities where minor procedures and same-day surgeries can be provided;
- Introducing new facilities where newer diagnostic and interventional imaging services can be provided to the Bahamian public; and
- Providing a location where the delivery of telemedicine services to remote primary care facilities can be supported.

The expansion of the public health tertiary-level healthcare infrastructure inventory is based on the overall strategy to strengthen the integrated delivery of healthcare services to maximize quality, efficiency, and safety. The construction of The Project is expected to take thirty-six (36) months to complete. This includes eight (8) months for design approval, and twenty-eight (28) months for construction and installation, excluding defect liability period.

2.0 PROJECT JUSTIFICATION

More than twenty (20) years ago MoHW created the Dorsett Report (1999) which reviewed the suitability of the Princess Margret Hospital (PMH) as the premier public tertiary-level healthcare provider to meet the existing and projected demands of the Bahamian population. The report concluded that in 1999, the hospital ability to provide services could not meet the demand of the population at a level that would keep pace and maintain international standards. Due to the old equipment and facilities, renovations of PMH were required. It was recommended that renovation occur in three phases.

It was stated that the existing PMH site is limited and to construct a new building on the existing site would decrease the functionality of the entire hospital in terms of traffic flow, parking, internal circulation, and other factors. The relationships between departments in the hospital would also be compromised. This still holds true today.

The first phase of renovation was determined to occur at the existing PMH site and it was during this time that it was determined a greenfield site was needed for further expansion. There was a call for the expansion of services to support maternal, infant and child services; a pre- and post-partum inpatient unit with nursery services; a special care baby unit and a paediatrics unit. Additionally, more space was required for laboratory services; diagnostic and interventional imaging services; the capacity to support day surgeries and minor procedures and the capacity for intensive care units to support maternal and child health services.

The maternal mortality rates and child mortality rates are less than optimal in PMH and do not reflect the funds invested in assuring optimal healthcare; therefore, the Government of The Bahamas has determined that not only the quality of healthcare should be addressed but the facility in which the care is provided. The Project will be the first medical facility that will concentrate on women and children. The new hospital will incorporate infection prevention and control measures to ensure safe spaces for the admission, treatment and management of women and children, including new-borns, while also providing an opportunity to expand the scope and types of ancillary services to support the management of these patients and the wider community.

The location and development of The Project will position a tertiary hospital closer to larger population centres of New Providence, minimises disruption of existing hospital services at the PMH, introduce designs that will promote a healing environment, enhance the quality of service and efficiency of operations, offer ample parking, remove the challenges associated with navigating the traffic congestion of downtown and increase the ability to introduce inpatient room designs that can improve patient safety, experience and privacy.

The increase in capacity to deliver quality health services at the primary, secondary and tertiary levels of care was highlighted by the 2020 COVID-19 Epidemic and the devastation caused by Hurricane Dorian in 2019. PMH has a capacity of 402 beds and although recent renovations have helped to meet the local medical needs of the population, the expansion of clinical spaces has been outpaced by the need for tertiary health services in the country. The current footprint of PMH and available surrounding properties cannot support expansion required to meet demands.

According to the Ministry's plan, the construction of The Project will increase the capacity at PMH to manage adult and geriatric ward services. The need for the new hospital is based on:

- The present and forecasted trends for the epidemiological profile, especially with regard to maternal mortality and infant mortality ratios and service coverage metrics.
- The current limitations to the expansion of the infrastructure of PMH as the premier public tertiary hospital centre.

- The challenge for physical space at PMH to appropriately allocate hospital resources that support specific women and child health conditions.
- The need to increase the supply of health resources for women (including maternal) and child health care and for the improvement of the health of the population of The Bahamas.

3.0 ENVIRONMENTAL LAWS, REGULATIONS AND REQUIREMENTS OF THE BAHAMAS

The Owner and Contractor will be required to utilize accepted regulatory standards as a minimum to protect the environment, the health and safety of all personnel (Contractor, Sub-contractors and third parties) working on The Project, and any others who may be affected by The Project activities.

3.1 National Environmental Codes and Regulations Applicable to The Bahamas

Construction of The Project must comply with a range of national legislation, regulations, strategies and policies in order to provide for the management of environmental effects. There are fifteen (15) legislations that are relevant and applicable to the management of the physical and natural environment of the proposed Project as outlined in Table 1.

Table 1: National Environmental Laws in The Bahamas

Act Title	**Year Enact**	**Comments**
Water & Sewerage Corporation Act	1976	Provides regulatory framework for the management of water resources in The Bahamas.
Environmental Health Services Act	1987	Provides the framework for environmental regulations that will ensure compliance for The Project. The Act authorized the Department of Health Services (DEHS) to develop regulations that prevent and control air pollution, soil contamination and preserve water quality.
Wild Animals Protection Act	1968	Prohibits the taking, capturing or hunting of any animal without a permit.
Wild Birds Protection Act	1952	Prohibits the taking, capturing or hunting of any animal without a permit. Protects birds and eggs during closed season.
Plants Protection Act	1916	Relates to plant disease and controls importation of plants to prevent outbreaks of exotic disease and establishment of unwanted species.

Conservation and Protection of the Physical Landscape of The Bahamas Act	1997	Protects physical landscape from environmental degradation, flooding and removal of hills; regulates filling of wetlands, drainage basins or ponds; prohibits digging or removing sand from beaches and sand dunes; prevents harvesting or removing protected trees. In order to perform activities that may affect the physical landscape of The Bahamas, permits must be obtained for these activities. The Department of Physical Planning issues the permits and enforces the regulations.
Planning and Subdivision Act	2010	This Act provides for: A land use planning-based development control system led by policy, land use designations and zoning. Prevention of indiscriminate division and development of land. Promotion of sustainable development in a healthy natural environment. Maintenance and improvement of the quality of the physical and natural environment. Protection and conservation of the natural and cultural heritage of The Bahamas.
The Forestry Act	2010	Protects wetlands, water reserves, endemic flora and fauna and protected trees. It establishes a legal framework for the long-term sustainable management of forests, a governmental forestry agency and a permanent forest estate. It requires a license for timber cutting and other activities in the Forest Reserves. The Act mandates that a National Forest Plan be developed every five years to govern management activities, such as harvesting and reforestation measures, prescriptions for fire prevention, wildfire suppression and prescribed burning and soil and water conservation.
The Private Roads and Subdivision Act	1961	This Act enables the Department of Physical Planning to regulate road construction and subdivision development.
Disaster Preparedness Response Act	2006	This Act provides for a more effective organization of the mitigation of, preparedness for, response to and recovery from emergencies and disasters.
The Ministry of the Environment Act	2019	This Act establishes the Ministry of the Environment to oversee the integrity of the environment of The Bahamas, to make the minister responsible therefore a corporation sole, to establish the environmental administration fund and the environmental trust fund and for matters connected thereto.

The Environmental Protection (control of plastic pollution) Act	2019	This Act prohibits single use plastic food ware and non-biodegradable and biodegradable single use plastic bags. Prohibit the release of balloons; regulate the use of compostable single use plastic bags and for connected matters.
The Environmental Planning and Protection Bill	2019	The Act provides 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. The Bill has been enacted by the Parliament of The Bahamas and if sent to the Gazette during the time of this project the legislation will be enforced.
Environmental Impact Assessment Regulations,	2020	To provide procedures for a Certificate of Environmental Clearance (CEC). The Regulations provide procedures for the review proposed projects inclusive of monitoring and compliance requirements. The Regulations dictate the requirements for a CEC.
Health and Safety at Work Act	2002	This Act makes provisions relating to health and safety at work and for connected purposes. It details the general duties of employers and employees at work.

3.2 National Environmental Policies in The Bahamas

Table 2: List of relevant National Policies in The Bahamas

Relevant National	**Subject**	**Summary**
National Policy for the Adaptation to Climate Change 2005	Climate change assessment for the immediate and project adaptation techniques for The Bahamas	The National Policy for the Adaptation to Climate Change outlines a national framework to meet the goals and objectives of the United Nations Framework Convention on Climate Change (UNFCC). The Bahamas is committed to reduce greenhouse gases and address climate change impacts.
National Invasive Species Strategy for The Bahamas, 2013	Identifies and recommends a management framework for the control and	The National Invasive Species Strategy for The Bahamas originally published in 2003, was updated in 2013 as part of the Global Environment Facility

	eradication of invasive species.	funded project, Mitigating the Threats of Invasive Alien Species in the Insular Caribbean (MITIASIC). It sets forth a management framework for the control and eradication of invasive species.
National Biodiversity Strategy and Action Plan, 1999	A plan to maintain biodiversity through sustainable development for a small island developing nation.	The Bahamas Government is committed to conserve biodiversity and to pursue sustainable development. This document highlights the role of biodiversity in the Bahamian social and environmental context and recommends measures to ensure its compatibility with future development.

3.3 ISO 1400

The ISO 14000 is a set of industry standards that provide practical tools for companies and organizations of all kinds looking to manage their environmental responsibilities.

ISO 14001:2015 and its supporting standards such as ISO 14006:2011 focus on environmental systems to achieve this. The other standards in the family focus on specific approaches such as audits, communications, labelling and life cycle analysis, as well as environmental challenges such as climate change.

3.4 Occupational Safety and Health Administration (OSHA)

In the absence of specific health and safety construction regulations, contractors should adhere to the Occupational Safety and Health Administration (OSHA) regulations. OSHA is an agency of the United States Department of Labour. OSHA's mission is to "assure safe and healthy working conditions for working men and women by setting and enforcing standards and by providing training, outreach, education and assistance". The agency is also charged with enforcing a variety of whistle-blower statutes and regulations. OSHA's workplace safety inspections have been shown to reduce injury rates and injury costs without adverse effects to employment, sales, credit ratings, or firm survival. Regulations such as the use of Personal Protective Equipment (PPE), housekeeping, safety training and education, fall protection and working in confined space etc.

3.5 Government Departments

Government departments that will be involved with aspects of approval and permitting of this Project include:

Department of Environmental Planning and Protection DEPP

The Department of Environmental Planning and Protection (DEPP) will review and approve the Environmental Impact Assessment (EIA) and Environmental Management Plans (EMP) for The Project. Monthly environmental reports will be submitted to DEPP.

Forestry Unit

The Forestry Unit will authorize and provide permits for harvesting and removal of protected trees.

Ministry of Public Works

The Ministry of Public Works will authorize and provide permits for activities and maintain physical infrastructure in the country.

Department of Physical Planning

The Department of Physical Planning will authorize and provide permits for activities such as excavation, filling, roadworks, and all construction activities.

Ministry of Health and Wellness

The Ministry of Health and Wellness (MoHW) will authorize licenses for operation of the facility and supervise the healthcare provided.

4.0 PROJECT DESCRIPTION

4.1 Geographic Description of New Providence, Bahamas

4.1.1 Project Location

The Project site is located in central New Providence, The Bahamas (See Figure 1). New Providence is seven miles (7 mi.) long and twenty-one miles (21 mi.) wide; and approximately three hundred and fifteen miles (315 mi.) from Florida, USA. The site is located east of the New Providence Highway, west of Ardastra Gardens Estates Subdivision, and north of the Greater Chippingham community. The total Project area is fifty and three hundredths' acres (50.03 ac.) (202,464 m^2), and there is sufficient space for future development.

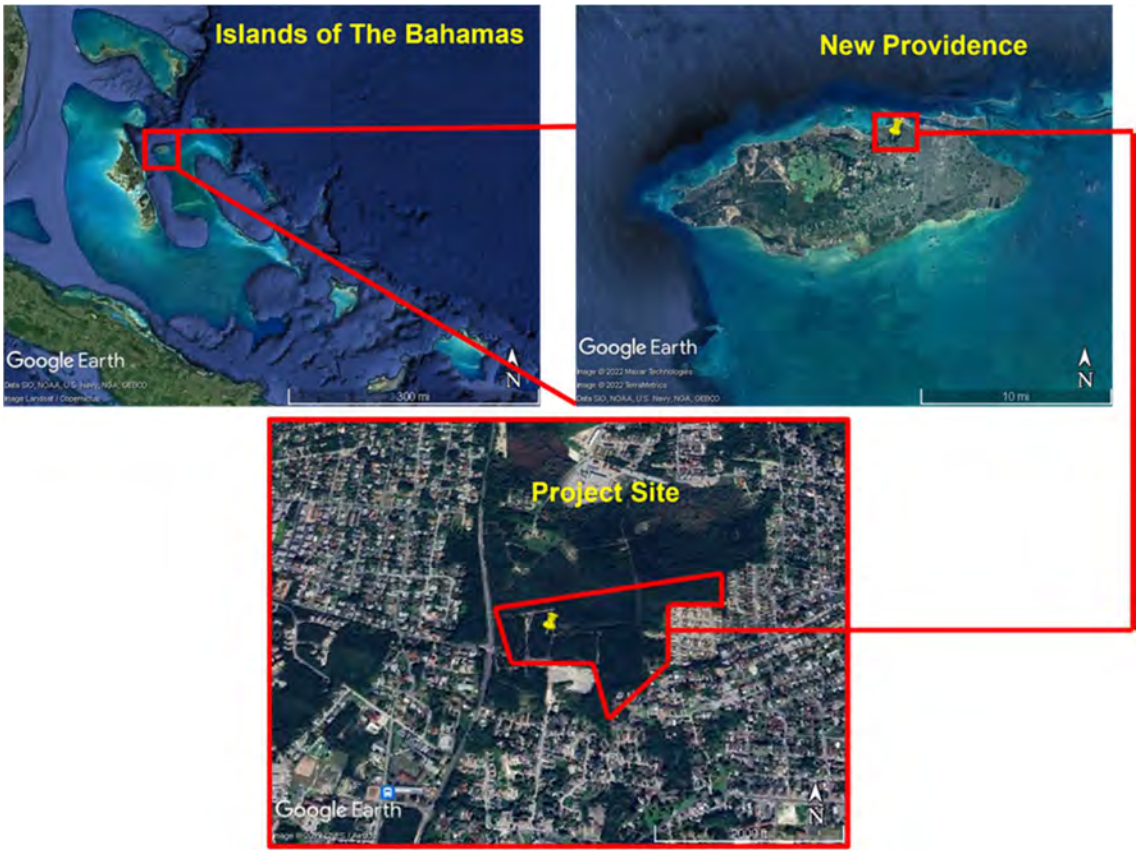


Figure 1: The Bahamas Hospital Location Map

4.1.2 National Park

The Project site is located within a portion of the proposed area for the Perpall Tract National Park. Perpall Tract National Park is one of the proposed protected areas under the Caribbean Challenge Initiative (CCI) "20 by 20" target in 2015. Since then, the park was not gazetted nor has a manging entity been declared. The Proposed Perpall Tract National Park consists of one hundred and seventy-seven acres (177 ac.) of an important interior upland ecosystem. This proposed national park contains a wide variety of native and protected flora and is an important habitat for a large diversity of avian species.

Due to the location of the proposed development, the developer will ensure that the effects of construction and development activities will be minimized through continuous monitoring and ensuring that both staff and site workers adhere to the national environmental laws of The Bahamas. This includes but is not limited to:

- No littering of any domestic, construction or operational waste.
- Wildlife (inclusive of any avian or reptile species) feeding will be strictly prohibited.
- Noise levels shall be consistently monitored and kept to a minimum.
- The removal or destruction of any terrestrial plant species will be strictly prohibited, without a permit by the Forestry Department.

- The removal, harming, or killing of any avian or reptile species will be strictly prohibited.

To further offset the negative impacts from any construction activities, silt fencing will be used to prevent any run-off from construction activities in order to protect the surrounding native vegetation. All construction and operation management plans will be presented to The Department of Planning and Protection (DEPP) for review. This ensures that the management plans align with any future plans and meet the minimum requirements for an establishment existing in a National Park. See section 8.0 for additional mitigation measures that will be enforced to ensure activities will not negatively impact the Proposed Perpall Tract National Park.

Figure 2: Protected Area Map

4.1.3 Climate and Weather

The climate of The Bahamas consists of a tropical maritime wet and dry climate, with occasional winter incursions of modified polar air. As a result, Nassau does not receive frost, sleet, snow, or extreme temperatures. In the month of August, Nassau has recorded temperatures ranging from an average high of 90° F (32° C) to an average low of 77° F (25° C). In January, the average high temperature is 79° F (26° C), and the average low is 65° F (18° C).

Humidity is high all year long in Nassau, usually maintaining around 80% humidity in the summer. Precipitation is highest from May through October. The average annual rainfall

is about 44 inches (1,120 mm), occurring mostly during the summer. The high precipitation values can be attributed to extreme storm events, such as hurricanes and tropical storms. Historically, given the geographical location of The Bahamas archipelago, the islands are subject to regular natural disasters that include hurricanes, storms and cyclones. In addition to this, the low-laying topography of The Bahamas makes the country particularly vulnerable to flooding caused by storm surges and sea level rise.

The Bahamas presents high risk to hurricane hazards with islands in the northern and southern part of the country experiencing more intense winds. This risk is then further increased during the months of August, September and October when there is an increase in temperatures, rainfall patterns and other climatic trends. Throughout the years, storm surges, strong winds and floodings resulting from hurricanes, tropical storms, and heavy rain have led to a number of damaged houses, public buildings, roads, airports, energy and power line, health care facilities, etc., throughout The Bahamas.

It is noted that the proposed site is less likely to impacted by storm surges, strong winds, floods, or other severe weather impacts given the proposed location for The Project. According to *Hurricane City, et al.,* the last major hurricane to make landfall in New Providence over the last ten years was Hurricane Matthew in 2016 (Nassau Bahamas History with Tropical Cyclones, n.d.). Additionally, it was also reported that the current average years between direct major hurricane hits to New Providence is once every 6 years (Nassau Bahamas History with Tropical Cyclones, n.d.); thus, making the site area less likely to receive a direct hit from a major hurricane. Furthermore, the current site area is less likely to suffer impacts from flooding caused by severe weather due to the fact that it is not located within a flood zone.

4.1.4 Geotechnical Study

Certified Testing Laboratories International (CTLI) were employed to complete a Geotechnical Investigation Report (Geotechnical Engineering Exploration Report, Bahamas Hospital Complex, 2023) with the purpose to explore the soil conditions of the purposed site. CTLI's scope included the investigation of the subsurface of The Project site to produce a site description, soil condition profile and geotechnical recommendations and limitations.

The methodology used for the assessment was the Standard Penetration Test (SPT). A total of seven (7) borings were drilled at fifteen feet (15 ft.) deep. Additionally, no borings within the building structure footprint were taken. However, around the building perimeter and other close areas were sampled. In addition to the SPT, eight (8) core samples were taken for further laboratory testing.

The assessment findings were that subsurface profile consisted of approximately six inches (6 in.) of sand, limestone fragments, roots and limestone formation observed at a depth of fifteen feet (15 ft). The laboratory results indicated that the limestone core samples compression strength ranged from fifty to one hundred and fifty-three kilo

pound-force per square foot (50 ksf to 153 ksf). Additional findings indicated that groundwater was explored at seven and two tenths' feet (7.2 ft.) below the surface.

The geotechnical study revealed that the substate can support the proposed multi-level infrastructure on a system of shallow foundations. Alternatively, the proposed structure could be supported on a deep foundation system consisting of Auger Cast in Place (ACIP) piles installed into the limestone.

See Appendix B for full Geotechnical Engineering Exploration Report.

4.2 Proposed Land Development

The Project include the construction of a state-of-the-art medical facility and parking lot. The design of The Project shall be based on the existing local industry specifications and standards but will also be guided by internationally accepted standards in areas where the Building Code may not currently address. The total land area available for The Project is fifty and three hundredths' acres (50.03 ac.). The total floor area of the proposed Project is thirty-four thousand square meters (34,000 m^2). See Appendix A for entire conceptual plan.

Figure 3: The Bahamas Hospital Phase 1 Conceptual Plan

Figure 4: The Bahamas Hospital Phase 2 (Future Development) Conceptual Plan

4.2.1.1 Medical Facility

The design includes a two hundred (200) bed hospital offering acute tertiary care services that will target the provision of services for women and children. The design will reflect an eco-friendly, energy-saving, modern hospital that is integrated with the existing network of healthcare services in the country. The building area shall not exceed fifty percent (50%) of the land area and the height of the building will not exceed six (6) floors.

4.2.1.2 Parking Facilities

The ground parking spaces will meet the basic parking needs of patients, family members and employees. The parking lots will contain five hundred and ten (510) parking slots.

4.2.1.3 Green Space

The green area will be at least thirty five percent (35%) of the land area.

5.0 UTILITIES AND INFRASTRUCTURE

Major Project utility components will be located in a Mechanic Center.

5.1 Electricity

The electrical power for the site will be provided by The Bahamas Power and Light (BPL). Diesel-powered generators will be used to provide back-up power during the operational phase and will be located in the Mechanic Center. Detailed construction plans for the generators and accompanying electrical distribution system will be prepared and submitted to the BPL for review prior to commencement of construction activities.

Design Content

Electrical design mainly includes a power transformation and distribution system, power and fire distribution system, lighting and emergency lighting distribution system, equipment connection and lightning protection grounding system, UPS (Uninterrupted Power Supply) system, automatic fire alarm and control system, etc.

Power Distribution System

The Mechanic Center will house the medium voltage distribution room, the generator room and the substation that will contain the transformers and switch gears.

Two separate medium-voltage services/feeders will be provided from two different distributions and will be operated at the same time. Sectional configuration is adopted. Each medium-voltage power supply can ensure the full load of electricity at the same time.

The trunk electrical distribution system will serve single large capacity load or essential load; others will be served by combined truck & radial electrical distribution system.

The generators will be located in the generator room and will provide emergency power for all load of electricity. Full load emergency generator together with sufficient fuel availability will allow the generator to operate at least seven (7) days continuously. The loads that cannot be interrupted for more than half a second (0.5 sec.) such as the ICU, IT Machine etc., will be powered by UPS.

Epidemic Power Supply

Critical areas such as the Emergency room, ICU, and mortuary, etc.; and machines such as the negative pressure air fan that require electrical power at all times will be powered by a duplicate supply. Generators will be used as the electric source for safety services.

The ultraviolet sterilizing lamps or air disinfection machines should be set up in cleaning corridors, cleaning rooms, toilets, waiting rooms, consulting rooms, treatment rooms, wards, operating rooms, and other places that require sterilization and disinfection. The places where the polycarbonate tube, busway and cable tray, are located should be enclosed.

Energy Conservation Considerations

Energy conservation that will be considered include:

- Lighting of each place designed according to electrical codes, with the potential use of LED lamps and fixtures.
- The power factor for low-voltage side of the transformer and distribution system will be nine tenths' minutes (0.9 min).
- Set up an energy management system.

- Power consumption is measured separately for air conditioning, lighting, etc.
- The lighting system of public areas, such as corridors, hallways, lobbies, large spaces and other places will adopt intelligent control methods and energy-saving controls by using time switches or inductive switches.
- The design of outdoor lighting should meet the requirements of controlling light pollution and avoid spills from indoor lighting at night.
- Set up an air quality monitoring system in the important areas with high personnel density and large changes in the number of people over time. The system can collect and analyse the data of the concentration of carbon dioxide (CO_2), and link to ventilation system.
- Setup a solar photovoltaic power generation system.

5.2 Water and Sewage System

Water and sewage services will be provided by The Bahamas Water and Sewerage Corporation (WSC). Potable water infrastructure throughout the proposed project facilities will be connected to WSC network. Potable water will be provided through this network and will follow standards set by WSC and the Department of Environmental Health Services (DEHS). The system will utilize a series of pumps to pressurize the distribution lines and supplying water to buildings and fire hydrants present. The system will be laid out in a loop configuration with backflow prevention controls. Water pipelines lines will be located approximately three feet (3ft.) underground.

All potable water and sewage construction plans will be prepared and submitted to WSC for review and approval prior to commencement of construction activities

Domestic Water Supply

Domestic water will be piped from WSC network through a one-hundred-millimetre (100mm) diameter water supply pipe, into the water storage tank, and finally into a water conservation cistern.

Based on a capacity of two hundred (200) beds, four hundred (400) patients per day, and six hundred and fifty (650) staff members; water consumption is estimated to be about thirty-eight thousand, nine hundred and forty gallons (38,940 gal.) per day and the maximum hourly domestic water consumption is about four thousand, one hundred and eight gallons (4,180 gal.) per hour.

The facility will use approximately two hundred, seventy-two thousand, five hundred and eighty gallons (272,580 gal,) water tank to cater for seven (7) days of reserve/available water consumption. Water supply pumps (VFD) will supply domestic water throughout the hospital. UV filters and filter tanks will be set on the water supply pipelines to filter the water of impurities and regularly check the quality of domestic water supply.

The daily water supply system and the seven (7) day reserve water of the standby water supply are the same water supply system, and the water supply pipeline is shared. Backflow preventers shall be set. The effective volume will be three hundred and eight thousand gallons (308,000 gal.).

Hot Water System

The hot water supply is a mechanical circulation water supply system that will provide hot water to inpatient wards, medical staff areas, bathrooms, and wash basins in the staff bathroom. The hot water supply will be 140˚F, and return temperature will be 122˚F.

Purified Water System

Different types of purified water will be supplied to Haemodialysis, CSSD, Labs, Pathology Department, endoscopy centre and main operating theatre. Each area may require a mechanism to ensure that the requirements for that area is met.

Drinking fountains will be distributed around the hospital facilities to supply drinking water.

Sewage System

A sanitary sewage system will be implemented to treat all wastewater generated on The Project which includes facilities to collect and transport sewage. The estimated wastewater flow is calculated at thirty-five thousand, two hundred gallons per day (35,200 gal/day) in this hospital. The sanitary and sewage system will be installed and managed according to DEHS and WSC standards. Additional considerations to be taken into account when determining how wastewater is managed include gravitational flow wastewater with vent pipes, installation of grease interceptors to treat oily kitchen wastewater, use of cooling tanks to pre-treatment high-temperature wastewater prior to discharge, and analyses, testing, as well as pre-treatment of infected sewerage and wastewater prior to it being discharge into the sedimentation tank.

During the construction phase portable toilets will be used on site. These portable toilets should be kept a minimum of one hundred and fifty feet 150 ft.) away from exposed groundwater, be serviced at least twice per week by a licensed contractor and secured to prevent them from tipping over.

Fire Fighting System

Indoor and outdoor fire hydrant water supply system, automatic sprinkler system, gas fire extinguishing system, portable fire extinguishers and other firefighting facilities will be featured in the design of The Project. Domestic water and fire demand will share the same tank. Fire water supply shall not be used in normal times.

Epidemic Prevention Measures

The following considerations will be employed when constructing the facility to mitigate and support the management of patients who may require admission.

- Temporary emergency site is prepared with water supply and sewerage pipe.
- The vent outlet of the infected drainage system is set up for disinfection and discharge high in the sky.
- The infected sewers are closed with closed inspection ports.
- Sanitary appliances and floor drains are set up with the sink trap no less than one hundred and sixty-four hundredths' feet (0.164 ft.) in depth. Wash basin drains to the floor drainage system to prevent the damage of the trap.

Energy Conservation Measures

The following steps will be taken to implement energy-efficient measures:

- Solar hot water supply system.
- Human body induction sensors will be installed on infrastructure such as wash basins, showers, toilets, urinals etc., to conserve water.
- Energy-efficient products such as pumps and hot water units.
- High-quality pipes and valves.
- Intelligent water meters.

5.3 HVAC

The building will include appropriate space for the various mechanical systems which support the effective operations of hospital.

Some of the mechanical systems are:

- Heating, ventilation, and air conditioning (HVAC);
- Air handling system;
- Fume and biological hood exhaust;
- Refrigerant Piping of the variable refrigerant flow (VRF);
- High-Efficiency Particulate Air filtered exhausts;
- Air cleaning system;
- Differential pressure of designated adjacent spaces;
- Cooling system for medical equipment;
- Air-air heat exchange system; and
- Fuel systems.

Clean Air Conditioning System in the Operation Theatre

Facilities that will run year around such as the Operating Theatre and side-rooms will need a safe and reliable air-conditioning system to ensure a clean and safe operating space.

Some important steps to achieve this includes:

- A backup of the heating & cooling source, where a terminal air conditioning box of the operating room or special area is considered for backup.
- Ensuring that the HVAC system meets the requirements of the Operating Room temperature, humidity, and cleanliness class.
- Preventing cross-infection and the effective control of the operating room static pressure gradients.

Air Conditioning System of Comfortable Room

The variable refrigerant air conditioning system will produce fresh air that will meet the requirements of patients and medical staffs of at the new hospital and ensure proper ventilation to dilute and remove contaminants; and control the transmission of airborne infection.

Ventilation System

The following steps will be included in the construction of the new hospital for installation of an efficient ventilation system:

- All toilets to be set up with a toilet exhaust system. The exhaust air volume will be according to a fifteen (15) times per hour calculation. The exhaust fans are discharged to the outdoor through the roof exhaust fan exhaust pipe.
- The mechanical room will be set up with mechanical exhaust systems and a natural inlet.
- The operating room, delivery room and pharmacy services will have independent ventilation systems where contaminants are exhausted by fans to the outdoor.
- The independent ventilation system shall be used in the biosafety cabinet and fume hood, where the exhaust shall be discharged into an air filter before being discharged into the atmosphere via the roof.

HVAC Intakes

HVAC intakes should be located in areas that are inaccessible to the public, such as in secured fenced areas; to prevent the possibility of foreign matter being introduced into the intake. If the HVAC is located in parking areas, design measures should be implemented to prevent introduction of vehicle exhaust from entering the system. The HVAC intake should also be away and upwind from the biosafety cabinet and/or fume hood exhaust.

Safety & Protection of the Environment

The following steps will be taken to ensure that a safe environment has been designed and implemented in the new facility:

- System outdoor air quantity for the air handling system will be calculated as the sum of the individual space requirements as defined by the standard and shall be calculated to meet the requirements of the fume hood and heat-producing device.
- Design of the ventilation system will ensure air movement from clean to less-clean areas.
- A filtration system will be set up for the outdoor air and return air of the air-handing system to prevent the spread of bacteria, fungi and other pollutants.
- The ventilation rate of the Hospital pathology, laboratory, negative pressure isolation room, and other areas that increase the risk of infection of bacteria and viruses through the air should meet the need of discharging indoor pollutants, and treating the exhaust gas before discharging it into the outdoor.

Smoke Management Systems

The smoke management system in buildings will be designed in accordance with the requirement of local code and standards set by the National Fire Protection Association (NFPA).

Epidemic Prevention Measures

To prevent the transmission of airborne infection in the Hospital, effective measures should be designed for a major public health event of sudden and serious airborne infectious diseases. For example, there may be the need to consider HVAC systems that can be used for general cooling needs but can be transformed to adapt for an epidemic.

Energy-Saving Measures

Measures that will be implemented in the design of the facility include:

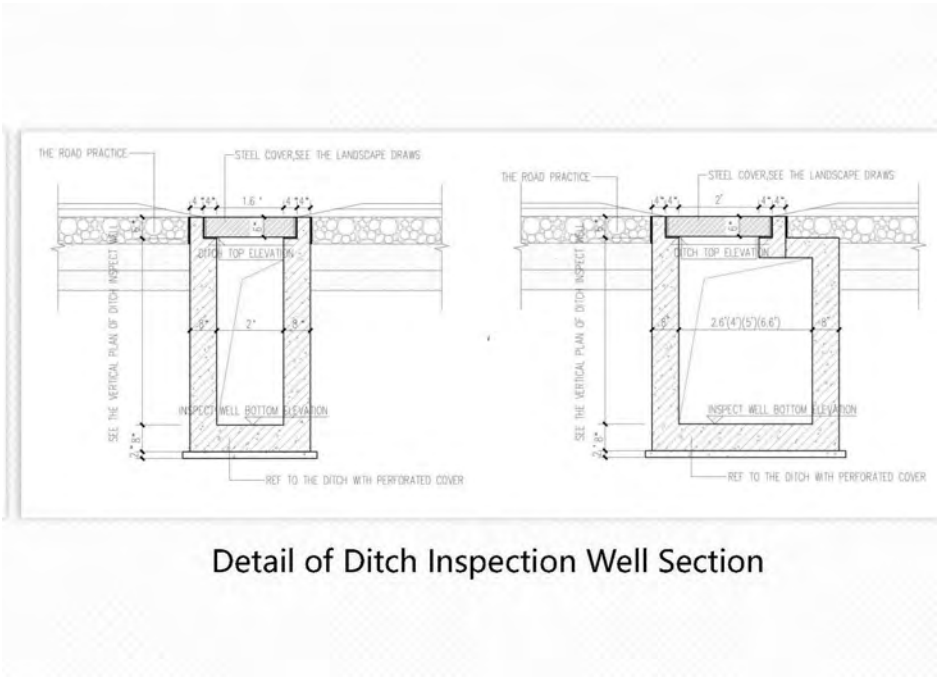
- Coefficient of Performance cooling system.
- In order to reduce or even eliminate the use of the boiler, an energy recovery system will be used.
- Frequency conversion technology of fan and pump.
- A refrigerant that is environmentally friendly.
- Indoor air quality control.

5.4 Roadways and Storm Drainage

Roadways are proposed to provide access to all facilities, parking lots and buildings throughout the site. The roadways will be for vehicle use and constructed of asphalt. All roads will be crowned to allow for proper drainage where the water generated should flow into the drainage system.

Stormwater from the roads and buildings will be collected in drainage basins and conveyed to stormwater retention areas throughout the site. The retention area should allow for a fast rate of flow and be large enough to prevent overflow. Water collected from

drainage basins will be directed into drains which will be connected to one hundred and fifty to one hundred and eighty feet (150 ft. to 180 ft.) deep disposal wells. The drainage system should be able to handle flood water from light to heavy rainfall.



Detail of Ditch Inspection Well Section

Figure 5: Design of drainage

Some drainage measure for the building includes:

- Overflow ports on the roof.
- Landscape to include trees that absorb water at a fast rate.
- Permeable areas included within the parking lot.
- Rainwater recycling tanks set up outside.

Special care should be taken to ensure that roadway drainage and stormwater discharge does not enter the retained vegetation on the site. The increase of water into this sensitive environment can introduce chemicals such as fuel, oil and herbicides. This can negatively impact the wildlife inhabiting the area.

Flood Control Measures

Activities during the construction and operational phases, such as earthworks and utility installation, can increase the risk of flooding on site and its surrounding areas. Additionally, extreme weather conditions (i.e., hurricanes) also pose the risk of flooding during construction and operational phases. To reduce the risk of potential flooding the following measures will be implemented:

- Silt fencing will be installed to act as barrier between site and adjacent areas during construction.
- Trench size for utilities will be limited to control the amount of water exposed on site.
- Buffer zones will be established to minimize and absorb the impacts of construction activities to surrounding habitats and wildlife.
- Permeable areas will be included within the parking lot and green spaces.

Energy Conservation Measures

Energy conservation that will be considered include:

- High-quality pipes and valves.
- Water-efficient irrigation system.
- Intelligent water meters.
- Drainage systems will have adequate capacity to provide stormwater storage with sponge facilities.
- Rainwater recycling system.

Figure 6: The Bahamas Hospital Layout

Figure 7: Estimated footprint of The Bahamas Hospital

Figure 7 Key: D&T = Diagnostic and Treatment, IPD = In-patient Diagnostics, OPD = Out-patient Diagnostics, A&E = Accident and Emergency, Admin = Administration

6.0 ALTERNATIVES TO THE PROJECT DEVELOPMENT

6.1.1 No Action Alternative

The "No Action" alternative would be to let The Project site remain in its present condition. This alternative will preserve the natural state of area; however, the benefit of having an additional medical facility in The Bahamas would not be realized. An additional hospital will provide The Bahamas with increased amenities such as additional bed and room capacity, increased surgery and emergency room capacity, improved services for woman and childcare, and improved laboratories and facilities. Increased medical capacity is crucial as was seen during the Covid 19 pandemic.

6.1.2 Alternative Location

Due to the present location of the Hospital being within the proposed area for the Perpall Tract National Park alternate locations were suggested to preserve the area. There were four (4) alternative sites assessed for the development of the Hospital.

Figure 8: Alternative Locations for The Project

Alternative Site 1: Gladstone Road, Jubilee Gardens Subdivision New Providence, The Bahamas

The first property surveyed as an alternative site for the Hospital is on Gladstone Road in Jubilee Gardens Subdivision, New Providence, The Bahamas at 25.035809 latitude and -77.401772 longitude (See Figure 9). The site is on a main thoroughfare and consist of a greenspace. The property has enough space for future development; however, it was determined that this site would not be a feasible or suitable site for the proposed development due the land being low-lying and falling within a flood-zone.

Figure 9: Alternative Site 1: Gladstone Road, Jubilee Gardens Location

Alternative Site 2: Prospect Road, Skyline Park New Providence, The Bahamas

The second property surveyed as an alternative site for the Hospital is located on Prospect Road in Skyline Park, New Providence, The Bahamas at 25.061981 latitude and -77.38819 longitude (See Figure 10). The site is on a main thoroughfare and consist of a greenspace. It was determined that this site would not be a feasible or suitable site for the proposed development due there being insufficient space for future development, the land being low-lying and the land itself being cavernous.

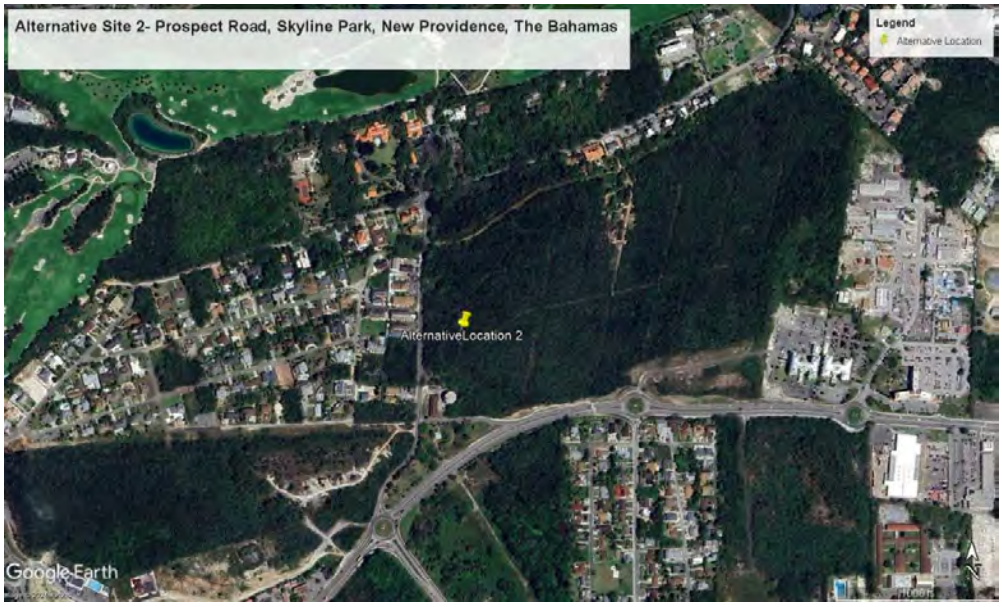


Figure 10: Alternative Site 2: Prospect Ridge, Skyline Park Location

Alternative Site 3: John F Kennedy Drive, Lake Cunningham Estates New Providence, The Bahamas

The third property surveyed as an alternative site for the Hospital is located on John J. Kennedy Drive in Lake Cunningham Estates at 25. 059759 latitude and -77. 82095 longitude (See Figure 11). The site is on a main thoroughfare and consist of a greenspace. It was determined that this site would not be a feasible or suitable site for the proposed development due there being insufficient space for future development, the land being low-lying and the land itself being unsuitable for a multi-story complex.

Figure 11: Alternative Site 3: JFK Drive, Lake Cunningham Estates Location

Alternative Site 4: John F Kennedy Drive, Lake Cunningham Estates New Providence, The Bahamas

The fourth property surveyed as an alternative site for the Hospital is located on John J. Kennedy Drive in Lake Cunningham Estates at 25. 059759 latitude and -77. 82095 longitude (See Figure 12). The site is on a main thoroughfare and consist of a greenspace. It was determined that this site would not be a feasible or suitable site for the proposed development due there being insufficient space for future development, the land being low-lying and the land itself being cavernous.

Figure 12: Alternative Site 4: JFK Drive, Lake Cunningham Estates Location

Proposed Site: New Providence Highway, Ferguson Manor, New Providence, The Bahamas

The propose property for the Hospital is located east of New Providence Highway in Ferguson Manor at 25.070097 latitude and -77.369347 longitude (See Figure 1). The site is on a main thoroughfare and consist of a greenspace. Essentially, the current location provides enough space to construct the Hospital to provide all the necessary services to provide better and more efficient care for the community. The location also has high elevations large enough to support a multi-storey building, is close to the community centres, minimises disruption of existing hospital services at PMH and will remove the challenges associated with navigating the traffic congestion of downtown. The location will also allow for immediate care and transport of patients as the hospitals, both the private (Doctors Hospital) and the public hospital (PMH) is located approximately six (6) miles away.

7.0 EXISTING ENVIRONMENTAL CONDITIONS

7.1 Biological Environment

7.1.1 Botanical Assessment

7.1.1.1 Terrestrial Environmental Assessment

The vegetation on The Project site were investigated to record the existing natural environment. Field studies were conducted on the 21st and 25th of October 2022. The purpose of the study was to map vegetation types, determine floristic diversity, identify the presence and abundance of invasive species and conduct a protected species survey in the areas of proposed works.

7.1.1.2 Methodology

Vegetation types were mapped and verified by walking along the interior and the perimeter of the site using existing footpaths, and surveyor transects. Vegetation Type taxonomy was based on Areces et al. (1999). Vascular plant species occurring in each vegetation type were recorded and used to compile a floral list (See Table 3). Plant taxonomy was based on Correll and Correll (1982). The presence, location, and abundance of vascular species listed under the National Invasive Species Strategy for The Bahamas (2013), and the Protected Trees Order (2021) were noted when encountered.

The primary objective of protected species potential estimations is to estimate the total protected species potential across the site as per DEPP regulations. The Department of Forestry requirements for conducting a protected species survey in The Bahamas stipulate that one (1) one tenth acre (0.1 ac.) plot must be surveyed for every ten (10) acres of vegetation to be impacted, assuming that the vegetation is homogenous across those ten (10) acres. To assess the relative abundance of protected species recorded, Google Earth software was used to select areas for six (6), sixty-six by sixty-six feet (66 ft. x 66 ft.) square sampling plots on the site (See Figure 14). The plot was sized using a string line on a reel and a one hundred meter (100 m.) measuring tape. Once the plot was established, the number of protected species observed within the plot was recorded (See Table 6). Logger's tape was used to determine the diameter at breast height of mature trees and a hypsometer was used to determine each tree's height. To avoid double counting or missing a plant, flagging tape was placed on individual plants when counted. In areas with a high number of small species, inappropriate for flagging, the botanist counted per quadrant to avoid double counting or missing a plant.

7.1.1.3 Observations/Findings

7.1.1.3.1 Habitat Description

The site spans approximately fifty acres (50 ac.) and contains one (1) major terrestrial ecosystem which is an Interior Upland ecosystem. There are two (2) vegetation classes on the site, Dry Broadleaf Evergreen Formation-Forest and Human Altered Environment. Transect lines cut by a tractor run from north to south as well as west to east throughout the site. There is also a large clearing on the south-eastern perimeter of the property and former WSC trenches running west to east on the northern perimeter of the site. These disturbed areas most likely would have been a part of the Dry Broadleaf Evergreen Formation-Forest before its disturbance. Besides a twenty to twenty-five feet (20-25 ft.) dense canopy, the presence of these Human Altered Environments, remnant access roads, transect lines, wellfield trenches and new growth indicate that the vegetation growth within the site area is in an intermediate phase. Therefore, the vegetation growth at the site can be described as secondary growth.

7.1.1.3.1.1 Interior Upland

There are two (2) Interior Upland vegetation classes present on the site, Dry Broadleaf Evergreen Formation-Forest and Human Altered Environment.

7.1.1.3.1.1.1 Dry Broadleaf Evergreen Formation-Forest

Dry Broadleaf Evergreen Formations are interior upland vegetation types that consist of broadleaf deciduous plants on sandy and/or limestone substrate. These formations are classified by the height of trees and the presence of a well-defined canopy. A Dry Broadleaf Evergreen Formation-Forest is present throughout the interior of the site except in the disturbed areas. It consists of a twenty to twenty-five feet (20-25 ft.) dense canopy, dominated by *Ardisia escallonioides* (Marlberry), *Lysiloma latisiliquum* (Wild Tamarind), *Manilkara zapota* (Sapodilla), and *Guetarda scabra* (Rough Velvet Berry).

Photo 1: Dry Broadleaf Evergreen Formation-Forest in the interior of the site

7.1.1.3.1.1.2 Human Altered Environment

Human Altered Environments are defined as areas in which the natural habitat has been altered or degraded by human activities. These areas consist of mainly pioneer and invasive species. A Human Altered Environment is present in the disturbed areas throughout the site i.e., transect lines and cleared areas. These areas are dominated by pioneer species such as *Solanum erianthum* (Salve Bush), *Senna chapmanii* (Stinking Pea), *Trema lamarckiana* (Pain-In-Back), and *Waltheria indica* (Sleepy Morning). This vegetation class is nestled within the old-growth Dry Broadleaf Evergreen Formation-Forest and on both the western and south-eastern perimeters of the site.

Photo 2: Human Altered Environment due to the west-east transect line on the western perimeter of the site

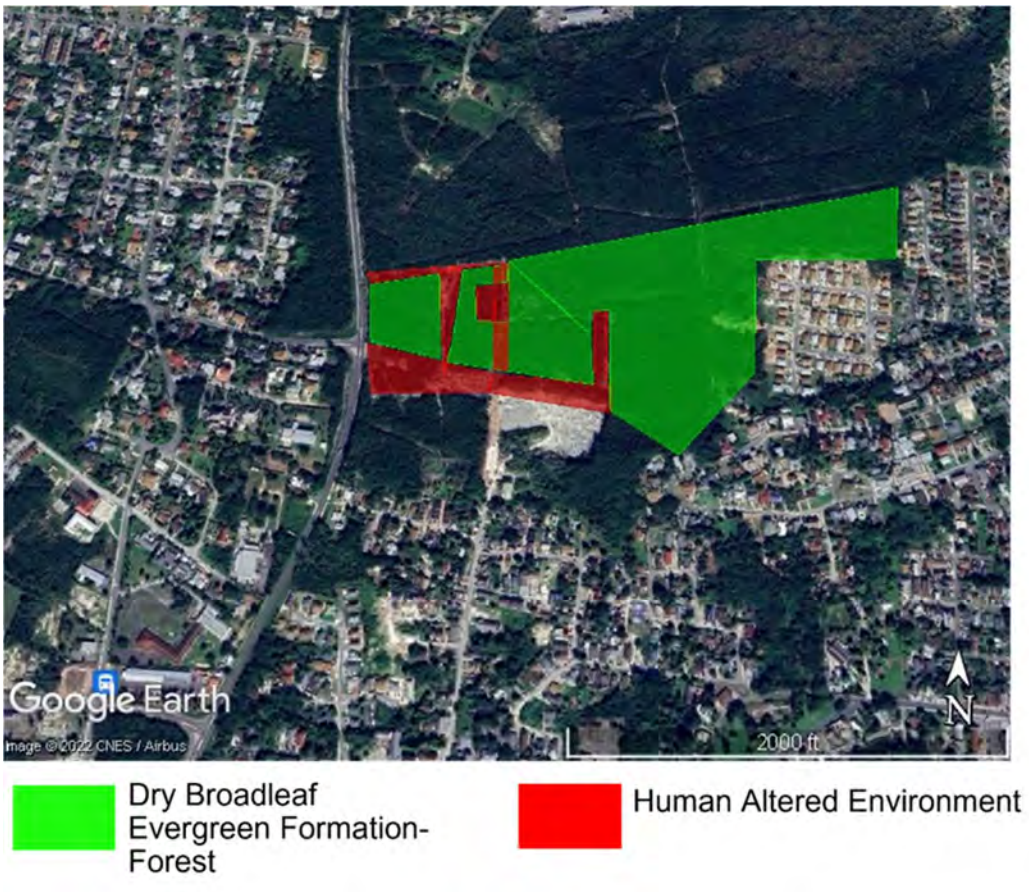


Figure 13: The Bahamas Hospital Project Vegetative Map

7.1.1.3.2 Vascular Plant Diversity

Species diversity and richness on the site are in line with what is expected of a native terrestrial ecosystem in The Bahamas. A total of eighty (80) species were recorded on the site, including fourteen (14) protected species, which is expected of the combination of a relatively old-growth Dry Broadleaf Evergreen Formation-Forest and a Human Altered Environment.

Table 3: Vascular Plant Species recorded on The Project site

Table 3 Key: **DBEF =** Dry Broadleaf Evergreen Formation-Forest, **HAE =** Human-Altered Environment

Botanical Name	Common Name	Location	
		DBEF	HAE
1. *Acacia choriophylla*	Cinnecord	✓	
2. *Alvaradoa amorphoides*	Alvaradoa	✓	
3. *Ardisia escallonioides*	Marlberry	✓	
4. *Ateleia gummifera*	Stinking Pea Root	✓	
5. *Baccharis dioica*	Brooms Bush	✓	
6. *Bidens alba*	Shepherds Needle	✓	
7. *Bourreria succulenta*	Strongback	✓	
8. *Bursera simarouba*	Gum Elemi	✓	
9. *Byrsonima lucida*	Guanaberry	✓	
10. *Caesalpinia bahamensis*	Bahamian Brasiletto	✓	
11. *Canella winterana*	Wild Cinnamon Bark	✓	
12. *Cassytha filiformis*	Love Vine	✓	
13. *Casuarina equisetifolia*	Australian Pine	✓	✓
14. *Chiococca alba*	Snow Berry	✓	
15. *Chiococca parvifolia*	Pineland Snow Berry	✓	
16. *Chrysobalanus icaco*	Coco Plum	✓	
17. *Chrysophyllum oliviforme*	Satin Leaf	✓	
18. *Coccoloba diversifolia*	Pigeon Plum	✓	
19. *Coccoloba swartzii*	Tie Tongue	✓	
20. *Corchorus hirsutus*	Jack Switch	✓	
21. *Dioscorea microphylla*	Wild Yam	✓	
22. *Diospyros crassinervis*	Feather Bed	✓	
23. *Drypetes lateriflora*	Guiana Plum	✓	
24. *Echites umbellataus*	Devil's Potato	✓	
25. *Erithalis fruticose*	Black Torch	✓	
26. *Eugenia axillaris*	White Stopper	✓	
27. *Eugenia confuse*	Ironwood	✓	
28. *Eugenia foetida*	Spanish Stopper	✓	

29. *Exothea paniculate*	Butterbough	✓	
30. *Guapira discolor*	Small Leaved Blolly	✓	
31. *Guapira obtusata*	Beefwood	✓	
32. *Guettarda scabra*	Rough Velvet Berry	✓	
33. *Gymnanthes lucida*	Crabwood	✓	
34. *Ipomoea indica*	Morning Glory		✓
35. *Jacquemontia havanensis*	Havana Vine	✓	
36. *Juniperus barbadensis*	Red Cedar	✓	
37. *Lantana involucrate*	Wild Sage	✓	
38. *Lasiacis divaricate*	Wild Bamboo	✓	
39. *Leucaena leucocephala*	Jumbay		✓
40. *Leucothrinax morrisii*	Thatch Palm	✓	
41. *Lysiloma latisiliquum*	Wild Tamarind	✓	
42. *Malpighia polytricha*	Touch Me Not	✓	
43. *Manilkara zapota*	Sapodilla	✓	
44. *Metopium toxiferum*	Poisonwood	✓	
45. *Ocotea coriacea*	Lancewood	✓	
46. *Pera bumeliifolia*	Brown Ebony	✓	
47. *Petitia domingensis*	Bastard Stopper	✓	
48. *Phyllanthus epiphyllanthus*	Rock Bush	✓	
49. *Piscidia piscipula*	Dog Wood	✓	
50. *Pithecellobium keyense*	Ram's Horn	✓	
51. *Psychotria ligustrifolia*	Smooth Wild Coffee	✓	
52. *Pteridium aquilinum*	Bracken Fern	✓	
53. *Randia aculeata*	Box Briar	✓	
54. *Reynosia septentrionalis*	Darling Plum	✓	
55. *Rhoeo spathacea*	Oyster Plant	✓	✓
56. *Rhynchospora colorata*	Starrush Whitetop	✓	
57. *Sabal palmetto*	Sabal Palm	✓	
58. *Schefflera actinophylla*	Queensland Umbrella Tree	✓	
59. *Scleria lithosperma*	Slender Nut Rush	✓	
60. *Senna chapmanii*	Stinking Pea	✓	✓
61. *Sideroxylon foetidissimum*	Mastic	✓	
62. *Sideroxylon salicifolium*	Willow Bustic	✓	
63. *Simarouba glauca*	Paradise Tree	✓	
64. *Smilax havanensis*	Chaney Briar	✓	
65. *Solanum erianthum*	Salve Bush		✓
66. *Stemodia maritima*	Pond Bush		✓

67. *Swietenia mahagoni*	West Indian Mahogany	✓	
68. *Tabebuia bahamensis*	Five Finger	✓	
69. *Tecoma stans*	Yellow Elder		✓
70. *Tetrazygia bicolor*	Wild Guava	✓	
71. *Thelypteris reptans*	Walking Wood Fern	✓	
72. *Thouinia discolor*	Quicksilver Bush	✓	
73. *Tillandsia utriculate*	Swollen Wild Pine	✓	
74. *Tournefortia volubilis*	Soldier Vine		✓
75. *Trema lamarckiana*	Pain In Back		✓
76. *Turnera diffusa*	Diamiana	✓	
77. *Turnera ulmifolia*	Bahamian Buttercup	✓	
78. *Varronia bahamensis*	Granny Bush	✓	
79. *Waltheria bahamensis*	Bahama Waltheria		✓
80. *Waltheria indica*	Sleepy Morning		✓

7.1.1.3.3 Invasive Species

Five (5) invasive species were observed at the site. These species are outlined below along with their occurrences, abundance on the site, and recommendations for control.

Table 4: Invasive species recorded on the proposed Bahamas Hospital Project site

Table 4 Key: DBEF = Dry Broadleaf Evergreen Formation-Forest, **HAE** = Human-Altered Environment

Species	Occurrence and Abundance	Recommendations*
Casuarina equisetifolia, Australian Pine	Ten to fifteen (10-15) trees, ranging from ten to twenty feet (10-20 ft.) tall on the edge of the DBEF-Forest, and fifteen to twenty feet (15-20) trees ranging from six to fifteen feet (6-15 ft.) tall in the HAE in the interior of the site.	Control
Casuarina glauca, Australian Suckering Pine	Eight to ten (8-10) trees, ranging from four to twenty feet (4-20 ft.) tall on the northern perimeter of the site at the edge of the	Eradication

	Wellfield trenches and DBEF-Forest.	
Ipomoea indica, Morning Glory	A large cluster of vines in the HAE on the western perimeter of the site.	Control
Leucaena leucocephala, Jumbay	Eight to twelve (8-12) trees, ranging from three to five feet (3-5 ft.) tall on the edge of the DBEF-Forest, and numerous saplings spread throughout the HAE in the site.	Control
Schefflera actinophylla, Queensland Umbrella Tree	One (1) tree, approximately fifteen feet (15 ft.) tall within the DBEF-Forest on the north-western perimeter of the site.	Control

*Recommendations as per the National Invasive Species Strategy for The Bahamas, 2013

Photo 3: *Casuarina equisetifolia* (Australian Pine) in the background above the DBEF-Forest on the site

7.1.1.3.4 Protected Species

The Forestry Act Declaration of Protected Trees Order 2021 lists one hundred and twenty-seven (127) vascular plant species as protected. Eighty-six (86) species are listed as Endemic or Endangered or Threatened and forty-one (41) are listed as Cultural or Historical and Economic. Fourteen (14) species listed on the Forestry Act Declaration of Protected Trees Order 2021 were recorded at the site (see Table 5). Twelve (12) of the fourteen (14) species, *Bursera simarouba* (Gum Elemi), *Caesalpinia bahamensis* (Bahama Brasiletto), *Canella winterana* (Wild Cinnamon Bark), *Guapira discolor* (Small Leaved Blolly), *Juniperus barbadensis* (Red Cedar), *Leucothrinax morrisii* (Thatch Palm), *Lysiloma latisiliquum* (Wild Tamarind), *Pera bumelifolia* (Brown Ebony), *Sabal palmetto* (Sabal Palm), *Senna chapmanii* (Stinking Pea), *Swietenia mahogani* (West Indian Mahogany) and *Turnera ulmifolia* (Bahamian Buttercup) are listed under the subsection Cultural or Historical and Economic in the Act. Two (2) species at the site, *Thouinia discolor* (Quicksilver Bush) and *Varronia bahamensis* (Granny Bush) are listed under the subsection of Endemic or Endangered or Threatened Species in the Act.

Table 5: Protected Species recorded on the proposed Bahamas Hospital Project site

#	Species Recorded		Location
	Botanical Name	Common Name	
1	*Bursera simarouba*	Gum Elemi	Fifteen to twenty (15-20) trees, ranging from eight ot fifteen feet (8-15 ft.) tall distributed sporadically throughout the site.
2	*Caesalpinia bahamensis*	Bahama Brasiletto	One (1) tree, approximately six feet (6 ft.) tall in the north-western section of the site.
3	*Canella winterana*	Wild Cinnamon Bark	One (1) tree, approximately six to eight feet (6-8 ft.) in height in the north-western section of the site.
4	*Guapira discolor*	Small Leaved Blolly	Fifteen to twenty (15-20) trees, three to six feet (3-6 ft.) in height, and distributed throughout the site.
5	*Juniperus barbadensis*	Red Cedar	Two (2) trees, approximately four to six feet (4-6 ft.) in height and three (3) seedlings on the northern perimeter of the site.
6	*Leucothrinax morrisii*	Thatch Palm	Twenty to thirty (25-30) trees, six to twelve (6-12 ft.) tall and spread out relatively evenly throughout the site.
7	*Lysiloma latisiliquum*	Wild Tamarind	Twenty-five to thirty (25-30) trees, approximately eight to fifteen feet (8-15 ft.) tall, some with a DBH

			greater than five centimeters (5 cm.), dispersed throughout the site.
8	*Pera bumelifolia*	Brown Ebony	Ten to twelve (10-12) trees, ranging from six to eight feet (6-8 ft.) tall spread throughout the DBEF-Forest ecosystem on the site.
9	*Sabal palmetto*	Sabal Palm	Three to five (3-5) trees, ranging from eight to ten feet (8-10 ft.) in height distributed sporadically throughout the DBEF-Forest in the north-western section of the site.
10	*Senna chapmanii*	Stinking Pea	Twenty-twenty-five (20-25) trees, ranging from two to three feet (2-3 ft.) in small clusters spread sporadically within the HAE on the site.
11	*Swietenia mahoganii*	West Indian Mahogany	Six to eight (6-8) Trees, ranging from eight to ten feet (8-10 ft.) tall on the western perimeter of the site and four to five (4-5) seedlings on the edge of DBEF in the interior of the site.
12	*Thouinia discolor*	Quicksilver Bush	Numerous trees, ranging from four to eight feet (4-8 ft.) tall along the northern and eastern perimeter of the site.

13	*Turnera ulmifolia*	Bahamian Buttercup	One (1) plant on the western perimeter of the site.
14	*Varronia bahamensis*	Granny Bush	Numerous trees, ranging from two to ten feet (2-10 ft.) tall along the northern and eastern perimeter of the site.

Photo 4: *Pera bumelifolia* (Brown Ebony)

7.1.1.3.4.1 Methodology

Six (6) randomly selected plots were established to estimate the number of protected species on The Project site (See Figure 14). The number of protected species per plot was determined using plot sampling methodology (See Table 6). The estimated number of individual protected species across the entire Project area was also determined by considering the average number of trees per acre and multiplying the subsequent quotient by the total acres surveyed (See Table 7).

Figure 14: Protected Species Plot Map

Table 6: Protected species survey plot results from the proposed Bahamas Hospital Project site, New Providence, The Bahamas

Plot	Location	Species	#
1	25°04'11.22"N 77°21'51.54"W	*Bursera simarouba,* Gum Elemi	15
		Leucothrinax morrisii, Thatch Palm	12
		Lysiloma latisiliquum, Wild Tamarind	16
		Sabal palmetto, Sabal Palm	1
		Varronia bahamensis, Cat's Tongue	1
2	25°04'07.42"N 77°21'58.52"W	*Bursera simarouba,* Gum Elemi	19
		Lysiloma latisiliquum, Wild Tamarind	55
		Sabal palmetto, Sabal Palm	1

3	25°04'07.65"N 77°22'02.39"W	*Bursera simarouba,* Gum Elemi	13
		Galactia spiciformis, Spiciform Milk Pea	2
		Leucothrinax morrisii, Thatch Palm	7
		Lysiloma latisiliquum, Wild Tamarind	5
		Senna chapmanii, Bahama Senna	2
		Swietenia mahoganii, West Indian Mahogany	1
		Thounia discolor, Quicksilver Bush	4
4	25°04'02.01"N 77°22'02.88"W	*Bursera simarouba,* Gum Elemi	9
		Lysiloma latisiliquum, Wild Tamarind	8
		Senna chapmanii, Bahama Senna	1
5	25°04'03.59"N 77°22'09.31"W	*Bursera simarouba,* Gum Elemi	27
		Canella winterana, Wild Cinnamon	1
		Ceiba pentandra, Silk Cotton	2
		Leucothrinax morrisii, Thatch Palm	4
		Lysiloma latisiliquum, Wild Tamarind	31
		Pera bumeliifolia, Brown Ebony	1
		Senna chapmanii, Bahama Senna	2
6		*Bursera simarouba,* Gum Elemi	4

	25°04'04.40"N 77°22'17.45"W	*Canella winterana*, Wild Cinnamon	3
		Leucothrinax morrisii, Thatch Palm	1
		Lysiloma latisiliquum, Wild Tamarind	2

Table 7: Estimated number of protected species potential on the proposed Bahamas Hospital Project site, New Providence, The Bahamas

Protected Species	**Total # Recorded**	**Average per survey plot (#/6)**	**Total potential per acre (average x 10)**	**Total potential on site (# per acre x 50)**
Bursera simarouba, Gum Elemi	87	14.5	145	7250
Canella winterana, Wild Cinnamon	4	0.67	6.67	333
Ceiba pentandra, Small-leaved Blolly	2	0.33	3.33	167
Galactia spiciformis, Spiciform Milk Pea	2	0.33	3.33	167
Leucothrinax argentata, Thatch Palm	24	4	40	2000
Lysiloma latisiliquum, Wild Tamarind	109	18.17	181.7	9085

Pera bumeliifolia, Brown Ebony	1	0.17	1.7	85
Sabal palmetto, Sabal Palm	2	0.33	3.33	167
Senna chapmanii, Bahamian Senna	3	0.5	5	250
Swietenia mahoganii, West Indian Mahogany	1	0.17	1.7	85
Thounia discolor, Quicksilver Bush	4	0.67	6.7	335
Varronia bahamensis, Cat's Tongue	1	0.17	1.7	85

While Table 7 provided estimated calculations based on the results of the sampling plots, the actual (more likely) abundance of protected species throughout the site might be lower based on observations as these species were only noted in the intact natural vegetated sections of the site due to prior disturbances.

7.1.2 Avian Assessment

An avian survey was conducted to identify the presence, abundance, and habitat utilization of avian species within the boundaries of the site.

7.1.2.1 Methodology

The assessment comprised eight (8) hours of active avian and ecological observations. Field studies comprised of both a winter avian survey (September-March) and a summer avian survey (April-August). A winter avian survey was conducted on Thursday 27th October 2022 between the hours of 7:00 AM and 9:00 AM. A summer avian survey was conducted on Saturday 10th & Sunday 11th of June 2023. The avifauna of the area was assessed and recorded by walking along the perimeter of the site and within the interior of the site by utilizing established transects, and access roads. Avifauna taxonomy and range is based on Currie et. al. (2019) Species numbers were recorded in the abundance categories, Single (1), Few (2-10), and Many (11-100). Species recorded were compiled for final abundance estimates. Status is based on the International Union for Conservation of Nature (IUCN).

7.1.2.2 Observations/Findings

7.1.2.2.1 Species Diversity

A total of fifteen (15) species were recorded during the investigation (See Table 8).

Table 8: Avifauna observed on the proposed Bahamas Hospital Project site

TABLE 8 KEY:

Range

PRB = Permanent Resident Breeding

WRB = Winter Resident Breeding

WRN = Winter Resident Non- Breeding

e = endemic subspecies

Status

LC = Least Concern (Conservation-IUCN)

IUCN = International Union of Conservation of Nature

Scientific Name	Common Name	Master Observation	Range/ Conservation Status
Butorides virescens bahamensis	Green Heron	Single	PRB/e/LC
Calliphlox evelynae	Bahama Woodstar	Single	PRB/e/LC
Coereba flaveola bahamensis	Bananaquit	Few	PRB/e/LC
Dumetella carolinensis	Gray Catbird	Many	WRN/LC
Falco sparverius	American Kestrel	Single	PRB/LC
Mimus polyglottos polyglottos	Northern Mockingbird	Single	PRB/LC
Mniotilta varia	Black and white Warbler	Single	WRN/LC
Patagioenas leucocephala	White-crowned Pigeon	Many	PRB/LC

Seiurus aurocapilla	Ovenbird	Single	WRN/LC
Steophaga americana	Northern Parula	Single	WRN/LC
Steophaga discolor	Prairie Warbler	Single	WRN/LC
Steophaga palmarum	Palm Warbler	Few	WRN/LC
Steophaga ruticilla	American Restart	Few	WRN/LC
Turdis plumbeus plumbous	Red-legged Thrush	Few	PRB/e/LC
Vireo crassirotris crassirostris	Thick-billed Vireo	Single	PRB/e/LC

7.1.2.2.2 Range

The range of a species in the geographic areas where the birds can be consistently found e.g., migrant birds have seasonal ranges while restricted range species remain on the same island or in the same region year-round.

7.1.2.2.3 Permanent Resident Breeding

Permanent Resident breeding (PRB) species refers to the resident species that live and breed year-round throughout the Bahama Islands. There were eight (8) PRB species (approximately fifty-three percent (53%)) of the species recorded during the survey.

7.1.2.2.4 Endemic Species

Endemic species are birds that exist only in The Bahamas. Four (4) PRB species, *Butorides virescens bahamensis* (Green Heron), *Coereba flaveola bahamensis* (Bananaquit), *Turdis plumbeus plumbeus* (Red-legged Thrust), and *Vireo crassirotris crassirostris* (Thick-billed Vireo) are recorded on the site are endemic subspecies and one (1) PRB species, *Calliphlox evelynae* (Bahama Woodstar) is an endemic species found in The Bahamas. Approximately thirty-three percent (33%) of the species recorded were endemic to The Bahamas.

7.1.2.2.5 Winter Resident Non-breeding

Winter Resident Non-breeding (WRN) species refers to the winter migrants to the Bahama Islands from North America. Seven (7) of the species recorded on the site (Approximately forty-seven percent (47%)) were WRN.

7.1.2.2.6 Conservation Status

7.1.2.2.6.1 Protected Species

All of the species observed during the site assessment are protected under the Wild Birds Protection Act Chapter 249 (Statute Law of The Bahamas).

7.1.2.2.6.2 Endangered Species

None of the species recorded are classed as endangered.

7.1.2.2.6.3 Habitat Utilization

Fourteen (14) species recorded were land birds and were recorded in the Dry Broadleaf Evergreen Formation-Forest vegetation type. One (1) species recorded, *Butorides virescens bahamensis* (Green Heron), is a wetland bird and was also recorded in the Dry Broadleaf Evergreen Formation-Forest. *Mimus polyglottos polyglottos* (Northern Mockingbird) and *Seiurus aurocapilla* (Ovenbird) were observed feeding on the site. Nesting activity was not observed on the site. The Dry Broadleaf Evergreen Formation-Forest consists of *Eugenia axillaris* (White Stopper*), Coccoloba swartzii* (Tie Tongue), and *Leucothrinax morrisii* (Thatch Palm) with fruits, flowers, or buds would provide food for avian species. The site does not provide habitats utilized by wading birds (ponds, wetlands) or habitat for sea birds (isolated rocks). The descriptions of vegetation types and plant species observed are a fair representation of the botanical features on the site. While it is likely that additional species would be recorded with further field studies, the numbers and species are not likely to impact the results of this study for the purposes it is intended. Additional avian field studies repeated over a period are likely to record other species on the site, these species would likely utilize the site for perching, feeding, and nesting.

Photo 5: *Mimus polyglottos polyglottos* (Northern Mockingbird) perching in *Lysiloma latisilquum* (Wild Tamarind)

7.2 Physical Environment

7.2.1 Topography

The whole site is relatively flat throughout except some areas in the south which have a high altitude. The property elevation is on average about thirty feet (30 ft.) Above Sea Level (ASL) and there is a gentle upward slope on the south side of the property. The elevation is about fifteen to sixteen feet (15 ft.-16 ft.) ASL on the northwestern, middle and southeastern side of the site, the minimum elevation is about nine (9) feet ASL on the northeastern side of site and the maximum elevation is twenty-seven to fifty-eight feet (27- 58 ft.) on the south western site of the site.

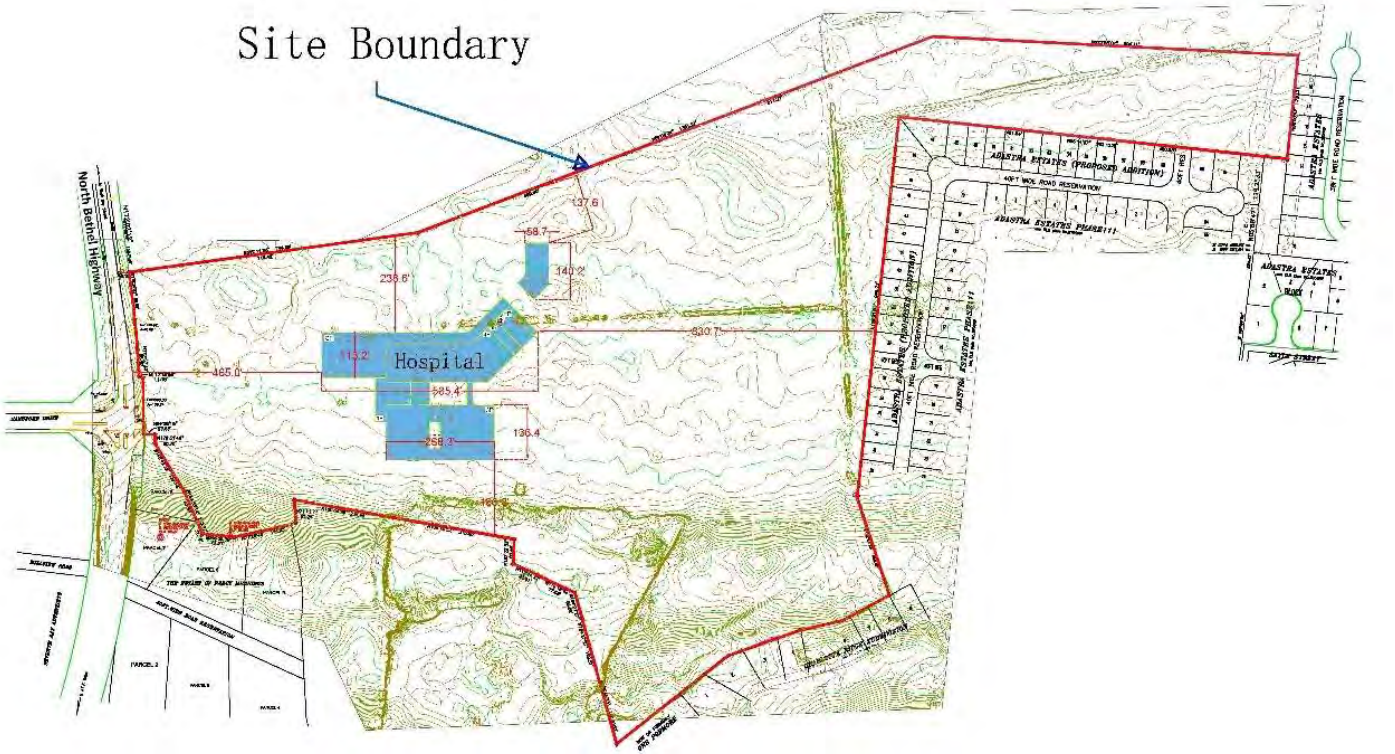


Figure 15: Topographic Map of The Project Site

7.2.1.1 Wellfield

Wellfields are located throughout the island of New Providence and was historically used to supply freshwater to residents (See Figure 16). Due to the high population density, New Providence's water supplied is heavily supplemented by ground water barged from North Andros and/or potable water generated by a Seawater RO Plant (US Army Corp of Engineers, 2004). Approximately, three quarters (3/4) of New Providence's potable water supply is derived from North Andros and RO (US Army Corp of Engineers, 2004).

There is a network of historic wells, each supporting its own unique mini-ecosystem of lilies, ferns and other wildlife located on The Project Site. These wells provide essential flood drainage for nearby residential neighbourhoods. Special efforts will be made to ensure construction will not negatively impact the surrounding vegetation.

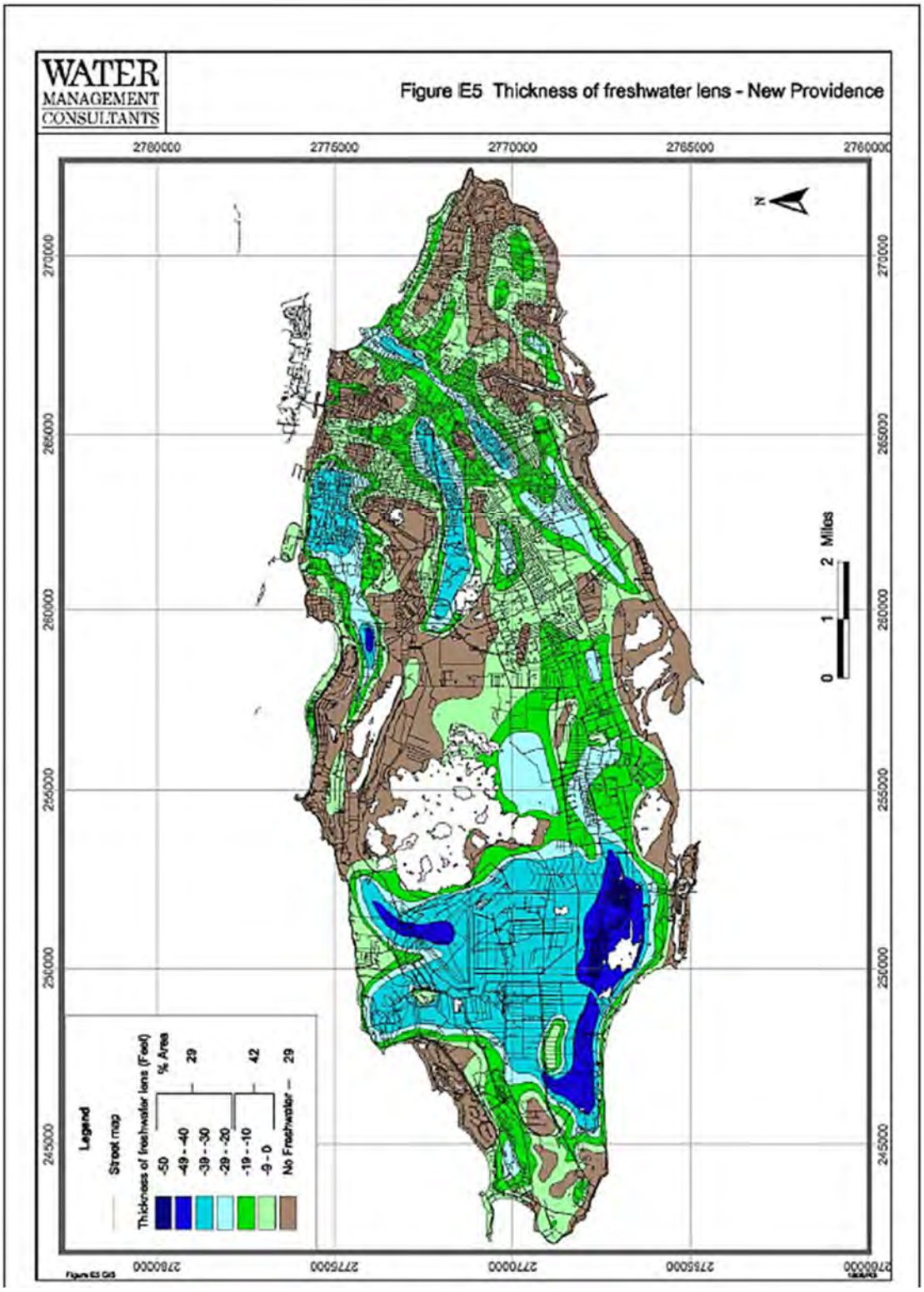


Figure 16: Map of the Freshwater Resources in New Providence

7.2.2 Water Quality Analysis

JSS Consulting contracted Adka Laboratories Consultants Co Ltd. and Environmental Services to conduct a water quality analysis for three (3) water samples collected throughout The Project survey area during previous assessments (See Figure 17).

Figure 17: Location of water quality sample sites

7.2.2.1 Methodology

Each water sample was analysed according to the guidelines set forth by the Department of Environmental Health Services (DEHS). Adka Laboratories tested each sample for several different parameters including:

- Heterotrophic Plate Count
- Total Coliform
- Faecal Coliform
- E. coli

Surface water quality sampling was also conducted in field. The following parameters was analysed using the Horiba U-50 Multiparameter Water Quality Meter.

- Temperature
- pH
- Total Dissolved Solids
- Conductivity
- Salinity
- Dissolved Oxygen (D.O.)

The following sections will outline the results and range for each field sample and the parameters it was tested for.

Table 9: GPS location of water quality sample sites

Sample	Latitude	Longitude
Site 1	25°4'11.00" N	-77°21'57.00" W
Site 2	25°4'6.00" N	-77°22'3.00" W
Site 3	25°4'9.00" N	-77°22'14.00" W

7.2.2.2 Results

Table 10: The Bahamas Hospital Water Quality Analysis Results

TABLE 10 KEY:

DEHS- Department of Environmental Health Service (NAS)

FDEP- Florida Department of Environmental Protection

WHO- World Health Organization

***T**-Too numerous to count

Parameters	Site 1	Site 2	Site 3	DEHS/FDEP/WHO Water Guidelines ppm=mg/L
Heterotrophic Plate Count	T	T	T	0 – 200 CFU
Total Coliform	T	T	T	0 CFU
Faecal Coliform	T	4	7	0 CFU
E-Coli	304	4	11	0 CFU

Table 11: The Bahamas Hospital Project Site Field Parameters Results

Parameters	Site 1	Site 2	Site 3	DEHS/FDEP/WHO Water Guidelines ppm=mg/L
pH	7.53	7.10	7.12	6 – 8
Temperature	89.6°F	85.5°F	83.7°F	85°F
Total Dissolved Solids (TDS)	422	508	353	100-1,000 g/L
Conductivity	576	704	493	1,000-2,000µs
Salinity	0.3ppt	0.37ppt	0.25ppt	0-2.00ppt

7.2.2.3 Discussion

The results of the tests showcase that the water quality at The Project site can be described as contaminated and there is cause for concern. Water quality analysis (Table 10) displayed that each parameter tested exceeded the recommended range set in place by the regulatory agencies. These results can be due to leakages of septic systems in the surrounding communities, coupled with waste that was generated by past squatters, and concurrent watershed events from a mining site on the southern perimeter of the property.

A comprehensive plan needs to be created to rectify leakages in the surrounding community's septic systems, remove structures and waste generated by squatters, and install a proper drainage system to redirect water and alleviate flooding. These steps are necessary to improve the water quality parameters to acceptable standards.

7.3 Socioeconomic Aspects

7.3.1 Land Used

The Project site is on public land, owned by the Government of The Bahamas, and approval to use the land has been granted to the MOHW for the purposes of constructing a hospital.

The site is currently a greenspace and whiles not designated as a protected area, the site is located within a portion of the proposed area for the Perpall Tract National Park. Refer to section 4.1.2.

7.3.2 Population

The 2022 National Census indicates the population of The Bahamas has three hundred and ninety-nine thousand, three hundred and fourteen (399,314) people with New Providence containing two hundred and ninety-six thousand, five hundred and twenty-two (296,522) persons. New Providence is approximately eighty (80) square miles and the most densely populated island in The Bahamas (Census Office, 2022).

7.3.3 Economy of The Bahamas

According to the data of the World Bank in 2021, the tourism and financial sectors are the pillars of The Bahamas' national economy making up about fifty percent (50%) and ten percent (10%) of GDP respectively. From 2015 to 2019, the economy of The Bahamas grew slowly; however, Hurricane Dorian in 2019 and the Covid 19 Pandemic in 2020 caused a downturn in economic growth.

Table 12: Main Indicators of The Bahamas in 2016-2020

Year	**2017**	**2018**	**2019**	**2020**	**2021**
GDP (US $100 million)	124.9	130.2	135.8	99.1	112.5
GDP growth rate (%)	3.1	3.0	1.2	-16.3	13.7
Per capita GDP (US$)	32720	33768	34863	28608	28239
Per capita GDP growth rate (%)	2.1	2.0	0.2	-17.1	-0.1

*Data sourced from The Bahamas Hospital Feasibility Study

Hurricane Dorian was one of the biggest hurricanes to hit The Bahamas and caused an estimated amount of three point four (3.4) billion dollars in damages (Zegarra et al. 2020). According to the IDB The Bahamas experienced a sharp decrease in GDP growth rate, with the islands directly hit by the hurricane, such as Abaco and Grand Bahama experiencing significant decreases in economic activity.

The Covid 19 Pandemic not only impacted the Bahamian economy but disrupted the world's economic order and global public health. With the implementation of social distancing measures to curb the spread of the virus there was a decline in the country's GDP. Due to the Bahamian economy heavily relying on Tourism, the Covid 19 Pandemic cause a steep decline in the country's economic activity between 2020 and 2021. The IDB estimates that the Covid 19 Pandemic caused The Bahamas nine point five (9.5) billion dollars due to tens of thousands of job losses and impacts to the country's tourism sector (IDB 2022).

Despite the downturn in the Bahamian economy due to the Covid 19 pandemic and Hurricane Dorian, the Bahamian domestic economy registered a growth of thirteen and seven tenths' percent (13.7%) in 2021 (Central Bank 2021 annual report).

These two events illustrated that access to local healthcare services is imperative. The Bahamas should be able to support its citizens in the event of restrictive travel due a pandemic/epidemic and during natural disasters. The Project aims to provide increase healthcare services to the local communities with introduction of a new medical facility. This will allow for immediate care to patients nearby as the hospitals, both private (Doctors Hospital) and public hospital (PMH) is located approximately six (6) miles away.

7.3.4 Labour Regulation.

The current Employment Act of The Bahamas provides the specific provisions on labour dispute, wage, employment contract, labour, insurance benefits, work hours, holidays, employment of non-local residents and arbitration of trade unions. The Project will adhere to established ratios of local to non-Bahamian workers during construction and operational phases. Compliance with this regulation is crucial as The Project is a government-administrated project therefore there will be scrutiny for adherence. Work halts due to workers unsatisfaction can be managed by adherence to agreed payment schedules and other items in the compensation package.

8.0 ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Environmental impacts are changes in the natural environment caused by development that can have adverse effects on the surrounding community, air, freshwater environments, marine environments and terrestrial environments. Environmental impacts can be caused by direct and indirect actions and takes into consideration the footprint of impacts and known habitats on-site. Impacts detailed below are determined by activities associated with normal construction and operation, which can negatively affect the natural environment and/ or may entail an environmental component.

Long-term negative impacts to the natural resources in the area are not expected to occur as a result of the proposed construction work. Impacts to the environment are expected to be short term in nature. To ensure this, construction will be closely monitored to prevent encroachment, or contamination of terrestrial habitats.

Generally, the potential environmental issues associated with The Project include the following:

Table 13: Environmental Impacts on The Project site

Physical Impacts	Biological Impacts	Socio-Economic Impacts
• Air, dust and Noise Pollution	• Impacts on Wildlife	• Safety for workers • Traffic Impacts

• Light Pollution • Flooding • Solid Waste Impacts • Sewage and Refuse Disposal. • Groundwater Quality Impacts	• Impacts on Vegetation	• Community Impacts • Land use Impacts • Economic Impacts • Real Estate Value • Commissioning and Utilization of Hospital Services

8.1 Register of Significant Aspects and Impacts

Environmental impacts of The Project are impacts to the natural communities and wildlife in the area that can be reasonably inferred, considering the footprint of impacts and known habitats on-site. Other expected impacts are those related to normal construction and operation such as waste generation and disposal, fuelling, use of potentially hazardous materials as well as other accidents or malfunctions, which may entail an environmental component. The Register of Significant Aspects and Impacts (The Register) considers potential impacts that may be due to construction and operational activities. The Register will be used in the development of method statements to proactively manage and mitigate potential impacts pertaining to The Project. The Register evaluates the potential impacts identified in the Environmental Impact Assessment and assigns risk and magnitude scores. Risk Scores are measuring the likelihood of the impact occurring and is measured on a scale of 1-10 with 1 being unlikely to occur and 10 being highly likely to occur. Magnitude scores measures the scale of the impact if it occurs. Magnitude ranges are parameters are Low, Medium and High. Low Impact refers to short-term localized impact reversible in 1 year. Medium Impact refers to moderate term implications reversible in a 5-year period. High Impact refers to long term impacts that are not reversible within 5 to 10 years or are irreversible.

Table 14: Register of Significant Aspects and Impacts

Significant Aspect and Impact	**Activities**	**Potential Impact(s)**	**Mitigation**	**Risk Score**	**Magnitude Score**
Construction Phase					
Groundwater Quality	Construction	Introduction of hazardous substances into groundwater. Hazardous substances may include sediment, wastewater, concrete wash water, lubricants, fuels,	*Environmental monitoring reports will be submitted to the Department of Environmental Planning and Protection (DEPP). *No hazardous substances will be permitted to escape into the exposed groundwater at the work site.	10	High

		drilling spoils and hydraulic fluids.	*Wash water from the concrete trucks will be contained to a designated wash station. * All fuel/oil spills will be cleaned up. *Fuel Spill Prevention Plan will be outlined in the EMP.		
Groundwater Quality	Utility Installation	Turbidity	*Limit trench size. *Expulsion of water into existing drainage system. *NO dewatering directly into exposed groundwater or native vegetation.	1	Medium
Flooding	Removal of vegetative areas and an increased in paved surfaces	Increase in standing water.	*Installation of a drainage system. *Construction of drainage retention ponds or swales designed to collect and drain water at a fast rate. *Buildings should also be elevated to reduce the risk of flooding in the event of extreme weather and flooding conditions. *Establishment of flood control ditches to reduce the risk of rain-induced flooding. *Regular cleaning and maintenance of the drains. *Revegetation of areas to reduce erosion and slow the rate of stormwater runoff.		

			*Constructing sedimentation basins to temporarily store stormwater. *Permeable areas in the parking lot to reduce standing water and runoff.		
Erosion and Sedimentation	Land Clearing, Excavation, and Stockpile Erosion	Turbidity, Groundwater Contamination	*Stockpiles to be stored away from open trenches with exposed ground water. *Sediment and erosion control methods (such as silt fences) will be in place prior to and during construction.	5	Medium
Air Quality	Earthworks	Dust Accumulation	*Spraying water on the construction site and excavated areas. *Fencing/installing barriers to shield from dust and aggregates. *Do not accumulate and burn waste at the site. *All dump trucks will require tarpaulins when transporting material.	5	Medium
Noise and Light Pollution	Construction of Buildings and use of Heavy Machinery	Excessive Noise and Light Pollution	*Precaution will be taken while using the machines and equipment during construction. Avoid usage of machines/equipment with extra noise.	5	Medium

			*Work will be conducted during reasonable hours. *The Contractor will inform the surrounding offices and community prior to operations that bear the risk of nuisance and accidents. *Light impacts will be managed by directing light away from residential and vegetative areas, tilting lights downwards, and using light shades where necessary.		
Solid Waste Management	Construction	Increase of solid waste and waste accumulation	*Refuse and wastes should be removed from the site regularly and disposed of at NPEP. *In case of hazardous waste, store in a safe place, in a lidded container and make provisions for management. *Excavated material will be reused in construction and/or made available for community projects. *All domestic and construction waste that cannot be recycled or reused on site should be stored in a lidded container in the laydown area. Waste should be removed from site by a licensed contractor as necessary.	10	High

			*Waste bins should contain signs or showing symbols of items that can be disposed of.		
Solid Waste	Land Clearing	Vegetative waste	*Recycling by creation of mulch or biochar.	10	Low
Sewage and refuse disposal	Installation of Sewage system	Water quality	*Any portable toilet(s) that are on-site should be secured to avoid vandalism or falling over. Toilets must be located more than one hundred and fifty feet (150 ft.) from the edge of the exposed groundwater. *A licensed contractor will be responsible for servicing portable toilets.	5	Medium
Terrestrial Ecosystem and Biodiversity	Clearing and landscaping	Habitat loss – eighty (80) plant species Identified. One (1) major ecosystem identified.	*Only vegetation around footprint will be removed. *Various flora removed for construction will be replanted in the areas selected for restoration. *All invasive species will be removed. *Surrounding vegetation will be maintained. *Species native to The Bahamas will be used in landscaping. If flora must be	6	High

			imported, no prohibited species will be included in the landscaping. *Development of an Integrated Pest Management program that employs use of chemicals as a last resort. *Development of a Fire Control Plan. *Smoking only in designated areas. *Fuel storage only in designated and prepared areas. *No Hunting.		
Wildlife	Land clearing	Destruction of habitat and loss of species inhabiting the area.	*Before commencement of works, areas designated for land clearing will be checked for wildlife. *Any wildlife encountered will be relocated to a similar habitat away from development.	10	Medium
Fuel handling and oil/fuel filled equipment	Construction	Spills and/or leaks of: Fuel, lubricating oil, and coolants associated with the operation of heavy machinery and drilling equipment during project work.	*Spills will immediately be contained, and the Environmental Manager (EM) contacted for major incidents. *Spill Kits will be placed on all operating machinery. *All vehicle, and equipment used on-site must be well maintained. Equipment	10	High

		Equipment oil and hazardous materials, which can result in soil and water contamination; and impact the receiving environment.	repaired, if necessary, by the Contractor prior to mobilizing to site. *Idling must be kept to a minimum. Any equipment not in use for extended periods of time must be switched off. *Refueling should be done on a concrete apron or prepared area and drip trays should be used to contain any spill. *Periodic inspections by the Environmental Manager (EM) will be conducted. Equipment deemed to be unacceptable by the EM will be sent off-site. *All fuel transfers should be done as far away as practical from drainage and water bodies (use one hundred feet 100 ft.) distance from water as a guideline). *Individuals fueling equipment should be trained and must ensure that fuel containers are properly sealed when they are transported. *There is to be no smoking on site.		
Accident for transportation of dispose materials	Transportation and Disposal	Traffic Accidents	*The transportation of the waste and other materials should be in a safe manner considering road traffic regulations.	3	Low

Safety for Workers	Construction	Accidents and Injuries	*The mandatory use of PPE (helmets, safety belts, masks, gloves, and boots) by workers depending on the nature of work. *All workers familiar with site emergency response plans and safety procedures. *All workers familiar with material handling procedures. *First responders identified and present on site.	5	Medium
OPERATIONAL PHASE					
Air and Noise Quality	Emissions from Heavy Equipment and Vehicles	Pollution	*Diesel and gasoline operating equipment must have preventive maintenance in compliance with applicable environmental regulations to prevent air pollution. *Gasoline operating equipment should have catalytic converters in good condition. Catalytic converters or filters for diesel equipment shall be incorporated, as required. *Hospital ventilation and air purification systems. *Outdoor air and return air of the air-handing system will have a filtration	3	Medium

			system to prevent the spread of bacteria, fungi and other pollutants. *Exhaust gas produced in the hospital will be treated before being discharged into the outdoor environment. *Refrigerants with a low environmental impact will be utilized. *Air-filtration systems will have regular inspections and maintenance. *If equipment (i.e., generators) are maintained on site, any maintenance or testing programs will be done during daytime working hours in order to prevent any discomfort or nuisance to neighbouring communities.		
Light Impacts	Operation Activities	Pollution	*The design should avoid spills from indoor lighting at night. *Avoid the use of ultraviolet light. *Light will be directed light away from residential and vegetative areas, tilted	2	Low

			downwards, and using light shades where necessary.		
Hazardous Waste, Solid Waste and Biomedical Waste	Operation Activities	Pollution	*Implement an Operational Solid Waste Management Plan. *Implement a Hazardous Waste Management Plan. *Medical grade waste will have designated infectious waste containers *Medical grade waste will be disposed of using high-temperature incineration or other effective sterilization methods *Classification and management of pharmaceutical waste will be implemented. *Proper classification, storage, and a dedicated waste management system with suitable treatment technologies will be established for chemical waste (Drugs, solvents). *Strict radiation standards will be maintained when handling radiological waste.	8	Medium

			*Professional electronic waste recovery and processing organizations will be engaged to dispose of electronic waste.		
Groundwater Quality	Landscaping activities	Runoff of pesticide and herbicide, fuels from the parking lot, and hazardous waste polluting	*Implement an integrated Pesticide and Herbicide Management Plan. *Use native plant species in the landscape design. *Installation of a proper drainage system that will consist of drain basins with oil interceptors.	5	Medium
Sewage and refuse disposal	Installation of Sewage system	Water quality	*During the operational phase, sewage and wastewater system will be placed away from retained vegetation and more than six feet (6 ft.) away from any buildings. The system will be operated and maintained according to DEHS standards. *Proper management of chemical use, storage and disposal within the Hospital. * Use of eco-friendly chemical agents. *Maintenance of building utility facility to ensure leaks don't contaminate groundwater.	1	Low

			*Establishment wastewater monitoring system that will detect any anomalies.		
Terrestrial Ecosystem	Operation Activities	Habitat Degradation-waste generated may be a hazard to wildlife and cause pollution.	*Implement a Wildlife Management Plan. *Implement an educational training programme for workers to follow as a way to manage wildlife. *Limit the use of herbicides and pesticides. If necessary, organic pesticides should be considered. *Prohibit hunting within the area.	2	Medium
Traffic and Transport	Traffic Congestion and/or accidents	Traffic accidents	*Implement pedestrian routes that will: - Be clearly separated from vehicle routes by fencing and/or a curb, or other suitable means. - Be wide enough to safely accommodate the number of people likely to use them at peak times. - Allow easy access to relevant local work, tourist and residential areas. - Be kept free of obstructions. - Be clearly and suitably signed.	5	Low

			*Implement vehicle routes that will ensure that: - Are wide enough to safely accommodate the number of vehicles likely to use them at peak times. - Allow easy access to delivery areas. - Are free of obstructions and are clearly and suitably signed. - Eliminate or reduce the need for reversing. - Provision of suitable parking areas. * Traffic Study.		
Electromagnetic	Use of medical, communication, and electronic equipment and power lines	Increase in radiation	*All standards set out by the Department of Environmental Health Services guidelines, regarding medical equipment will be followed. *All equipment should meet the electromagnetic compatibility standard and will be maintained and regularly calibrated.		

			*Communication equipment will be located away from sensitive areas and proper shielding devices should be used. *Standard-compliant electronic equipment will be used and regularly inspected and maintained. Power lines should be located away from sensitive areas and proper shielding devices should be used.		

8.2 Physical Environment Impacts and Mitigations

8.2.1 Groundwater Quality Impacts

Mitigating potential harmful effects to the groundwater quality is extremely important for the scope of construction. The groundwater on site is already contaminated (see Tables 10 and 11), therefore proper management should be implemented to prevent further contamination on site.

Existing contaminated standing water should be handled carefully as to avoid health and safety risk to personnel on site. The Department of Environmental Health Services (DEHS) and the Water and Sewage Corporation (WSC) should be contacted before commencement of works to locate and stop any sewage leaks that maybe originating from the surrounding communities. Existing contaminated water on site should be pumped into a deep well or a licenced contractor should be contacted to properly disposed of it. Proper PPE such as gloves, mask and eye protection should be worn during this process and all efforts should be made to avoid direct contact as to avoid infection. To prevent continuous contamination, any structures and waste generated by squatters should be removed. Any contaminated soil on site should be removed from site and not reused during construction activities. Contaminated debris and soil should be disposed of at the New Providence Ecological Park (NPEP). Additional testing should be done after mitigation measures stated above are completed and before commencement of any excavation works to be sure that the groundwater is no longer contaminated.

Construction Phase

Potential impacts to the groundwater quality during the construction phase include fuels spills, oils spills, leaching of wastewater, hazardous waste spills and utility installation. Introduction of fuel, oil and other wastewater into groundwater supply can cause contamination that can be considered harmful to the surrounding environment and neighboring community.

Fuel and Oil Spill

Fuel and oil spills can occur from improper handling and storage of fuel or oil on site, leaks from construction machinery, and improper fueling practices on site. This includes stationary machinery such as generators and tower lights or mobile machinery such as excavators and backhoe loaders. Introduction of fuel and oil into groundwater can cause contamination.

To help mitigate these concerns identifying the main source of potential releases during the construction phase is important. Fuelling sites/areas and the use heavy equipment vehicles on and around the site should be given special attention. The equipment will be stored on an asphalt surface or an area prepared with impermeable material. Oil spill kits will be kept onsite in or near machinery to clean up minor spills immediately. Oil rags

will be properly stored and disposed of at a licensed facility and a ticket produced as verification. A maintenance schedule and log will be used to ensure that equipment is maintained and ensure that any leaks that develop is fixed. Vehicles or holding tank that have leaks should be removed from site and fixed before a large volume release occurs into the environment. An area will be designated as the permanent maintenance location and will be prepared with an impermeable surface and an appropriate containment. Oil spill kits should be always kept nearby.

There should be no storage of large quantities of fuel on site. All refuelling activities should be done by trained workers and should be done as far away as practical from drainage and exposed groundwater (use one hundred feet 100 ft.) distance from water as a guideline). A Fuel Spill Prevention Plan will we outlined in the EMP.

Hazardous Waste

Impacts and mitigations related to Hazardous Waste spills is discussed in Section 8.2.4.2

Wastewater

Impacts and mitigation related to leaching of wastewater into ground water is discussed Section 8.2.4.3.

Utility Installation

As construction progresses the negative impact on groundwater quality increases from dewatering activities for utility trenching. Utility installation will require trenching efforts throughout the site. Excavations may encounter water which require pumping. If this occurs water must be expelled away from any from surrounding vegetation, and exposed groundwater.

Operational Phase

The operational phase presents the potential of runoff from pesticide and fertilizers, fuel spills from the parking lot, and hazardous waste polluting groundwater as well as standing surface water bodies. To reduce the need for pesticides and herbicides, native species will be used that are acclimated to the soil and climate conditions in The Bahamas. These plant species are more likely to become established and thrive on less water and chemical additives. An integrated Pest Management System should also be implemented for use of chemicals, preferably an organic pesticide, in limited quantities and as a last resort. The Integrated Pest Management System will be outlined in the EMP.

To prevent hydrocarbon fuels leaching into the groundwater system, the drainage system will consist of drain basins with oil interceptors. Drainage basins should be connected to a deep well. Standard operating procedures are to be developed in the Operational Management Plan and enforced to reduce the chance of spills.

8.2.2 Erosion and Sediment Impacts

The Project is expected to have minor excavation activity for land clearing and site grading activities to accommodate the development of roadways, the parking lot and the hospital's foundation. This has the potential to cause erosion and sedimentation as some of the vegetative features in the affected area that act as a sponge for run-off and rain catchment will now be removed. Erosion and sedimentation can be harmful to the environment, as it can cause groundwater pollution, and negatively impact surrounding vegetation and wildlife. Clearing will only be done for the footprint of works, therefore, erosion impacts associated with The Project is expected to be low overall.

The implementation of an effective erosion and sediment control plan during the construction phase will help mitigate against erosion impacts. It may include the use of silt curtains for the exclusion of sediment into any retained vegetation, trenches or exposed water during times of clearing and grubbing.

8.2.3 Flooding Impacts

The risk of flooding is of great concern as The Project site contains historic wellfields that act as a natural drainage from surrounding communities. Several activities during the construction phase also have the potential to create flooding, including dewatering of trenches for utilities, clearing of land and the removal of any ground material. These activities have the potential to cause a reduction in the absorption, evaporation, and infiltration rates of water into the soil. This will result in the increase in standing water around the site and increase the risk of flooding during significant rains, and extreme weather conditions including effects from climate change and hurricane season.

As The Project nears completion the increase in impervious surfaces for buildings, roads, roofs and gutters, can result in an increase in the amount of water entering the proposed drainage system. To help mitigate the effects of flooding several measures can be implemented:

- The development of an adequate drainage system that can handle flood water from rainfall or the weather changes.
- The construction of drainage retention ponds or swales designed to collect and drain water at a fast rate.
- Buildings should also be elevated to reduce the risk of flooding in the event of extreme weather and flooding conditions.
- Establishment of flood control ditches to allow to reduce the risk of rain-induced flooding.
- Regular cleaning and maintenance of the drains.
- Revegetation of areas to reduce erosion and slow the rate of stormwater runoff.
- Constructing sedimentation basins to temporarily store stormwater.
- Having permeable areas in the parking lot to reduce standing water and runoff.

There is currently only one (1) drainage flow located on The Project site. Stormwater tends to flow from the higher elevation in the southwest to lower elevations in the northeast (See Figure 18). The new drainage plan will include drainage swales and flood control ditches to ensure that stormwater is collected and diverted from surrounding communities (See Figure 19).

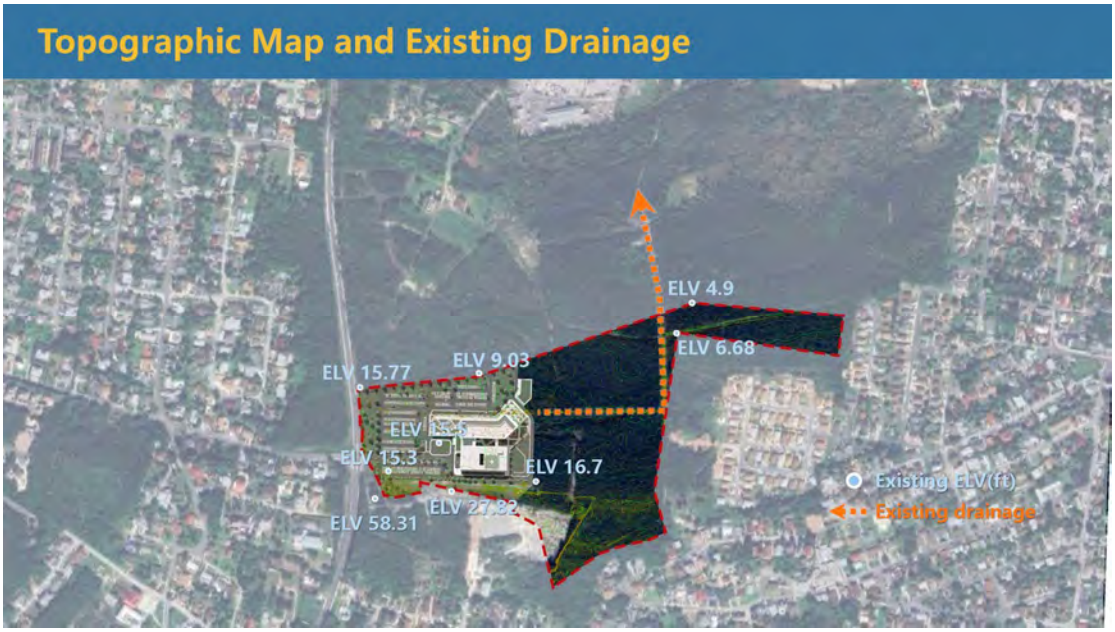


Figure 18: Existing drainage at The Project site

Figure 19: New drainage at The Project site

8.2.4 Solid Waste Impacts

Waste generated during the construction and operation phases can negatively impact the site, surrounding vegetation, and the neighbouring community. Solid waste, in particular material that take long to degrade, can have numerous negative impacts to wildlife and terrestrial ecosystems and are usually caused by improper waste management. Increased pollution in the terrestrial environment has the potential to degrade the habitats utilized by avifauna and other fauna species observed on site. During weather events, solid waste can be transported beyond The Project site, which will negatively impact the surrounding residential communities. Accumulation of solid waste also has the potential to reduced air quality, pollute exposed groundwater and lead to the introduction of pest on the site.

New Providence has an organized and managed waste management system at the New Providence Ecological Park (NPEP). The Project should seek to reduce the production of waste and recycle material as much as possible. This will help to reduce and/or eliminate any solid waste from entering the adjacent environment and residential communities. Waste bins should be provided and secured on site and emptied on at least a weekly basis. Waste bins should contain signs listing or showing symbols of items that can be disposed of.

8.2.4.1 Land Clearing Debris

Vegetative waste will be created during clearing and grubbing activities on site. Native vegetation that are removed will either be replanted or mulched and placed along untouched plants to provide nutrients as they decompose. Invasive species encountered should be sorted separately and should not be incinerated or used as mulch to prevent spread throughout the site. The entire tree and root system of the invasive species may be carefully cut and treated with herbicide then removed manually or by heavy equipment. All invasive species debris should be handled properly ensuring that all seedlings are removed and disposed of according to the Invasive Species Management Plan outlined in the EMP.

8.2.4.2 Hazardous waste management

There is the potential for hazardous waste impacts associated with the construction and operational phases.

Construction Phase

Hazardous materials such as concrete, paint, solvents and other chemicals may be high in pH and are considered harmful to the surrounding environment and neighbouring communities.

Protection of groundwater, and any other sensitive environments is of most importance; therefore, there shall be no contact with groundwater through spillage, hosing off surfaces, rain, cleaning of tools or concrete washout. A concrete and equipment washing site will be bunded, lined to contain any concrete and chemicals. All accepted washing

locations must be cleaned up prior to demobilization. Any excess material shall be removed upon Project completion, and transported NPEP to be disposed of.

All hazardous materials brought on site should be accompanied by material safety datasheets (MSDS). These sheets detail proper handling, storage and disposal techniques for use of hazardous materials as well as proper treatment if persons are exposed to the materials. All MSDS should be accessible to staff who will be in contact with or using the hazardous materials, so they understand how to safely use them.

To help mitigate the effects of hazardous waste several measures can be implemented:

- All equipment and hazardous material (such as used absorbent pads) will be stored in designated waste bin/locations to reduce the risk of spills and pollution events into the environment. Storage facilities should be free from obstruction, structural defects, and covered to prevent the potential of mixing with water and only used to store hazardous waste.
- Appropriate signage should be used to depict hazards in the area as well as a "NO Smoking" sign.
- Temporary storage facilities will be inspected at least once a day by designated staff to check for leaky containers. Access should be limited to these designated persons.
- Hazardous Waste storage facilities at the site will have disposal containers that are covered, made of inflammable material, sealed to prevent leaking, and positioned on an impervious surface as far from any water as possible. Secondary containment for all disposal containers should be one hundred and ten percent (110%) of the maximum volume of the container.
- Appropriate spill containment and clean-up equipment will be easily accessible near hazardous waste storage facilities.
- Disposal of all hazardous waste utilized or generated during construction will occur offsite by a licensed contractor at a licensed facility as per DEHS requirements. Hazardous waste should be collected as quickly as possible after being generated.

Operational Phase

The operational phase presents the potential for accumulation hazardous and medical waste onsite. Improper handling and disposal of the hazardous waste can cause contamination of groundwater and the surrounding terrestrial environment, as well as transmit disease, negatively affecting neighbouring communities.

Medical Grade Waste

To prevent disease transmission and contamination due to medical grade waste the following measures will be followed:

- Designated infectious waste containers will be used for collection of waste that can transmit disease. Waste will be disposed of using high-temperature incineration or other effective sterilization methods.
- Classification and management of pharmaceutical waste will be implemented. A recovery system will be used to reclaim unused drugs to prevent pollution of the environment.
- Proper classification, storage, and a dedicated waste management system with suitable treatment technologies will be established for chemical waste (drugs, solvents) from laboratories, operating rooms, etc.
- Strict radiation standards will be maintained when handling radiological waste.
- Professional electronic waste recovery and processing organizations will be engaged to dispose of electronic waste to prevent contamination of the surrounding environment.

All private waste management companies will be approved by DEHS and Ministry of Health and Wellness (MOHW) before commencement of operations.

A proper Operations Waste Management Plan and Operational Hazardous Waste Management should be established for management of waste at the hospital. The plan should meet the standards set by DEHS and include The Environmental Health Service Act regulations for the domestic, hazardous and medical waste disposal.

8.2.4.3 Sewage and Waste Refuse

The improper disposal or treatment of human waste can result in a breathing ground for diseases and can negatively impact human health. During the construction phase, portable potties will be distributed throughout the site and will require weekly maintenance. Portable toilets should be serviced bi-weekly by a licensed company. To prevent leaching of wastewater into the groundwater or surface bodies, any portable toilet(s) that are on-site should be secured to avoid vandalism and to prevent them tipping in windy conditions. Toilets must be located more than one hundred and fifty feet (150 ft.) from the any exposed groundwater.

During the operational phase, hospital activities will result in the production of wastewater and sewage from bathroom facilities, laundry facilities, kitchen as well as from hospital wards and theatres. The wastewater may contain drug residues and pathogens from provided medical services and as well as chemicals like detergents and disinfectants used in laundry services. To ensure the environment it protected the following mitigation measures will be included:

- A sewerage and wastewater system. The sewage and wastewater system will utilize facilities such as sedimentation tanks and biological filters to ensure waste is treated before being discharged. The sewage and wastewater system will be placed away from remaining vegetation and more than six feet (6 ft.) away from

any buildings. The system will be operated and maintained according to DEHS standards.

- Proper management of chemical use, storage and disposal within the hospital. Eco-friendly chemical agents will be used.
- Maintenance of building utility facility to ensure leaks don't contaminate groundwater.
- Establishment wastewater monitoring system that will detect any anomalies.

8.2.5 Air Pollution and Dust Abatement

Land clearing, excavations and construction activities all have the potential to increase dust accumulation on site. Dust can cause eye irritation, respiratory issues and cause other hazards to human health. The surrounding environment will also be affected as dust can coat surrounding leaves and produce. To reduce the impact of dust on site, the following activities should be implemented:

- Clearing should only include the footprint needed for construction or thirty-five percent (35%) of the site.
- Water is to be used as a dust retardant as needed.
- Screening and fencing should be used to reduce wind, improve aesthetics, and mark the limit of works.
- The use of Proper Protective Equipment including dust masks and eyewear/safety glasses.
- Dump trucks moving loose material are to be covered with tarpaulins.

During the operational phase, equipment and operational activities on site has the potential to cause air pollution. These include pollutants such as anaesthesia gases and disinfectants in the operating room, drug preparation techniques in the pharmacy and various chemical reagents from laboratory services and testing. To prevent the release of contaminates and pathogens during operation of the Hospital, the laboratory and pharmacy will have ventilation and air purification systems. The outdoor air and return air of the air-handing system will have a filtration system to prevent the spread of bacteria, fungi and other pollutants. Also, all exhaust gas produced in the hospital will be treated before being discharging it into the outdoor environment. All diesel and gasoline operating equipment should be regularly maintained. Gasoline operating equipment should have catalytic converters in good condition and the catalytic converters or filters for diesel equipment shall be incorporated, as required.

8.2.6 Noise Pollution

The Project construction activities will increase the level of noise that will affect nearby businesses and residences. The general rule shall be that construction operations be restricted to daylight hours between 0700 hrs. and 1900 hrs. Any reason to work outside these hours to speed up the progress of works, local communities will be given advance

notice and specific requests will be reasonably accommodated. A batch plant will also be located on the site to reduce noise levels produced by movement of cement trucks.

Operational Phase

During the operational phase, an increase in noise produced by emergency sirens, machinery (i.e. generators and HVAC system) and increase in traffic can cause discomfort to neighbouring residents and businesses. To decrease noise pollution during the operational phase, if equipment (i.e., generators) are maintained on site, any maintenance or testing programs will be done during daytime working hours in order to prevent any discomfort or nuisance to neighbouring communities. In regard to increase in noise pollution caused by emergency sirens, procedures will also be implemented to ensure that sirens are silenced a certain distance away from the hospital. Increase in noise caused by traffic increase will be discussed in section 8.4.6.

8.2.7 Light Pollution

The general rule shall be that construction operations be restricted to daylight hours. Any reason to work outside these hours to speed up the progress of works, local communities will be given advance notice. If construction is to occur during hours when enough daylight is not available, and lighting of the work area is required, the Contractor is expected to manage excess lighting and glare by:

- Strategic placement of lights only where necessary and away from residential communities and remaining greenspaces,
- Tilting lights downwards, and
- Using shielding to restrict the glare of lights.

During the operational phase lights will be utilized at night for the purpose of securing the site. The Project design should ensure that outdoor lighting is managed properly as to avoid disturbing adjacent residences and wildlife in the area. Management measures include methods mentioned above as well as:

- The design should avoid spills from indoor lighting at night.
- Avoid the use of ultraviolet light.

8.2.8 Electromagnetic Radiation Pollution

During the Operational Phase, electromagnetic radiation pollution can come from medical equipment such as X-rays and MRI's; communications equipment such as Wi-Fi and mobile phones; electronic equipment such as computers, monitors, etc. and power lines. To mitigate against pollution due to electromagnetic radiation the following measures will be implemented:

- All standards set out by the DEHS guidelines, regarding medical equipment will be followed, this will include effective shielding measures, and setting up of

protective isolation zones. All equipment should meet the electromagnetic compatibility standard and will be maintained and regularly calibrated.
- Communication equipment will be located away from sensitive areas and proper shielding devices should be used.
- Standard-compliant electronic equipment will be used to avoid excessive electromagnetic radiation. Equipment will also be regularly inspected and maintained.
- Power lines should be located away from sensitive areas and proper shielding devices should be used.

8.3 Impacts on the Natural Environment

Potential impacts to the natural environment include habitat loss as a result of land clearing; the introduction of invasive species through imported flora; and the use of chemicals such as pesticides and herbicides.

8.3.1 Impacts on Wildlife

Wildlife on site can be impacted due to land clearing activities. Land clearing can cause a decrease in native wildlife due to habitat loss and habitat fragmentation. This can cause an increased risk of predation due to the lack of shelter and reduced food availability. The proper management of wildlife, specifically nesting birds is extremely important.

During construction, if wildlife is encountered (e.g., nesting birds, or injured fauna, juvenile animals), construction should be halted immediately and that information should be passed on to the Environmental Manager and/or Environmental Monitor. Animals will be relocated to nearby suitable habitat not impacted by development. Additional mitigation measures that should be implemented to ensure management of wildlife present at the site include:

- All site inductions will include guidance on how to deal with wildlife encounters, including any species at risk that may be present, and arrangements for dealing with injured or orphaned wildlife. This guidance should be summarized in a handout suitable for quick reference by on- site staff and be available in areas that all employees on site will have access to.
- Prior to clearing vegetation, the environmental manager or wildlife specialist will schedule inspections for wildlife, installation of protective fencing, pre-stressing, and onsite briefings for Contractors.
- Where possible, bees should be removed manually using a professional beekeeper to smoke, vacuum and trap the hive.
- Areas of retained vegetation should be identified and clearly marked with fencing and signage.
- A site map should identify areas prone to wildlife appearance and areas that should be avoided, if possible, to prevent disturbing of habitat.

- Clearing of pathways for greenspaces are to be done manually and not by heavy equipment.

During the operational phase an Employee Wildlife Management education training programme should be designed and implemented. This programme should include prohibiting hunting and harassment of wildlife within The Project vicinity and protocol in the event of wildlife encounter. Also, avian-friendly lighting will be used to minimize impacts to birds during the night.

8.3.2 Impacts on Vegetation

Construction activities and development will result in the loss of existing natural vegetation including protected species; the introduction of invasive species through imported flora; the introduction of rodents as a result of poor sanitation; and use of pesticide and fertilizers that can directly or indirectly impact wildlife. Land clearing places strenuous pressures on the environment and can result in habitat loss and habitat fragmentation of native vegetation. The construction of the medical facility and parking lot is expected to impact a total of thirty-four thousand square meters (34,000 m^2) of vegetation.

To reduce the effects of terrestrial habitat loss, habitat restoration is proposed. Various flora removed for construction will be replanted in the areas selected for restoration. The landscape palette should have an integration of native species mixed with ornamentals, which will include protected species and species present on the site in its natural state. Native population will be sourced locally as much as reasonably possible to help maintain the native genetic plant diversity. The design of the landscape will be low impact and based upon xeriscape principles which will reduce and help eliminate the need for irrigation maintenance. If flora must be imported, no prohibited species will be included in the landscaping. All invasive species encountered will be removed and disposed of according to the Invasive Species Management Plan outlined in The Bahamas Hospital Project EMP.

No hazardous substances will be allowed to escape into remaining vegetation at The Project site. To help mitigate these concerns the following measure will assist is preventing contamination (For more details see the Fuel Spill Prevention Plan in The Bahamas Hospital EMP).

- Spill Kits will be placed on all operating machinery.
- All vehicles and equipment used on-site must be well maintained.
- Idling must be kept to a minimum. Any equipment not in use for extended periods of time must be switched off.
- Large quantities of fuel should not be stored on site.
- Equipment shall be inspected, and repaired, if necessary, by the Contractor prior to mobilizing to site.

- Maintenance laydown will be located away from remaining vegetation adjacent to site.

Fires

Fires at a construction site can endanger the lives of personnel on site; as well as destroy the terrestrial ecosystem leading to a decrease in food and shelter for fauna utilizing the area. Some of the mitigation measures to prevent fires include no smoking on site, proper handling and storage of fuel on site, and regular training and fire drills. A full Fire Control Plan will be outlined in The Bahamas Hospital Project EMP.

Pesticide and Herbicide Management

Pesticides and Herbicides can leach into groundwater causing contamination and unintendedly harm fauna species utilizing the area. A program that employs use of chemicals as a last resort, with a preference for organic pesticides and fertilizers that will not leach, will be implemented in landscaping to minimize the effects from pesticides and herbicides. A Pesticide and Herbicide Management Plan will be detailed in the EMP.

Pest Control Management

Pests contribute to the destruction of habitats, natural resources, and native plants that provide food and shelter to native fauna species. They also spread diseases which can affect human health and can be detrimental in some cases.

To prevent the introduction of pest on site, the following measures should be followed:

- The site should ensure that all food waste is secured and disposed of on a regular basis. If necessary, rats and other vermin should be dealt with by a licensed exterminator.
- The Department of Environmental Health Services should be contacted to fumigate for mosquito infestation.

A detailed Pest Control Management Plan will be outlined in The Bahamas Hospital Project EMP.

8.4 Socioeconomic Impacts

8.4.1 Land Use Impacts

The Project will require modification/removal of the natural terrestrial ecosystem. To mitigate against loss of the natural environment, construction activities will be limited to the footprint of works or about thirty-five percent (35%) of the land area. Green spaces immediately surrounding the facility will be retained.

8.4.2 Community Impacts

There is a potential for resistance from surrounding communities about construction impacts such as noise and dust. This will be mitigated through proper monitoring during construction and stakeholder engagement. Stakeholder engagements will present the purpose of The Project, objective of The Project, scope of works, baseline data, monitoring programme and outline the possible impacts and mitigation measures. A meeting should be held to present the hospital design and how that design insulates the facility from the immediately surrounding community through the erection of walls and fences, noise, light and dust control measures, the maintenance of green spaces immediately surrounding the facility and other such landscaping and design elements.

Daily monitoring of The Project will be done by an Environmental Management Team who will track all environmental inspections and potential hazards. They will ensure that environmental measures are implemented prior to commencement of works and enforce all hold points. They have the authority to stop works because of environmental issues.

8.4.3 Economic Impacts

Overall, The Project is expected to have a positive impact on the economy through job generation, capital investment and local sourcing of some material.

8.4.3.1 Job Generation

Development of The Project will create new job positions for Bahamians both during the construction and operational phases. Jobs will be generated through:

1. Employment of Bahamian contractors during the operational and construction phase.
2. Jobs managing and operating the medical facility.

The approximate number of workers scheduled to work during the construction phase of The Project is To Be Determined (TBD). In terms of labour, in addition to Bahamian workers, there are also the labour workers from Haiti, the Dominican Republic and other surrounding countries. It is expected that approximately that eighty percent (80%) of The Project workforce will be Bahamian.

During the operational phase, The Project is expected to house four hundred (400) patients per day, and six hundred and fifty (650) staff members.

8.4.3.2 Capital Investment

The Bahamas Hospital Feasibility Study outlines the estimated costs, methods of procurement, and construction procedures regarding the planning, and design of the proposed Bahamas Hospital Project. The feasibility study notes that these estimates represent the best judgment at this preliminary stage of The Project and is only intended to assist in decision making to move The Project forward. The cost of may be updated and will be kept under the control of MoHW.

The complete development of The Project will require significant capital investment. It is estimated that approximately US$289,398,499.58 will be invested into The Project. Of the total estimated, US$238,775,771.87 will be allocated for building construction and site development, including the parking area. The balance will be required to purchase medical equipment and furniture.

According to the feasibility study, whether The Project is fast-tracked in some manner or procured using a conventional Design-Build-Equip process, it is anticipated that the estimated costs as proposed will vary little.

The Feasibility Report breaks down the estimated cost in Table 15 below.

Table 15: Estimated Cost of The Bahamas Hospital Project (According to The Bahamas Hospital Feasibility Study)

Estimated Cost ($))	**m2**	**$/m2**	**Estimated Cost**
Total Program building Gross	34,000.00	6,092.98	207,161,331.07
Site Development	202,464.00	101	20,448,864.00
Parking (510 Pk Lots)	17,956.73	160	2,873,076.80
Design Fee			6,505,000.00
Commissioning M and E and Balance			287,500.00
Training, Commissioning, and Auxiliary Civil Works for Major Equipment.			1,500,000.00
Total Building Estimation Cost			**238,775,771.87**
Major Medical Equipment			**50,622,727.71**
Value-Added Tax (VAT)		10%	
Total Project Cost			**289,398,499.58**

8.4.3.3 Material Source

Some materials needed during the construction phase will be purchased throughout The Bahamas where feasible. Materials such as sand and fill are to be sourced from an approved company with license to mine the needed resources. Due to the modern design of the hospital, new construction technology will need to be utilized during construction. For this reason, most materials and machines will be imported or transported from other countries. The small construction machines and hardware materials will be locally purchased or rented to meet the construction requirements.

Importing material and machinery can also impact the construction timeline as procurement and delivery of materials can be prolonged due to many factors including bad weather and schedule delays.

8.4.4 Commissioning and Utilization of Hospital Services

Resistance from the private sector and acceptance of The Project by the community has the potential to affect the construction of The Project. The Private sector may pose resistance as the construction of The Project may threaten their projected financial plans. However, this impact is anticipated to be low as construction of the hospital is under the government's mandate to provide quality and equitable services to the public.

Due to the need for new hospital infrastructure and upgrades in services provided to the public, it is unlikely that there will be significant challenges with the community's acceptance of The Project. To mitigate any impacts and address any concerns and comments that the general public may have, townhall/stakeholder meetings with the Bahamian population, both in New Providence and across the archipelago will be conducted.

8.4.5 Real Estate Value

There was no Real Estate Value Assessment completed for this Project. However, research on other hospital developments has shown that surrounding communities tends to have a positive impact on property value. There is an increasing desire for properties near highly rated or larger hospitals (Clarke 2024). Thus, as the demand increases, so does the property value. Below are a few reasons for the increase value:

- Hospitals are opportunity hubs providing jobs with high wages.
- Job opportunities attract people which evokes the need for amenities in the area.
- Homes in these areas become more attractive to buyers, as they offer convenient access to advanced healthcare services.
- The development of healthcare infrastructure leads to an overall economic growth nationally, further boosting property values.

As a result, property owners may experience faster appreciation and the potential for higher rental rates.

8.4.6 Safety for Workers

The safety of workers on site is high priority for The Project. The aim is to ensure that the Contractor, Sub-contractors, their staff, and all visitor know and follow all rules and regulations of the site to prevent and limit any accidents and incidents from occurring. All workers on site should have induction training which outlines the health, safety and environmental rules and regulations for the site. Mandatory use of PPE such as hardhats, eye protection, masks, gloves, safety vest and boots should be worn by workers at all times. All personnel on site should be familiar with material handling procedures, emergency response plans and safety procedures. First Aid kits and First Aid responders should be identified and present on site.

8.4.7 Traffic Impacts

The proposed Project site has an irregular shape and is located east of the traffic light at the T-junction formed by the intersection of Sanford Drive and Bethel Highway – North. During construction there will be an increase in traffic (mainly large trucks) to and from the site. There is only one entry and exit point and there will be an increase in traffic on the main thoroughfare. The increase in vehicular traffic, movement of heavy machinery and change in traffic patterns due to road closures (if necessary) can cause impacts to the safety of road users (vehicular and pedestrian) and cause discomfort to the community due to increased noise, and increased emissions.

To mitigate the traffic impacts, the following strategies should be employed:

- Notice should be given to the community of the commencement of work and possible traffic inconveniences.
- Signage will need to be placed at the site entrance/exit and the main thoroughfare.
- Heavy machinery should have a banksman to assist in manoeuvring on and off site.
- Flagmen should be placed strategically at the site's entrance, exit, and onto the main thoroughfares to direct activities.

During the Operational Phase designated pedestrian and vehicle routes should be established to limit accidents and to provide safety for staff and visitors to the Hospital. These routes should be clearly designated by signage and strictly adhered to. Below outlines protocols for vehicle and pedestrian route.

<u>Pedestrian routes will:</u>

- Be clearly separated from vehicle routes by fencing and/or a curb, or other suitable means.
- Be wide enough to safely accommodate the number of people likely to use them at peak times.
- Allow easy access to relevant local work, tourist and residential areas.
- Be kept free of obstructions.
- Be clearly and suitably signed.

Vehicle routes will:

- Be wide enough to safely accommodate the number of vehicles likely to use them at peak times.
- Allow easy access to delivery areas.
- Are free of obstructions and are clearly and suitably signed.
- Eliminate or reduce the need for reversing.
- Provision of suitable parking areas.

A traffic study will be conducted for both the construction and operational phase to gather accurate information about the movement and behaviour of traffic within the vicinity of the development. This information will be used to assess the potential impact of The Hospital on the surrounding road network and predict traffic movement, volume and flow during operation of The Hospital. Traffic measures to increase traffic flow, reduce noise pollution and overall improve movement as outlined in this study would be taken into consideration. The traffic study will be added to the EIA prior to commencement of activities.

9.0 CONSTRUCTION AND OPERATIONAL ENVIRONMENTAL MANAGEMENT PLAN

The Environmental Management Plan (EMP) is a written document that provides a guideline for the practices to use to avoid potential environmental impacts. It details the mitigation measures to minimize/eliminate potential negative environmental impacts of the proposed Project; and to ensure The Project utilizes best management practices for all activities and project components.

9.1 Construction Phase

9.1.1 Construction Environmental Management Plan (EMP) Terms of Reference (TOR)

I. Executive Summary
II. Introduction
III. Project Description
IV. Laws, Regulations and Requirements
V. Government Departments
VI. Environmental Management Framework
VII. Environmental Management Tools
VIII. Register of Significant Aspects and Impacts
IX. Environmental Impacts
X. Management Plans and Mitigation Strategies
XI. Emergency Response Plan
XII. Public Consultation
XIII. Monitoring and Reporting
XIV. Conclusion

9.1.2 Construction Management Plans

Below includes brief descriptions of the management plans the Contractor must implement and adhere to in order to avoid unnecessary disturbance or damage to the environment. Full management plans will be outlined in The Bahamas Hospital EMP.

9.1.2.1 Sediment Control Plan

Protecting groundwater and other environmentally sensitive areas is of great importance during construction of The Project. The goal of this plan is to ensure that the groundwater and the retained vegetation surrounding the site are free from the risk of nonpoint source pollutants. The main construction activities that pose the greatest risk to groundwater contamination are, land clearing, transport, deposit of fill material on site, stockpile erosion, base formation, and dewatering. Some of the mitigation measures include defining the site boundaries using measures such as silt fencing; creating a buffer zone between the retained vegetation and the construction site; and implementing dust control measures.

9.1.2.2 Flood Control Plan

With the changes to the environment due to construction, the natural flow of water will be affected. Also, The Project site was observed to have standing water and contains historic wells that act as a natural drainage from surrounding communities; therefore, flood control management is a high priority for the construction phase. The goal of this Flood Control Plan in to outline measures to reduce the risk of flooding on site during the construction phase. The activities that have the potential for flooding include earthworks and utility installation during construction. Extreme weather events such as hurricanes also pose a risk of flooding. Some of the mitigation measure that will be implemented include, dewatering into a deep disposal well, use of porous pavement material, and installation of gutters, drainage basins and drainage/retention ponds.

9.1.2.3 Traffic Management Plan

Development of The Project will result in an increase in commercial traffic (mainly large trucks) to and from the site. The goal of the Traffic Management Plan is to minimize impacts on the public road system and establish protocols for vehicle and pedestrian movement within the site boundary. Some of the mitigation measure to be implemented include identifying clear control parameters on site such as flagman and signage and establishing/maintaining routes for personnel and vehicles.

9.1.2.4 Waste Management Plan

Implementation of a Waste Management Plan will ensure the protection of human health, environmental health and groundwater supply. The goal of this plan to ensure that the site employs waste reduction and recycling practices to reduce or re-use where possible and recycle where feasible. The plan should be communicated to all persons entering the site as it requires full cooperation of all employees and visitors. All waste material should be properly stored, then sorted/separated and considered for reuse or recycling before being removed and disposed of at the New Providence Ecological Park (NPEP). This plan

will outline how non-hazardous waste such as wood, glass, plastic, paper, food etc.; and hazardous waste such as adhesive, aerosol cans, paint and paint thinners, solvents, concrete, asphalt, lightbulbs, batteries, and insulation should be handled and disposed of.

9.1.2.5 Noise and Light Control Plan.

Noise and light disturbances should be managed to reduce the impacts to the surrounding communities and wildlife. The goal of this plan is to provide measures to mitigate against noise and light pollution. Some of these measures include restricting working hours to be between 0700 hrs. and 1900 hrs., maintaining equipment in good working order, strategic placement of lights away from residential areas, and tilting lights downwards.

9.1.2.6 Air Pollution Control Plan

Air pollution due to construction activities need to be managed to reduce the impacts to workers on site, the surrounding communities and wildlife. The goal of this plan is to provide measures to mitigate against dust and air pollution. Some of these mitigations measured include; using water to spray earthworks, roads and other surfaces as necessary to reduce dust generation; maintaining all construction equipment to reduce exhaust emissions; and visually monitor levels of dust deposition and air quality on site.

9.1.2.7 Sewage Management Plan

Ensuring the protection of human health, and ground water supply is of great concern on this Project site. The improper disposal or treatment of human waste can result in a breathing ground for diseases and can contaminate groundwater. The purpose of this plan is to clearly define the controls that will be used to manage wastewater generated on The Project site. Mitigation measures include proper placement and maintenance of portable toilets during the construction phase. All sewage generated will be treated according to standards provided by DEHS and WSC and be positioned away from any sensitive environments.

9.1.2.8 Terrestrial Ecosystem Management Plans

Terrestrial Management Plans will be implemented to protect the natural environment during construction activities. Terrestrial Management Plans listed in Table 16 below will outline the impacts and appropriate mitigation measures to be used to protect ecosystems within and surrounding The Project site.

Table 16:Summary of the Construction Terrestrial Management Plans

Management Plan	Impact	Mitigation
Vegetation Management Plan Purpose: Details measures to reduce the effects of vegetation and habitat loss	• Terrestrial habitat loss. • Loss of protected and endemic species.	• Removal restricted to the base footprint. • Installation of fencing to protect

for areas within and surrounding The Project site.		from encroachment, illegal dumping, and damage from machinery. • Site walkover prior to commencement of work. • Habitat restoration - Reuse of protected trees during restoration. • Removal of invasive species.
Hunting Management Plan Purpose: Protect the native fauna populations in the area against hunting activities.	• Disruption and reduction of wildlife populations.	• No hunting permitted during construction and operation.
Pesticide and Herbicide Management Plan Purpose: Outline measures for proper handling of pesticides and herbicides.	• Contaminate surrounding soil, groundwater and vegetation. • May unintentionally kill and infect wildlife in the area.	• Planting native species. • Use chemicals as a last resort.
Fire Management Plan Purpose: Coordinate the response of the workers in the event of a fire, and detail steps to prevent, contain and control fires during the construction and operation phase.	• Endanger the lives of workers. • Can cause severe structural damage; destruction of machinery, equipment or materials; and cause untimely delay in project completion. • Destroy food source and shelter for wildlife.	• Proper fuel handling and storage. • Establishment of fire breaks. • No smoking on site • The presence and maintenance of all 'classes' of fire extinguishers. • Regular training and fire drills for staff.

		• Proper storage and handling of combustible material. • Good housekeeping.
Pest Control Management Plan Purpose: Outline measures to prevent the introduction of new pests.	• Destruction of habitat. • Depletion of natural resources. • Depletion of native plants that provide food and shelter to native wildlife. • Spread diseases which can affect human health.	• Regular inspection of areas where infestation is likely to occur. • Inspection of incoming materials and goods. • Frequent cleaning of facilities, especially spaces where food is stored and prepared. • Installation and regular removal of traps by a licensed pest control company. • Ensure the removal or maintenance of areas with stagnant water to reduce mosquito numbers. • Use pesticide as a last course of action.
Wildlife Management Plan Purpose: Detail measures for preventing harm wildlife present on site. Outline what steps should be taken by staff should they encounter any wildlife on site.	• Disruption, injuring or killing wildlife as a result of construction activity. • Reduction in wildlife population.	• Construction should be halted immediately when a nest or wildlife is discovered. • Inform the Environmental Monitor/Manager of wildlife discovery. • Consult with wildlife specialist

		such as Animal Control, and Ardastra Gardens & Wildlife Conservation Centre for assistance when necessary.

9.2 Operational Phase

9.2.1 Example Environmental Management Plan (EMP) Terms of Reference (TOR)

I. Executive Summary
II. Introduction
III. Environmental Objectives and Targets
IV. Laws, Regulations and Requirements
V. Hospital Policies and Procedures
VI. Environmental Management Framework
VII. Environmental Management Tools
VIII. Register of Significant Aspects and Impacts
IX. Environmental Impacts
X. Management Plans and Mitigation Strategies
XI. Monitoring and Improvement Strategies
XII. Emergency Response Plan
XIII. Conclusion

9.2.2 Operation Management Plans

Below includes brief descriptions of the management plans The Hospital is required to include in the operational EMP in order to avoid unnecessary disturbance or damage to the environment. Full management plans will be outlined in The Bahamas Hospital Operational EMP.

9.2.2.1 Traffic Management Plan

Development of The Project will result in an increase in commercial traffic (ambulances, staff, and visitors) to and from The Hospital. The goal of the Traffic Management Plan is to minimize impacts on the public road system and establish protocols for vehicle and pedestrian movement within the site boundary. A Traffic Study will be implemented to ensure efficient flow of traffic in the areas surrounding The Hospital.

9.2.2.2 Flooding

The Project site was observed to have standing water and contains historic wells that act as a natural drainage from surrounding communities; therefore, flood control management is a high priority for the operational phase. The activities that have the

potential to cause flooding during the operational phase include, storm water runoff as well as direct runoff from precipitation. Extreme weather events such as hurricanes also pose a risk of flooding. Some of the mitigation measure that will be implemented include, maintenance of the drainage system, revegetation of areas to reduce erosion and slow the rate of stormwater runoff, and having permeable areas in the parking lot.

9.2.2.3 Waste Management Plan

Implementation of a Waste Management Plan will ensure the protection of human health, environmental health and groundwater supply. The goal of this plan to ensure The Hospital employs waste reduction and recycling practices to reduce or re-use where possible and recycle where feasible. The plan should be communicated efficiently as it requires full cooperation of all employees and visitors. The Waste Management Plan should include how medical, hazardous, non-hazardous, and domestic waste will be handled and disposed of. Mitigation measures to include, designated infection waste containers for medical grade waste, a classification and management system for pharmaceutical waste, proper management, handling and storage of chemical waste and procedures and standards for handling radiological waste. All waste material should be properly stored, then sorted/separated and considered for reuse or recycling before being removed and disposed of at the New Providence Ecological Park (NPEP). All private waste management company for The Hospital will be approved by DEHS and Ministry of Health and Wellness (MOHW) before commencement of operations.

9.2.2.4 Noise and Light Control Plan.

Noise and light disturbances should be managed to reduce the impacts to the surrounding communities and wildlife. The goal of this plan is to provide measures to mitigate against noise and light pollution. Some of these measures include; maintaining equipment in good working order, procedures for minimizing siren noise, strategic placement of lights away from residential areas, and tilting lights downwards.

9.2.2.5 Air Pollution Control Plan

Air pollution due to operation activities need to be managed to reduce the impacts to the surrounding communities and wildlife. The goal of this plan is to provide measures to mitigate against dust and air pollution. Some of these mitigations measured include but are not limited to having ventilation and air purification systems; using low impact refrigerants; maintaining all equipment and machinery such as the HVAC to reduce exhaust emissions; ensuring all air filtering systems are operational; and treating the exhaust before discharging it into the outdoor environment.

9.2.2.6 Sewage Management Plan

Ensuring the protection of human health, and ground water supply is of great concern on this Project site. The improper disposal or treatment of human waste can result in a breathing ground for diseases and can contaminate groundwater. The purpose of this plan is to clearly define the controls that will be used to manage wastewater generated during operation. Mitigation measures include installation and management of a

wastewater treatment plant during the operational phase, proper handling, storage and use of chemicals, the use of eco-friendly chemicals and establishment wastewater monitoring system. All sewage generated will be treated according to standards provided by DEHS and WSC and be positioned away from any sensitive environments.

9.2.2.7 Groundwater Quality

Protecting groundwater and other environmentally sensitive areas is of great importance during operation of The Project. Runoff of pesticide and herbicide, fuels from the parking lot, and hazardous waste polluting have the potential to contaminate groundwater. Mitigation measure include:

- Implementing an integrated Pesticide and Herbicide Management Plan where pesticides are used as a last resort.
- Using native plant species in the landscape design.
- Installation of a proper drainage system that will consist of drain basins with oil interceptors.

9.2.2.8 Wildlife Management Plan

The purpose of this plan is to detail measures for preventing harm wildlife present on site by outlining what steps should be taken by staff should they encounter any wildlife on site. Mitigation measure would include implementing an educational training programme for workers to follow as a way to manage wildlife; limit the use of herbicides and pesticides (If necessary, organic pesticides should be considered); and Prohibit hunting within the area.

9.2.2.9 Pest Management Plan

The Purpose of the Pest Control Management Plan is to outline measures to prevent the introduction of new pests during operation of The Hospital. To prevent destruction of the remaining habitat and reduce the spread diseases which can affect human health, the following mitigation measures should be included; regular inspection of areas where infestation is likely to occur, inspection of incoming materials and goods and frequent cleaning of facilities, especially spaces where food is stored and prepared. Licenced pest control companies should be consulted as needed.

9.2.2.10 Terrestrial Ecosystem Management Plans

Terrestrial Management Plans will be implemented to protect the natural environment during operational activities. Terrestrial Management Plans listed in Table 17 below will outline the impacts and appropriate mitigation measures to be used to protect ecosystems within and surrounding The Project site.

Table 17: Summary of the Operational Terrestrial Management Plans

Landscaping	• Terrestrial habitat loss.	• Only native species should be used

Purpose: Details measures to reduce the effects of vegetation and habitat loss for areas surrounding The Project site. Reduce the introduction of invasive species	• Loss of protected and endemic species.	• Invasive species should be removed. • Pesticides and herbicides used as a last resort.
Hunting Management Plan Purpose: Protect the native fauna populations in the area against hunting activities.	• Disruption and reduction of wildlife populations.	• No hunting permitted during construction and operation.
Pesticide and Herbicide Management Plan Purpose: Outline measures for proper handling of pesticides and herbicides.	• Contaminate surrounding soil, groundwater and vegetation. • May unintentionally kill and infect wildlife in the area.	• Planting native species. • Use chemicals as a last resort.
Fire Management Plan Purpose: Coordinate the response of the workers in the event of a fire, and detail steps to prevent, contain and control fires during the construction and operation phase.	• Endanger the lives of workers. • Can cause severe structural damage; destruction of machinery, equipment or materials; and cause untimely delay in project completion. • Destroy food source and shelter for wildlife.	• Proper fuel handling and storage. • Establishment of fire breaks. • No smoking on site • The presence and maintenance of all 'classes' of fire extinguishers. • Regular training and fire drills for staff. • Proper storage and handling of combustible material. • Good housekeeping.

10.0 CONSTRUCTION WORK METHODOLOGY

Construction works are anticipated to take approximately thirty-six (36) months to complete. This includes eight (8) months for design approval, and twenty-eight (28) months for construction and installation, excluding defect liability period. Construction methods will be employed to minimize or mitigate impacts on the environment.

The main construction activities associated can be summarized as:

- Land Clearing.
- Site Establishment.
- Movement of Materials.
- Utility Installation.
- Construction of the medical facility and the parking lot.
- Landscaping.

Consideration has been given to the types of heavy equipment that are expected to be used during the construction works. The equipment likely to be associated with each key component of the construction phase is outlined in Table 17 below.

Table 18: Equipment required for construction

Types of Equipment	Required for Construction Phase
Excavator	✓
Mobile Crane	✓
Front End Loader	✓
Dump Truck	✓
Bulldozer	✓
Concrete Mixer	✓
Roller	✓
Grader	✓
Scissor lifts and manlifts	✓
Tower Crane	✓
Asphalt paving machine	✓
Forklift	✓

Full method statements should be provided in the EMP.

11.0 STAKEHOLDER CONSULTATIONS

Public Consultation with relevant stakeholders is important in helping decision makers understand the views, values, interests, issues, and concerns held by the community in regards to the proposed development and to incorporate them into decisions. MoHW should hold a public consultation on the EIA to present the Project's purpose, objective, scope of works, baseline data, monitoring programme and outline the possible impact and mitigation measures. The meeting should be in a public location during a designated time and include stakeholders such as tourist, surrounding businesses, nearby residents, relevant Government Agencies, Non-Governmental Agencies, and any other groups that has a stake in The Project.

Once the logistics of the meeting are determined, the general public should be made aware of when and where the meeting is occurring. Adds should be placed in media sources such as the newspaper, on television, on the radio and on social media platforms at least 14 days in advance.

During the meeting, minutes should be taken and an email should be provided where stakeholders can submit their comments, questions and concerns regarding The Project. The Project should incorporate the answered to these comments and concerns in the final draft of the EIA.

12.0 CONCLUSION

The Ministry of Health and Wellness proposes to undertake the construction of a state-of-the-art medical facility with green spaces and a five hundred and ten (510) slot parking lot able to service patients, visitors, and staff. The Project area currently consists of an undeveloped Interior Upland ecosystem. A total of eighty (80) species were recorded on the site, including fourteen (14) protected species and five (5) invasive species. A total of fifteen (15) avian species were recorded during the investigation including eight (8) permanent resident breeding and six (6) winter non-breeding migrant species.

The overall goal of The Project is to expand the public health tertiary-level healthcare infrastructure in the country by increasing the capacity to manage adult ward services, specifically women and children services. The Project is expected to have a positive impact on the Bahamian economy through the generation of job opportunities for locals, capital investment and sourcing some The Project's material locally within the community where practical. Job opportunities would be generated through the construction and operational phases. During the construction phase Bahamian contractors will be hired to develop the property and during the operational phase, Bahamians would be hired to work at the constructed hospital. The local community would also benefit from the creation of the Hospital as it positions a tertiary hospital closer to larger population centres of New Providence, introduce designs that will promote a healing environment, enhance the quality of service and efficiency of health care, remove the challenges associated with navigating the traffic congestion of

downtown and increase the ability to introduce inpatient room designs that can improve patient safety, experience and privacy.

Throughout construction, environmental mitigation plans and environmental best-practices should be utilized to reduce impacts to the terrestrial environment. Although impacts are inevitable throughout the construction phase, the Interior Upland ecosystem communities should be considered and protected. Measures should be taken to limit damage of protected and native terrestrial flora and fauna. The proposed mitigation strategies include groundwater quality protection; erosion control mechanisms; wildlife management; vegetation management; noise, light and air pollution measures; measures to prevent flooding; solid waste management and sewage and waste refuge measures.

Given the scale of The Project, impacts due to construction activities are expected to be low to moderate. If The Project were to proceed as planned and all recommendations and measures outlined are adhered to, The Project will have minimal negative environmental impacts on the surrounding environmental and residential communities.

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APPENDICES

Appendix A: Project Conceptual Plans

Figure 1-1: The Bahamas Phase 1 Site Plan

Figure 1-2: The Bahamas Hospital Phase 1 and Phase 2 (Future Development) Site Plan

Figure 1-3: Bird's Eye View of Phase 1

Figure 1-4: Bird's Eye View of Phase 1 & 2

Figure 1-5: West Side Perspective View

Figure 1-6: Phase Area Master Plan

Figure 1-7: Site Components

Appendix B: Geotechnical Engineering Exploration Report

Geotechnical Engineering Exploration Report

Bahamas Hospital Complex, New Providence

Prepared for:

Island Dimensions & Development Co. Ltd

For:

Mr. Colin Higgs

Permanent Secretary of the

Ministry of Health and Wellness

Poinciana Hill Complex

New Providence, The Bahamas

Presented on April 25, 2023, By:

CERTIFIED TESTING LABORATORIES INTERNATIONAL BAHAMAS

TABLE of CONTENT

INTRODUCTION

This report presents the results of the geotechnical engineering exploration performed for the Bahamas Hospital Complex development proposed at the eastern side of the New Providence Highway between Saunders Beach and John F. Kennedy Drive in New Providence.

The purposes of the geotechnical engineering exploration were to determine the site general subsurface soil conditions, perform analyses and evaluations and provide geotechnical engineering recommendations for site preparation and support of the proposed hospital complex building structure.

SITE & PROJECT DESCRIPTION

Based on observations during our field work and information provided during the project team meeting on November 17, 2022, the site is a vacant, heavily wooded and relatively flat, land property (average elevation of el +10 ft. above sea level) proposed for development of a hospital complex to include an approximately 140k ft^2 footprint building concrete (presumed) structure, miscellaneous features, driveways and parking lots. No architectural drawings are available for preparation of this report; however, a preliminary site plan overlaid on a Boundary Survey Plan by Donald E. Thompson & Associates, indicates the hospital building will consists of a large ground floor podium with atop portions rising up to the 4^{th} floor for a 5-story-tall structure.

No column loads are available for preparation of this report due to the preliminary stage of the project; however, we estimate a maximum load of 800 kips for the interior columns (28 ft. column span) of the 5-story portion of the structure.

SUBSURFACE SOIL FIELD EXPLORATION

Soil Borings

Our subsurface soil field exploration was performed between March 13 and April 8, 2023, and consisted of seven (7), 15-ft-deep, Standard Penetration Test (SPT) borings (B1 through B7) drilled by our specialty subcontractor, under our full-time engineering observation, at locations whiting or nearby the proposed building structure footprint area laid out by the project surveyor. Our field crew recorded the boring location approximate Global Positioning System (GPS) coordinates using a hand-held device. The SPT boring approximate locations are shown in the Boring Location Plan enclosed in Appendix A.

Additional seven (7) to eight (8) borings within the building structure footprint were not drilled due to the heavy vegetation and the lack of a full Environmental Permit for clearance keeping the drill rig equipment from accessing their locations.

The SPT borings were advanced using a continuous-flight auger and a 2-inch O.D. split-spoon sampler driven with a 140-lb safety hammer falling 30 inches from the ground surface to a depth of 15 ft. The number of hammer blows required to drive the sampler a total of 24 inches in 6-in

increments were recorded in boring logs. The penetration resistance, N Value, is the summation of the second and third increments and is used to derive soil engineering parameter indexes from empirical correlations. Details of the boring soil sample classification and N Value are shown in the Boring Logs enclosed in Appendix A.

Rock Cores

In addition to the SPT borings, we drilled 3-in-diameter rock cores to a depth of 14 inches into the Limestone at eight (8) locations throughout the building structure footprint to determine the rock specimen's Unconfine Compression Strength in our laboratory.

SUBSURFACE SOIL CONDITIONS

Generalized Subsurface Soil Profile

The results of the field exploration indicate a generalized subsurface soil profile consisting of an approximately 6 inches of sand, limestone fragments and roots underlain by the Bahamian Limestone Formation to the explored depth of 15 ft.

A penetration resistance (N Value) of 50 and higher blows per foot of penetration (blows/foot) prevailed through the explored locations and depths of The Bahamian Limestone Formation indicating a predominately Hard Relative Hardness.

The laboratory test results indicate the Limestone core specimens' Unconfined Compression Strength ranged from about 50 ksf to 153 ksf.

Details of the subsurface soil profile including soil classification and N values are shown in the Boring Logs enclosed in Appendix A.

Details of the Limestone core specimens and Unconfined Compression Strength are shown in the Core Specimen table enclosed in Appendix A.

Groundwater

Based on measurements taken during and after completion of the borings, the groundwater was at depths ranging from 7.2 ft. to 14 ft. below the ground surface elevation at the boring locations. The groundwater depth at each boring location is provided in the Boring Logs enclosed in Appendix A.

GEOTECHNICAL EVALUATION & RECOMMENDATIONS

Shallow Foundations

Based on our evaluation of the subsurface soil exploration results, the estimated structure maximum column load and experience from a nearby project (Atlantis Phase III, Paradise Island, Nassau) with similar subsurface soil profile, the encountered subsurface soil conditions are suitable to support the proposed hospital structures on a system of shallow foundations, bearing

on or within competent Limestone, and on-grade slabs after performance of a site preparation in accordance with our recommendations and performance of a Full-Scale Footing Load Test.

The recommended site preparation work should consist of the complete grubbing and stripping of trees and vegetation and removal of any topsoil to 5 ft. beyond the structure footprint. Subsequently, the footings should be excavated by removing the surficial sand and loose rock fragments into a competent Limestone footing subgrade.

After construction of the footings, the surrounding areas could be raised to the structures' proposed Finished Floor Elevations (FFE) by placing approved fill soils in maximum 12-in thick lifts each compacted to at least 95% of the material's Maximum Dry Density (ASTM D1557).

Experience from a nearby project with similar subsurface soil conditions indicate the footings could be designed for a maximum safe soil contact pressure of 10 kips/ft^2, under sustained dead plus live loads, and 12.5 kips/ft^2, under sustained dead plus live load and transient wind loading; however, performance of a Full-Scale Footing Load Test to confirm the site-specific Limestone bearing pressures is advisable.

Deep Foundations

Alternatively, the proposed structures could be supported on a deep foundation system consisting of Auger Cast in Place (ACIP) piles installed into the Limestone. Nearby project experience confirmed an ACIP pile (18-in diameter and installed 20 ft. into limestone) allowable compression capacity of 255 tons and allowable tensile capacity of 125 tons; however, estimation of ACIP pile capacities will require determination of the site subsurface soil conditions to a depth of at least 40 ft. and the performance of a subsequent Pile Load Test Program.

Ground-Floor Slab

After construction of the footings or ACIP piles and raising of grades in accordance with our recommendations in the preceding paragraph, the ground-floor slab should be designed to be supported on-grade after compaction of the subgrade upper 12 inches to at least 95% of the material's Maximum Dry Density (ASTM D1557).

LIMITATIONS

The evaluations and recommendations provided in this report are based on a preliminary stage of the project and a subsurface soil field exploration limited to a reduced number of borings due to equipment accessibility constrains posted by the heavy vegetation and the lack of full environmental permit for clearance. Additional geotechnical engineering explorations, in the form of 15-ft-deep borings (or deeper) and cores, and structural information (i.e. wall and column loading system) are required to complement the information and recommendations provided in this report.

This report has been prepared to assist the Ministry of Health and Wellness and their design team. This report is only applicable to the envisioned project discussed herein. Any proposed changes in structures or their locations should be brought to our attention so that we can determine whether such changes affect our recommendations. CTLI cannot assume responsibility for use of this report for any areas beyond the limits of this study or for any projects not specifically discussed herein.

Information on subsurface strata and groundwater levels shown on the logs represents conditions encountered only at the locations indicated and at the time of the exploration. If different conditions are encountered during construction, they should immediately be brought to our attention for evaluation as they may affect our recommendations.

Verification of the boring and core locations, by the project surveyor, is advised due to rough accuracy provided by the hand-held device use to record their GPS coordinates.

Environmental issues (such as potentially contaminated soil and groundwater) are outside the scope of this study and our services and should be addressed in a separate study.

CLOSURE

It has been a pleasure working with you and we look forward to continuing our work in this and future projects.

Sincerely,

REGISTERED PROFESSIONAL ENGINEER
STEFAN J. KNOWLES
REG. NO. 10163
COMMONWEALTH OF THE BAHAMAS

Stefan J. Knowles, P.E
Geotechnical Engineer

IVAN E. MARCANO
LICENSE
4/25/23
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STATE OF FLORIDA
PROFESSIONAL ENGINEER

Ivan E. Marcano, P.E
Sr. Geotechnical Engineer

Whittington S.W. Brown
Chief Technologists

CERTIFIED LITHOTRIPTORIES INTERNATIONAL LTD. - CERTIFIED
COMMON SEAL OF

Boring B3

Boring B1

Rock Cores

APPENDIX A

CTLI-CERTIFIED TESTING LABORATORIES INTERNATIONAL

New Providence, Nassau

BORING LOCATION PLAN

Bahamas Hospital Complex
New Providence

Certified Testing Laboratories

LOG OF BORING B-1
SHEET 1

PROJECT PROPOSED NEW PROVIDENCE HOSPITAL PROJECT			**PROJECT NO.** 230010		
LOCATION NASSAU, BAHAMAS			**ELEVATION AND DATUM** 10 ft. MSL (APPRX)		
DRILLING EQUIPMENT CME 75			**DATE STARTED** 3/12/2023	**DATE FINISHED** 3/14/2023	**COMPLETION DEPTH** 15'
SIZE AND TYPE OF BIT 6" Continous Flight Auger			**NUMBER OF SAMPLES** 7	**DIST.** 7 / **UNDIST.** -	**CORE** -
CASING DIAMETER (in) -	**CASING DEPTH (ft)** -		**WATER LEVEL (ft)** 7.2	**FIRST** 7' / **COMPL** 7'	**24 HR.** 7.2'
SAMPLER 2" O/D SPLIT SPOON			**DRILLING FOREMAN** QUINCY CARTWRIGHT		
SAMPLER HAMMER SAFETY	**WEIGHT (lbs** 140	**DROP(in)** 30	**INSPECTOR** WHITTINGTON BROWN		

ELEV. (FT)	SAMPLE DESCRIPTION	DEPTH SCALE	SAMPLE DATA NUMBER	Type	RECOV (IN)	PENETR RESUST BL/6in	N-VALUE BLOWS PER FT	REMARKS (DRILLING FLUID, DEPTH OF CASING. FLUID LOSS, DRILLING RESISTANCE,ETC.
10	Tan Limestone	0	S-1	SS	1	5 15 18 19	56	Split Spoon 0' - 2'
8	Tan Limestone	2	S-2	SS	4	50/4	50	Split Spoon 2' - 4'
								Drill to 4'
6	Tan Limestone	4	S-3	SS	9	30 50/3	50	Split Spoon 4' - 6'
4	Tan Limestone	6	S-4	SS	14	38 26 22 13	48	Split Spoon 6' - 8'
2	Tan Limestone	8	S-5	SS	14	6 18 7 22	25	Split Spoon 8' - 10'
0	Tan Limestone	10	S-6	SS	14	12 12 27 30	39	Split Spoon 10' - 12'
								Drill to 13 ft. - Drill time: 1min.
-3	Tan Limestone	13	S-7	SS	14	12 12 26 38	38	Split Spoon 13' - 15'

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LOG OF BORING B-2
SHEET 2

PROJECT PROPOSED NEW PROVIDENCE HOSPITAL PROJECT			**PROJECT NO.** 230010			
LOCATION , NASSAU, BAHAMAS			**ELEVATION AND DATUM** 10 ft. MSL (APPROX)			
DRILLING EQUIPMENT CME 75			**DATE STARTED** 3/12/2023	**DATE FINISHED** 3/14/2023		**COMPLETION DEPTH** 15'
SIZE AND TYPE OF BIT 6" Continous Flight Auger			**NUMBER OF SAMPLES** 7	**DIST.** 7	**UNDIST.** -	**CORE** -
CASING DIAMETER (in) -	**CASING DEPTH (ft)** -		**WATER LEVEL (ft)** 10	**FIRST** 10'	**COMPL** 10'	**24 HR.** 10'
SAMPLER 2" O/D SPLIT SPOON			**DRILLING FOREMAN** QUINCY CARTWRIGHT			
SAMPLER HAMMER SAFETY	**WEIGHT (lbs** 140	**DROP(in)** 30	**INSPECTOR** WHITTINGTON BROWN			

ELEV. (FT)	SAMPLE DESCRIPTION	DEPTH SCALE	SAMPLE DATA					REMARKS
			NUMBER	Type	RECOV (IN)	PENETR RESUST BL/6in	N-VALUE BLOWS PER FT	(DRILLING FLUID, DEPTH OF CASING. FLUID LOSS, DRILLING RESISTANCE,ETC.
10	6" TOP SOIL	0	S-1	SS	8"	9 47 50/2	97/8	Split Spoon 0' - 2'
8	Tan Limestone	2	S-2	SS	13"	31 50/2	50/2	Split Spoon 2' - 4'
								Drill to 4'
6	Tan Limestone	4	S-3	SS	6"	50/4	50	Split Spoon 4' - 6'
4	Tan Limestone	6	S-4	SS	6"	50/2	50	Split Spoon 6' - 8'
2	Tan -Limestone	8	S-5	SS	24"	21 40 44 30	84	Split Spoon 8' - 10'
0	Tan Limestone	10	S-6	SS	23"	22 25 40 32	65	Split Spoon 10' - 12'
								Drill to 13 ft. - Drill time: 1min.
-3	Tan Limestone	13	S-7	SS	24"	24 24 38 40	1	Split Spoon 13' - 15'

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LOG OF BORING B-3
SHEET 3

PROJECT PROPOSED NEW PROVIDENCE HOSPITAL PROJECT			**PROJECT NO.** 230010		
LOCATION , NASSAU, BAHAMAS			**ELEVATION AND DATUM** 10 ft. MSL (APPROX)		
DRILLING EQUIPMENT CME 75			**DATE STARTED** 3/12/2023	**DATE FINISHED** 3/14/2023	**COMPLETION DEPTH** 15'
SIZE AND TYPE OF BIT 6" Continous Flight Auger			**NUMBER OF SAMPLES** 7	**DIST.** 7 / **UNDIST.** -	**CORE** -
CASING DIAMETER (in) -	**CASING DEPTH (ft)** -		**WATER LEVEL (ft)** 10	**FIRST** 10' / **COMPL** 10'	**24 HR.** 10'
SAMPLER 2" O/D SPLIT SPOON			**DRILLING FOREMAN** QUINCY CARTWRIGHT		
SAMPLER HAMMER SAFETY	**WEIGHT (lbs** 140	DROP(in) 30	**INSPECTOR** WHITTINGTON BROWN		

ELEV. (FT)	SAMPLE DESCRIPTION	DEPTH SCALE	SAMPLE DATA NUMBER	Type	RECOV (IN)	PENETR RESUST BL/6in	N-VALUE BLOWS PER FT	REMARKS (DRILLING FLUID, DEPTH OF CASING. FLUID LOSS, DRILLING RESISTANCE,ETC.
10	Tan Limestone	0	S-1	SS	4	50/1	50/1	Split Spoon 0' - 2'
8	Tan Limestone	2	S-2	SS	4	50/4	50/4	Split Spoon 2' - 4'
								Drill to 4'
6	Tan Limestone	4	S-3	SS	8	37 50/2	50/2	Split Spoon 4' - 6'
4	Tan Limestone	6	S-4	SS	6	50/4	50/4	Split Spoon 6' - 8'
8	Tan Limestone	8	S-5	SS	5	50/2	50/2	Split Spoon 8' - 10'
10	Tan -Limestone	10	S-6	SS	8	50	50	Split Spoon 10' - 12'
								Drill to 13 ft. - Drill time: 1min.
-3	Tan Limestone	13	S-7	SS	14	21 20 22 46	42	Split Spoon 13' - 15'

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LOG OF BORING B-4
SHEET 4

PROJECT PROPOSED NEW PROVIDENCE HOSPITAL PROJECT			**PROJECT NO.** 230010		
LOCATION , NASSAU, BAHAMAS			**ELEVATION AND DATUM** 10 ft. MSL (APPROX)		
DRILLING EQUIPMENT CME 75			**DATE STARTED** 3/12/2023	DATE FINISHED 3/14/2023	COMPLETION DEPTH 15'
SIZE AND TYPE OF BIT 6" Continous Flight Auger			**NUMBER OF SAMPLES** 7	**DIST.** 7 / **UNDIST.** -	**CORE** -
CASING DIAMETER (in) -	**CASING DEPTH (ft)** -		**WATER LEVEL (ft)** 14	**FIRST** 14' / **COMPL** 14'	**24 HR.** 14'
SAMPLER 2" O/D SPLIT SPOON			**DRILLING FOREMAN** QUINCY CARTWRIGHT		
SAMPLER HAMMER SAFETY	**WEIGHT (lbs** 140	**DROP(in)** 30	**INSPECTOR** WHITTINGTON BROWN		

ELEV. (FT)	SAMPLE DESCRIPTION	DEPTH SCALE	SAMPLE DATA NUMBER	Type	RECOV (IN)	PENETR RESUST BL/6in	N-VALUE BLOWS PER FT	REMARKS (DRILLING FLUID, DEPTH OF CASING. FLUID LOSS, DRILLING RESISTANCE,ETC.
10	Tan Limestone	0	S-1	SS	2	50/1	50/1	Split Spoon 0' - 2'
8	Tan Limestone	2	S-2	SS	24	15 34 30 34	64	Split Spoon 2' - 4'
								Drill to 4'
6	Tan Limestone	4	S-3	SS	8	50/5	50/5	Split Spoon 4' - 6'
4	Tan Limestone	6	S-4	SS	8	34 50/5	50/5	Split Spoon 6' - 8'
2	Tan Limestone	8	S-5	SS	7	50/4	50/4	Split Spoon 8' - 10'
0	Tan -Limestone	10	S-6	SS	6	50/3	50/3	Split Spoon 10' - 12'
								Drill to 13 ft. - Drill time: 1min.
-3	Tan Limestone	13	S-7	SS	14	22 31 27 22	58	Split Spoon 13' - 15'

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LOG OF BORING B-5
SHEET 5

PROJECT PROPOSED NEW PROVIDENCE HOSPITAL PROJECT			**PROJECT NO.** 230010			
LOCATION NASSAU, BAHAMAS			**ELEVATION AND DATUM** 10 ft. MSL (APPROX)			
DRILLING EQUIPMENT CME 75			**DATE STARTED** 3/12/2023	**DATE FINISHED** 3/14/2023		**COMPLETION DEPTH** 15'
SIZE AND TYPE OF BIT 6" Continous Flight Auger			**NUMBER OF SAMPLES** 7	**DIST.** 7	**UNDIST.** -	**CORE** -
CASING DIAMETER (in) -	**CASING DEPTH (ft)** -		**WATER LEVEL (ft)** 9	**FIRST** 9'	**COMPL** 9'	**24 HR.** 9'
SAMPLER 2" O/D SPLIT SPOON			**DRILLING FOREMAN** QUINCY CARTWRIGHT			
SAMPLER HAMMER SAFETY	**WEIGHT (lbs** 140	**DROP(in)** 30	**INSPECTOR** WHITTINGTON BROWN			

ELEV. (FT)	SAMPLE DESCRIPTION	DEPTH SCALE	SAMPLE DATA					REMARKS
			NUMBER	Type	RECOV (IN)	PENETR RESUST BL/6in	N-VALUE BLOWS PER FT	(DRILLING FLUID, DEPTH OF CASING. FLUID LOSS, DRILLING RESISTANCE,ETC.
10	Tan Limestone	0	S-1	SS	2	50/1	50/1	Split Spoon 0' - 2'
8	Tan Limestone	2	S-2	SS	9.5	37 50/3	50/3	Split Spoon 2' - 4'
								Drill to 4'
6	Tan Limestone	4	S-3	SS	6	50/3	50/3	Split Spoon 4' - 6'
4	Tan Limestone	6	S-4	SS	8	50/5	50	Split Spoon 6' - 8'
2	Tan Limestone	8	S-5	SS	24	12 16 27 23	43	Split Spoon 8' - 10'
0	Tan -Limestone	10	S-6	SS	14	11 20 11 12	31	Split Spoon 10' - 12'
								Drill to 13 ft. - Drill time: 1min.
-3	Tan Limestone	13	S-7	SS	14"	15 21 25 15	46	Split Spoon 13' - 15'

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LOG OF BORING B-6
SHEET 6

PROJECT PROPOSED NEW PROVIDENCE HOSPITAL PROJECT			**PROJECT NO.** 230010			
LOCATION , NASSAU, BAHAMAS			**ELEVATION AND DATUM** 10 ft. MSL (APPROX)			
DRILLING EQUIPMENT CME 75			**DATE STARTED** 3/12/2023	**DATE FINISHED** 3/14/2023		**COMPLETION DEPTH** 15'
SIZE AND TYPE OF BIT 6" Continous Flight Auger			**NUMBER OF SAMPLES** 7	**DIST.** 7	**UNDIST.** -	**CORE** -
CASING DIAMETER (in) -	**CASING DEPTH (ft)** -		**WATER LEVEL (ft)** 8	**FIRST** 8'	**COMPL** 8'	**24 HR.** 8'
SAMPLER 2" O/D SPLIT SPOON			**DRILLING FOREMAN** QUINCY CARTWRIGHT			
SAMPLER HAMMER SAFETY	**WEIGHT (lbs** 140	**DROP(in)** 30	**INSPECTOR** WHITTINGTON BROWN			

ELEV. (FT)	SAMPLE DESCRIPTION	DEPTH SCALE	SAMPLE DATA					REMARKS
			NUMBER	Type	RECOV (IN)	PENETR RESUST BL/6in	N-VALUE BLOWS PER FT	(DRILLING FLUID, DEPTH OF CASING. FLUID LOSS, DRILLING RESISTANCE,ETC.
10	Tan Limestone	0	S-1	SS	2	50/2	50/2	Split Spoon 0' - 2'
8	Tan Limestone	2	S-2	SS	12	41 50/2	50/2	Split Spoon 2' - 4'
								Drill to 4'
6	Tan Limestone	4	S-3	SS	10.5	34 50/2	50/2	Split Spoon 4' - 6'
4	Tan Limestone	6	S-3	SS	19	28 34 25 20	59	Split Spoon 6' - 8'
2	Tan Limestone	8	S-4	SS	14	24 26 19 15	45	Split Spoon 8' - 10'
0	Tan -Limestone	10	S-5	SS	14	18 28 31 34	59	Split Spoon 10' - 12'
								Drill to 13 ft. - Drill time: 1min.
-3	Tan Limestone	13	S-6	SS	14"	19 16 28 43	44	Split Spoon 13' - 15'

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LOG OF BORING B-7

SHEET 7

PROJECT			PROJECT NO.			
PROPOSED NEW PROVIDENCE HOSPITAL PROJECT			230010			
LOCATION			**ELEVATION AND DATUM**			
NASSAU, BAHAMAS			10 ft. MSL (APPROX)			
DRILLING EQUIPMENT			**DATE STARTED**	**DATE FINISHED**		**COMPLETION DEPTH**
CME 75			3/12/2023	3/14/2023		15'
SIZE AND TYPE OF BIT			**NUMBER OF SAMPLES**	**DIST.**	**UNDIST.**	**CORE**
6" Continous Flight Auger			7	7	-	-
CASING DIAMETER (in)	**CASING DEPTH (ft)**		**WATER LEVEL (ft)**	**FIRST**	**COMPL**	**24 HR.**
-	-		10	10'	10'	10'
SAMPLER			**DRILLING FOREMAN**			
2" O/D SPLIT SPOON			QUINCY CARTWRIGHT			
SAMPLER HAMMER	**WEIGHT (lbs**	**DROP(in)**	**INSPECTOR**			
SAFETY	140	30	WHITTINGTON BROWN			

ELEV. (FT)	SAMPLE DESCRIPTION	DEPTH SCALE	SAMPLE DATA					REMARKS
			NUMBER	Type	RECOV (IN)	PENETR RESUST BL/6in	N-VALUE BLOWS PER FT	(DRILLING FLUID, DEPTH OF CASING. FLUID LOSS, DRILLING RESISTANCE,ETC.
10	Tan Limestone	0	S-1	SS	14	20 46 49 50	95	Split Spoon 0' - 2'
8	Tan Limestone	2	S-2	SS	9	49 50/3	50/3	Split Spoon 2' - 4'
								Drill to 4'
6	Tan Limestone	4	S-3	SS	7	50/5	50/5	Split Spoon 4' - 6'
4	Tan Limestone	6	S-4	SS	9	50/5	50/5	Split Spoon 6' - 8'
2	Tan Limestone	8	S-5	SS	24	28 31 20 24	51	Split Spoon 8' - 10'
0	Tan -Limestone	10	S-6	SS	23	11 12 11 23	23	Split Spoon 10' - 12'
								Drill to 13 ft. - Drill time: 1min.
-3	Tan Limestone	13	S-7	SS	14	8 12 18 33	30	Split Spoon 13' - 15'

Certified Testing Laboratories International
#313 Baillou Hill Road
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Bahama Hospital Complex Development Core Specimen

Core Location	Test Date	Core Specimen Diameter (in)	Core Specimen Height (in)	Core Specimen Cross Sectional Area (in^2)	Core Specimen Weight (Lbs)	Core Specimen Density (pcf)	Max. Compression Load (LBS)	Unconfined Compression Strength (ksf)
C1	4/13/23	3.00	4.83	7.060	1.827	92.583	2470	50.38
C2	4/13/23	3.00	4.78	7.060	1.798	92.066	2910	59.35
C3	4/13/23	3.00	8.00	7.060	3.080	94.232	4350	88.73
C4	4/13/23	3.00	6.50	7.060	2.482	93.460	3140	64.04
C5	4/13/23	3.00	8.00	7.060	3.240	99.128	7530	153.58
C6	4/13/23	3.00	6.62	7.060	2.407	88.993	3090	63.03
C7	4/13/23	3.00	5.56	7.060	1.840	81.000	3720	75.88
C8	4/13/23	3.00	3.90	7.060	1.829	114.786	3520	71.80