Environmental Impact Assessment for Carmichael Village Microgrid Project, New Providence

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Contents

Executive Summary

The objective of the Environmental Impact Assessment (EIA) for the Carmichael Village microgrid project is three-fold:

1. To evaluate potential environmental impacts of the proposed project;
2. To suggest potential mitigation measures that can be implemented to reduce or eliminate any negative environmental impacts; and
3. To evaluate whether the proposed project can be implemented in a manner that is environmentally sustainable.

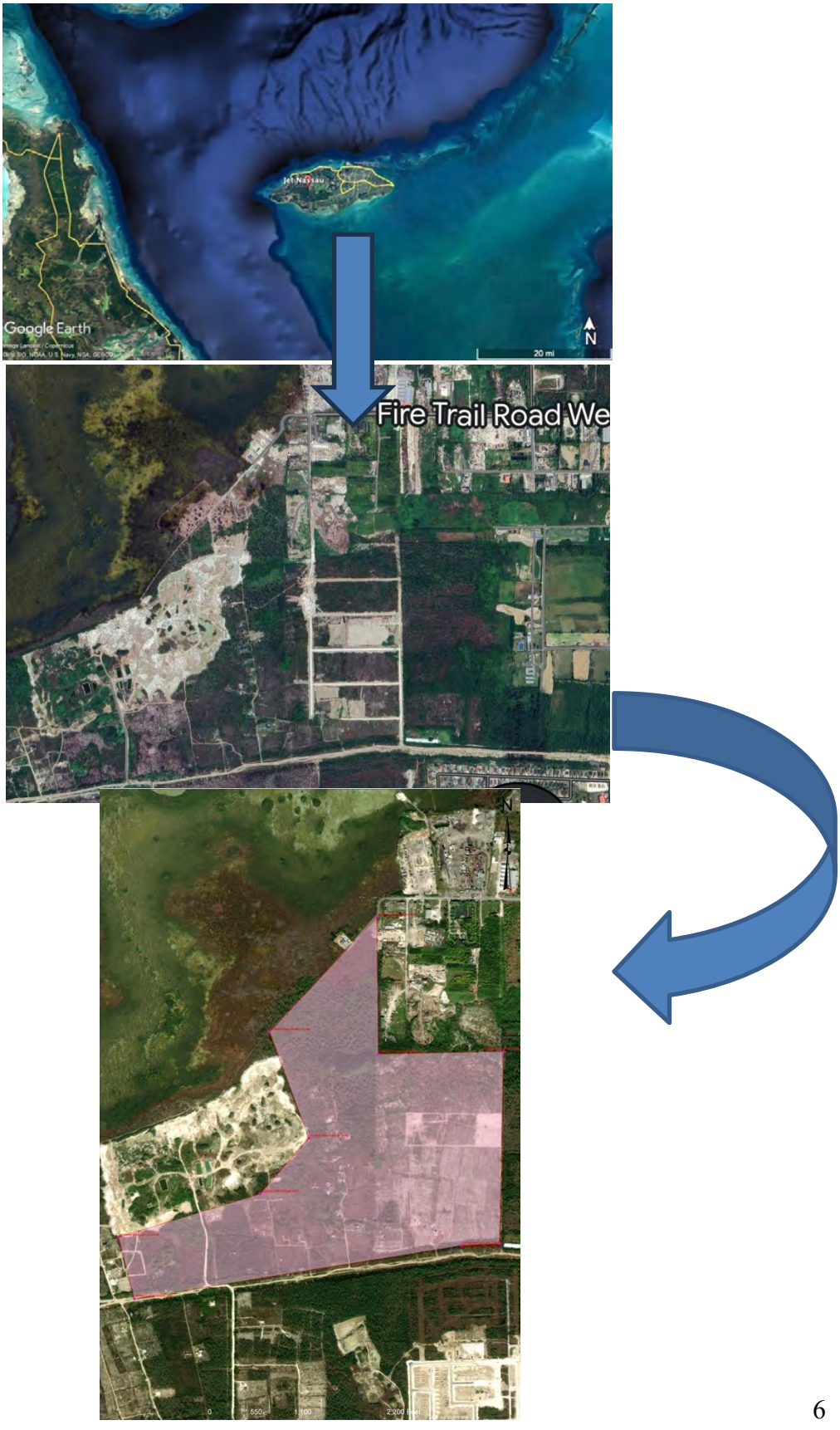
The Carmichael Village microgrid project involves the construction of a 20-megawatt solar microgrid. The project is a design-build project being implemented by the Project Execution Unit at the Ministry of Finance.

The largest environmental impact from the project will be the clearing of some of the vegetation at the site for the solar panels and associated infrastructure. There has been significant clearing of the site (legal and illegal) and the project will focus on utilizing areas already cleared in the first instance.

Employment of appropriate design and planning methodologies can result in execution of the Carmichael Village microgrid project in a more sustainable manner. Utilizing the recommended mitigation measures can minimize any negative environmental and socio-economic impacts.

The Ministry of Finance Project Execution Unit (PEU) has expressed its commitment to implementing the recommended mitigation measures to minimize negative environmental and socio-economic impacts from the project.

Map 1: Location of Carmichael Village microgrid project, New Providence



1.0 Introduction and objectives

1.1 Objective of the EIA

The objective of the Environmental Impact Assessment (EIA) for the Carmichael Village microgrid project is three-fold:

1. To evaluate potential environmental impacts of the proposed project;
2. To suggest potential mitigation measures that can be implemented to reduce or eliminate any negative environmental impacts; and
3. To evaluate whether the proposed project can be implemented in a manner that is environmentally sustainable.

1.2 Scope of the EIA

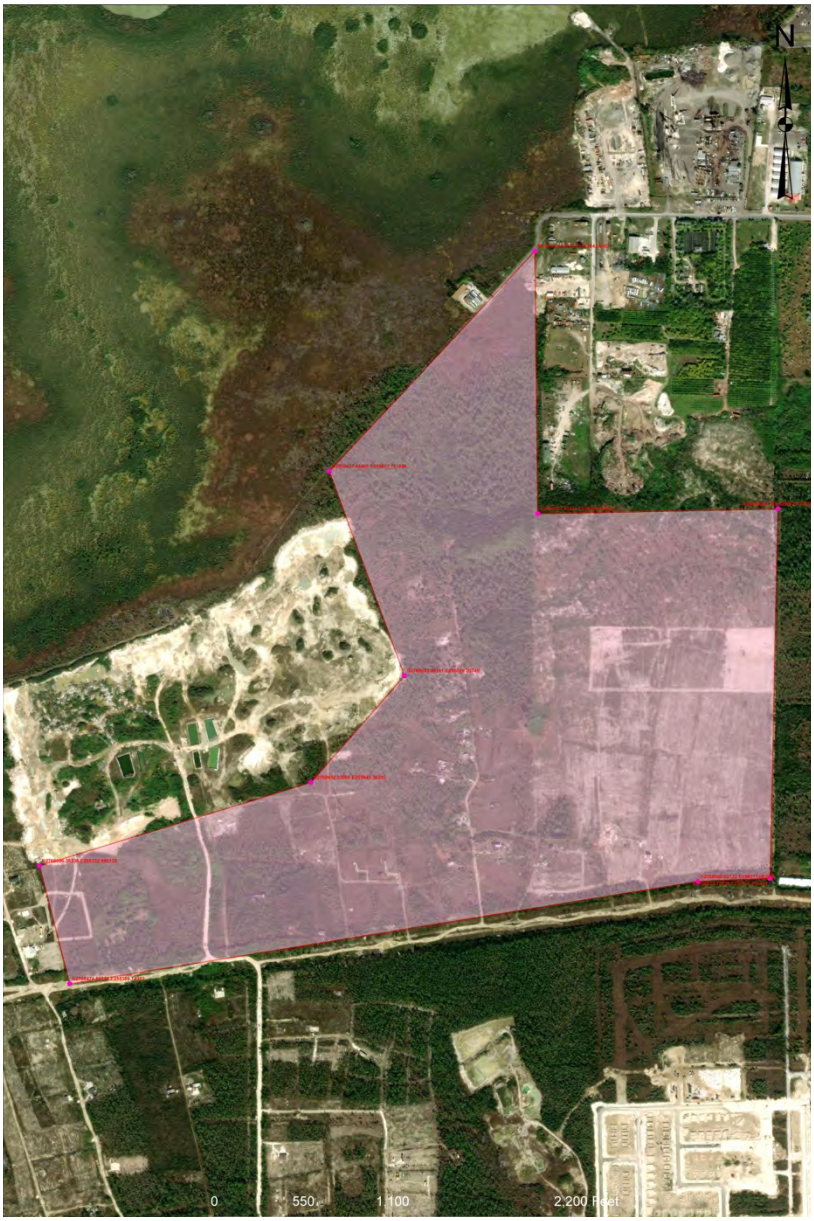
The EIA involved field surveys and research focused on the project site and its environs. Surveys conducted included plant, animal and avifaunal surveys in the terrestrial environment. Collection of socio-economic data was done through census data provided by the Bahamas Department of Statistics.

2.0 Project description and alternatives

2.1 Description

The proposed project site at Carmichael is located in the western district of New Providence. The area encompasses over 206 acres and is bound by Lake Killarney (north) and Bahamas Power and Light (BPL) powerline access road (south) (See Figure 2-1). The nearest public roads are Fire Trail Road (which ends at the northern boundary) and Carmichael Road (approximately 0.42 miles (665 meters) from the southern boundary). A map showing the boundaries of the site is provided in Appendix 1.

Figure 2-1: Aerial image of Carmichael Village microgrid site



Land use surrounding the site include industrial, residential, and agricultural activities. The nearest residential area is the recently established Carmichael Village, approximately 318 feet (97 meters) along the southeastern boundary. A number of illegal activities are also occurring on site, including illegal dumping, burning of copper, land clearing (See Figure 2-2). Some of these areas posed a significant threat to safety, with large dogs roaming in the interior near residences and evidence of firearm use. SEV team members had to be accompanied by armed police officers for some of the surveys.

Figure 2-2: Panoramic view of Northern site boundary (looking south).

The Carmichael Village microgrid project is a design-build project that will involve the construction of a 20-MW solar microgrid to be integrated into the power grid for New Providence. The intent is to utilize a minimum of 32% or 65 acres of the site. The goal will be to utilize areas that have already been cleared as there has been significant mining activities on the site. Along with mining and other anthropogenic activities, the human-altered portion of the site is 124 acres. The site is low-lying and floods in many areas during heavy rains, so it will also need to be filled in and graded in some areas to elevate it sufficiently for installation of the solar panels.

Over 60% of the site has been significantly altered by land clearing and other human activities (legal and illegal). The most significant areas impacted are by active quarry mining activities (approximately 15 acres in the northwest quadrant) and extensive land clearing for unknown uses (approximately 50 acres in the eastern quadrant). Other impacted areas (approximately 59 acres) are distributed throughout the site and include farmland, roads, trails, buildings, other structures, and indiscriminate dumping.

Several unpaved roads, paths, and trails are present throughout the site, providing access to the various activities occurring on site. These access points appear to be primarily used by heavy equipment and transport trucks and are not optimal for smaller vehicles. However, smaller vehicles were observed accessing residences, farms, shacks, and structures in the interior of the site. Access to the entire eastern quadrant of the site was limited due to active land clearing. Heavy machinery traffic posed a safety threat and as such the area could not be accessed for observations and survey.

The remaining land cover is vegetated, pine woodland with palm dominated and multi-species shrub layers (see Figure 3-4). It should be noted that the site sits within the proposed National Forest Estate (Carmichael North), which is designated as a Conservation Forest[1].

Figure 2-3: Photos of the current site

Northern area of the project site

[1] Forestry Regulations, 2014

Pine woodland in southern portion of the project site

Bulldozer actively clearing the site

Examples of the solar panels that may be installed are provided in Figure 2-4. The site plan for the project will not be developed until the design-build phase once a contractor has been selected through the Government tender process.

Figure 2-4: Examples of solar panels

2.2 Description of alternative to the proposed project

No alternatives were considered for the project as the Government of The Bahamas owns the property to be utilized for the project. The Carmichael Village site is one of five (5) sites on New Providence to be utilized for construction of solar microgrids.

2.3 “No action” alternative

With development, there is always an alternative of ‘no action’ which leaves the proposed site unchanged. If the project is not implemented, the site will remain the same as a heavily disturbed area with some ecological services, including habitat for birds.

3.0 Baseline description of New Providence

New Providence is the most populated island in The Bahamas with 246,329 residents (Department of Statistics, 2010). It is 80 square miles with a population density of approximately 3,079 persons per square mile. On the island of New Providence, the city of Nassau is the capital of The Bahamas and home to Central Government with the Houses of Parliament in the Downtown area.

3.1 Physical aspects

3.1.1 Climate

The climate of The Bahamas is tropical marine, wet and dry with winter incursions of modified polar air from the North American continent (Bahamas Department of Meteorology, 2021).

The Bahamas is located within the Atlantic Tropical Cyclone basin. This basin includes much of the North Atlantic, Caribbean Sea, and the Gulf of Mexico. On average, 6 to 8 tropical storms form within this basin each year. In 2016, The Bahamas was impacted by Hurricane Matthew with the islands of New Providence, Andros and Grand Bahama receiving severe damage in some coastal areas. In 2017, The Bahamas was impacted by Hurricane Irma. Significant damage occurred on the island of Great Inagua; Crooked Island was impacted as well. The Bahamas was not hit by any hurricanes in 2018.

In 2019, significant areas of the islands of Abaco and Grand Bahama were devastated by Hurricane Dorian. Estimated damage for these islands is US$3.4 Billion (IDB, 2019). The Bahamas was not affected by any hurricanes in 2021 nor in 2022.

The formation of these storms and possible intensification into mature hurricanes takes place over warm tropical and subtropical waters. Eventual dissipation or modification typically occurs over the colder waters of the North Atlantic or when the storms move over land and away from the sustaining marine environment. The official hurricane season lasts from June 1st to November 30th.

3.1.2 Topography

Topographically, the islands of The Bahamas are typically flat with elevations of less than 32 feet (10 meters). A higher coastal ridge may occur, usually located along the exposed side of most islands. Islands of the southeast and central Bahamas are generally of higher elevation than in the northern Bahamas. The islands are usually long and narrow oriented from northwest to southeast with central ridges extending to a maximum height of 200 feet (60 meters).

New Providence is composed of a mixture of rocklands and ridges with coastal wetland areas. The project site is found in the South Beach area in southern New Providence and is comprised of wetland and coppice habitats. Much of southern New Providence has been developed for residential housing with some commercial businesses.

The land surface of the project site is generally flatland, with some elevated areas. Elevation range from 6.5 feet (3 meters) to 25 feet (7.6 meters). The highest point is along a gently sloping hill, in the northern part of the site, that runs east to west and extends for approximately 492 feet (150 meters). The eastern and western parts of the hill area have been impacted by extensive mining activities

occurring on site and adjacent properties. Most of the areas north and south of the hill represent the majority of the intact vegetative cover at the site.

A copy of the topographic survey for the site is provided in Appendix 2.

3.1.3 Geology

The Bahamas archipelago is situated in the western North Atlantic and is comprised of extensive carbonate islands and shallow banks. There are 29 large islands, over 600 small cays, and more than 2,000 rocks, all low-lying. The surface deposits of archipelago are of Late Quaternary limestones from a glacioeustatic sea-level high-stand position; a depositional record of platform flooding and carbonate sediment production. Simply put, alternating glacial expansions and retreats created vast changes in sea levels across geologic time, allowing for the formation of the islands. The islands are tectonically stable, consisting of carbonate sediments with interspersed paleosols (Mylroie, 2016).

With geologic origins that are biogenic and completely carbonate, The Bahamas differs from other islands in the region. The islands rest on shallow water banks which are primarily composed of calcium carbonate sediments. These limestone sediments were created from rapidly growing marine life which extracted calcium carbonate from seawater creating voluminous depositions of sand and mud. The Bahamas consists of eight carbonate banks with the north and central islands resting on two of these banks.

Oolitic sands have also contributed to the geologic development of the islands, specifically during the last ice age when sea levels were significantly lower. It was then that oolitic sand dunes hardened and when sea levels rose, the rock ridges formed by these dunes became islands along the edges of the shallow banks.

Another source of islands in the archipelago are limestone rocklands, which were formed from the seabed when sea levels were at their highest. As sea level declined, the exposed seabed underwent erosion and weathering. The resulting formation was rocklands. Rocklands make up the broader islands in the archipelago (such as Andros and Grand Bahama) and oolitic sand dunes are represented in thin long islands (including Long Island and Cat Island).

Soil composition in the archipelago consists of organic and inorganic materials and the young age of the soil is reflective of the geologic age (young) of the limestone. Soils layers are typically thin and usually arranged in one or two layers above bedrock. Three soil types are recognized throughout the islands: organic, red clay, and sedimentary soils.

The substrate throughout the site is Lucayan Limestone, with hard irregular rock at the surface and minor karst features including sinks, holes, pits, and cavities. Standing water was observed in small, pitted areas with low elevation. No blue holes were observed on site. Little developed soil was observed, except for areas along the northern boundary, closest to Lake Killarney.

3.1.4 Hydrology and hydrogeology

In The Bahamas, the physical geology, hydrogeology, and water resources are very directly linked as there are no true rivers in The Bahamas. The only natural means of recharge for the underlying freshwater resources is via rainfall. The groundwater resources of the Commonwealth of the Bahamas comprise the fresh, brackish, saline and hypersaline waters found in the subsurface and in the lakes and ponds that intercept the land surface. Most of the freshwater resources occur as three-dimensional lens-shaped bodies, which overlie brackish and saline water referred to as Ghyben-Hertzberg lenses (see Figure 3-1).

Figure 3-1: Ghyben–Hertzberg Lens

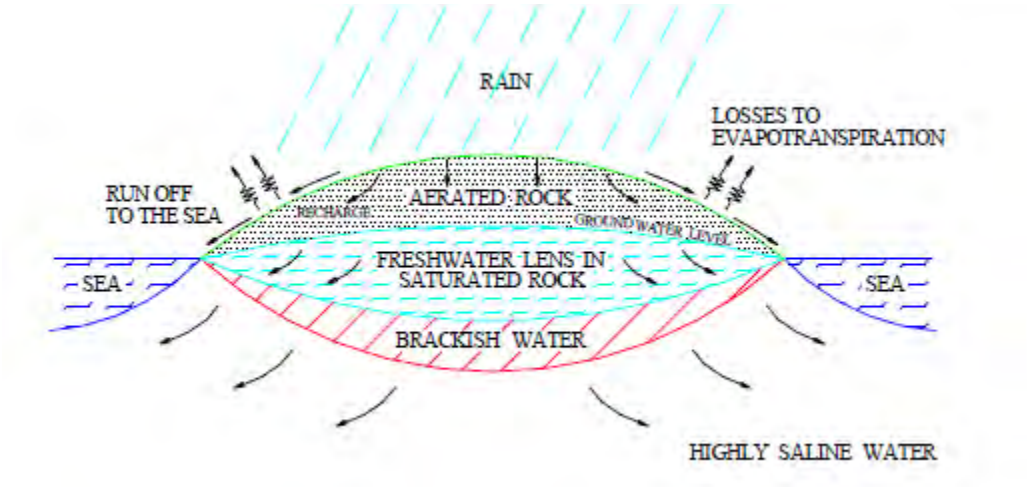
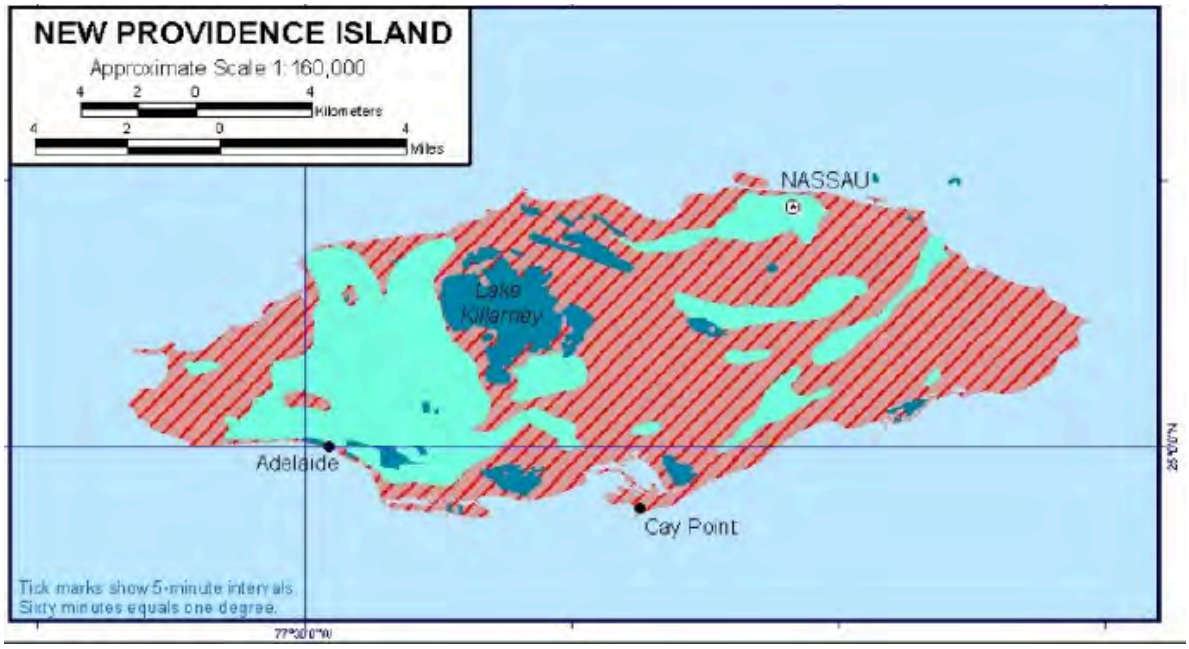


Figure 3-2 below shows areas throughout New Providence where the fresh water (< 1,500-mg/l chloride) is "locally plentiful" with the water table within 0 to 6 meters (0 to 20 feet) of the surface (USACE, 2004). Thickness of the water lenses in New Providence range from 20 to 50 feet (Cant, n.d.). The project site is located in an area that is characterized by surface water bodies rather than groundwater resources. Any water found here is likely brackish to hypersaline.

Fresh groundwater at the site ranges from scarce to locally plentiful. Pine Woodlands are an indication that there is fresh groundwater accessible on some areas of the site. Potable freshwater will be provided from municipal sources for project activities as there is no intent to utilize groundwater resources.

Figure 3-2: Diagram of New Providence Freshwater Lens



Map Legend	
Groundwater resources – Fresh water locally plentiful; unsuitable to large quantities of fresh water from shallow, freshwater lenses within poorly-stratified Pleistocene limestone aquifers. The water table is within 0 to 20 feet of the surface	
Ground water resources – Fresh water scarce or lacking; unsuitable quantities of fresh water from shallow poorly-stratified Pleistocene limestone aquifers.	
Surface water resources – Surface water features including ponds, lakes, creeks and blue holes; unsuitable to meager quantities of brackish to hypersaline water available.	

Source: USACE, 2004.

Rainfall

Rainfall is unevenly distributed across The Bahamas. Figure 3-3 shows the distribution of rainfall for The Bahamas.

The north and north central Bahamas receive some 50 to 60 inches (1270 to 1524 millimeters) of rainfall annually while in the southeast Bahamas, the rainfall decreases to some 36 inches (914 millimeters) annually (USACE, 2004). There is a distinct dry season (November to April) and a pronounced wet season (May to October). The seasonal effects of tropical cyclones have a pronounced effect on annual rainfalls across The Bahamas. Additionally, winter storms flowing off

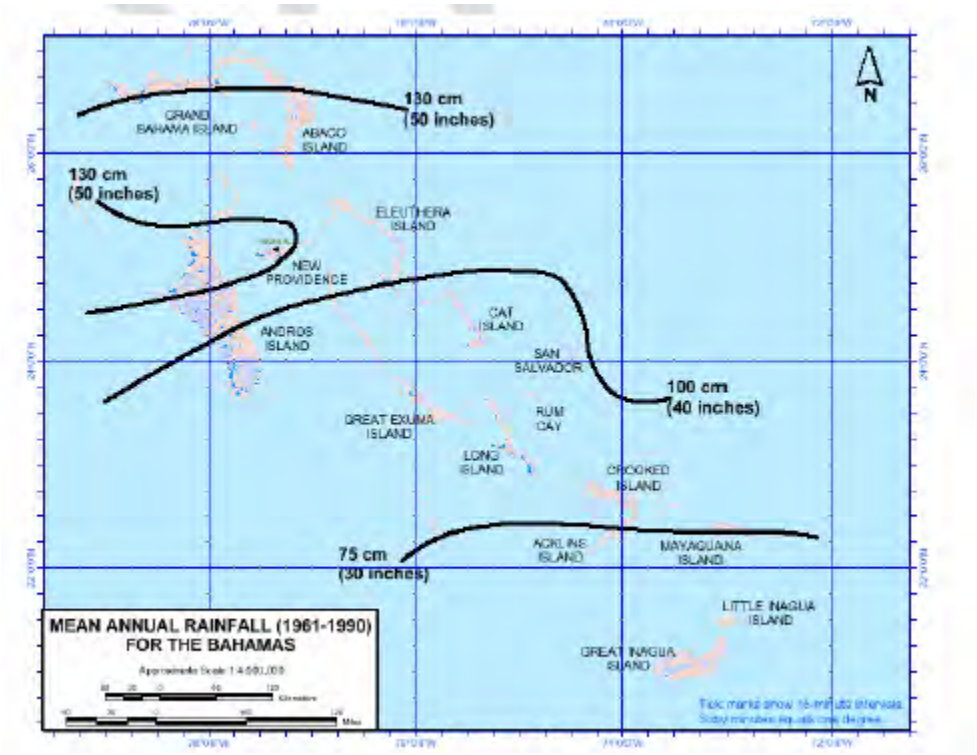
the North American continent also impact rainfall during the normally dry period. This effect however rarely extends into the central and southern Bahamas.

Surface Water

"Inland water bodies are, in most instances, places where the water table is at or near the same level as the land surface. These bodies are usually saline or brackish in nature. In other cases, ponding of water can occur after a heavy rainfall where the surface rock is impervious enough to retard infiltration. These intermittent freshwater pools may persist for a few hours or for the full length of the wet season. The two most prominent types of surface water bodies in The Bahamas are blue holes and salt ponds." (USACE Water Resources Assessment, 2004). No blue holes or salt ponds were observed on the project site.

Lake Killarney is to the northeast of the project site. Lake Killarney is a large shallow lake with brackish water. There is a small wetland area that ran along the east side of Fire Trail Road West at the northern end of the site that was filled over the course of EIA surveys on the site. This activity was reported to relevant Government agencies.

Figure 3-3: Mean Annual Rainfall for The Bahamas



Source: USACE, 2004.

Climate and Sea Level Rise

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

the frequency and intensity of hurricanes and the potential of rising sea levels. Changes in the position and the distribution of fresh, brackish and saline groundwater is anticipated due to any rising sea level, combined with possible reductions in groundwater recharge from changes in rainfall distribution.

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

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

3.1.5 Air quality

While no air quality issues were observed during surveys of the site, dust generation due to the extensive quarry mining is likely on windy days. With installation of solar panels and a ceasing of quarry mining, air quality is expected to improve at the site.

3.1.6 Noise pollution

Noise pollution is an issue in certain areas of the project site, particularly where this is heavy equipment operation and traffic due to quarry mining. There may be elevated noise levels during construction on the site, but these are expected to be limited to daylight hours so as not to disturb neighbouring residents during sleeping hours.

3.2 Biological aspects

3.2.1 Terrestrial habitats - Plants

An assessment of the vegetative community at the proposed site was conducted to determine vegetation types, list species present, and identify protected species present, as listed under the Forestry (Declaration of Protected Trees) Order, 2021. Botanical surveys were conducted throughout the month of May 2024.

A map is provided in Figure 3-4, showing vegetative cover and areas that have been altered by human action. Large areas of the site have been significantly altered by land clearing and quarry mining.

Geographic waypoints were collected via handheld GPS. Diameter at breast height (DBH) tape was used to measure tree diameter and a laser rangefinder to measure tree height. Photographs were taken during data collection activities on site. Satellite imagery via Google Earth, drone imagery, and groundtruthing was used to characterize the site. ArcMap[2] was utilized to analyze and delineate land cover and acreages, and in preparing relevant GIS maps of the site.

[2] ESRI imagery source: Maxar, Vivid Advanced. June 17, 2023. Release: Maps 2024.R

A walking releve was used in the identification of plant species throughout the site and four randomly selected 0.1-acre plots were established and georeferenced to establish variability of protected tree sizes, heights, and tree numbers across the site. Data collected for protected trees within the plots were tree diameter at breast height (DBH) in cm, number of trees, and tree height in meters. The data from each plot was averaged per plot and then expanded per acre using standardized forest calculations.

Plant taxonomy was based on Correll and Correll (1982)[3] and observations for protected species were based on species listed in the Forestry (Declaration of Protected Trees) Order, 2021[4].

Numerous native and nonnative plant species were observed on site including herbaceous species, grasses, shrubs, trees and vines. These species include pine (*Pinus caribaea var.bahamensis)*, Pineland Snow Berry (*Chiococca parvifolia),* Love Vine (*Cassytha filiformis*), and Bahama Brasiletto (*Caesalpinia bahamensis*). The complete list of plant species observed on site is shown in Table 3-1.

Table 3-1: Plant species observed on Carmichael Village site

	Common Name	***Scientific Name***
1	Alvaradoa amorphoides	*Alvaradoa amorphoides*
2	Australian Pine	*Casuarina equisetifolia*
3	Bahama Brasiletto	*Caesalpinia bahamensis*
4	Bahama Passion Flower	*Passiflora bahamensis*
5	Bahama Pigeon Plum	*Coccoloba tenuifolia*
6	Bahama Senna	*Cassia chapmanii*
7	Bahamian Pine	*Pinus caribaea var. bahamensis*
8	Banara	*Banara minutiflora*
9	Bastard Stopper	*Petitia domingensis*
10	Bermuda Grass	*Cynodon dactylon*
11	Black Mangrove	*Avicennia germinans*
12	Blue Flower	*Stachytarpheta jamaicensis*
13	Blue Rat Tail	*Stachytarpheta fruticosa*
14	Bracken Fern	*Pteridium aquilinum*
15	Brasiletto	*Caesalpinia versicaria*
16	Brazilian Pepper	*Schinus terebinthifolia*
17	Broom Bush	*Baccharis dioica*
18	Broom Sedge	*Andropogon virginicus*
19	Bull Vine	*Cissus intermedia*
20	Bushy Beard Grass	*Andropogon glomeratus*

[3] Correll DS, Correll HB. (1982). *Flora of the Bahama Archipelago*. Vaduz: A.R. Gantner Verlag KG.
[4] Forestry (Declaration of Protected Trees) Order, 2021

	Common Name	***Scientific Name***
21	Butterfly Pea	*Centrosema angustifolium*
22	Butterfly Pea	*Centrosema virginianum*
23	Capitate Spikerush	*Eleocharis geniculata*
24	Caracoli	*Abarema glauca*
25	Carpet Grass	*Axonopus compressus*
26	Carrajo Bush	*Anastraphia paucifloscul*osa
27	Cat Tail	*Typha domingensis*
28	Cat Tongue	*Ageratina havanensis*
29	Chaney Briar	*Smilax havanensis*
30	Cinnecord	*Acacia choriophylla*
31	Climbing Hempweed	*Mikania scandens*
32	Coconut	*Cocos nucifera*
31	Cocoplum	*Chrysobalanus icaco*
32	Coontie	*Zamia integrifolia*
33	Cuban Yellow Wood	*Zanthoxylum rhodoxylon*
34	Drop Seed Grass	*Sporobolus domingensis*
35	Dutchman's Pipe	*Aristolochia passiflorifolia*
36	Ear Leaf Acacia	*Acacia auriculiformis*
37	Eastern Gamagrass	*Tripsacum dactyloides*
38	Egyptian Acacia	*Vachellia nilotica*
39	Egyptian Grass	*Dactyloctenium aegyptium*
40	Field Marigold	*Thymophylla tenuiloba*
41	Five Finger	*Tabebuia bahamensis*
42	Flat Spiked Rush	*Abildgaardia ovata*
43	Flea Bane	*Erigeron quercifolius*
44	Gammalamme	*Bursera simaruba*
45	Goat Bush	*Tridax procumbens*
46	Golden Creeper	*Ernodea littoralis*
47	Golden Dew Drop	*Duranta repens*
48	Grass Leaved Golden Aster	*Pityopsis graminifolia*
49	Guana Berry	*Byrsonima lucida*
50	Hog Bush	*Callicarpa hitchcockii*
51	Hoop Vine	*Trichostigma octandrum*
52	Hop Bush	*Dodonaea viscosa*
53	Hyssop	*Bacopa monnieri*
54	Jumbay	*Leucaena leucocephala*
55	Lice Root	*Angadenia berteroi*

	Common Name	***Scientific Name***
56	Long Leaved Brake	*Pteris bahamensis*
57	Loose Panic Grass	*Urochloa adspersa*
58	Love Vine	*Cassytha filiformis*
59	Madeira, Mahogany	*Swietenia mahagoni*
60	Maidenhair Anemia	*Anemia adiantifolia*
61	Marlberry	*Ardisia escallonioides*
62	Marsh Fern	*Blechnum serrulatum*
63	Marsh Fleabane	*Pluchea rosea*
64	Marsh Gentian	*Eustoma exalatum*
65	Marsh Pennywort	*Hydrocotyle hirsuta*
66	Milkwort	*Asemeia grandiflora*
67	Morning Glory	*Ipomoea indica*
68	Natal Grass	*Melinis reopens*
69	Needle Bush	*Vachellia farnesiana*
70	No Known Common Name	*Amaranthus spinosus*
71	No Known Common Name	*Caesalpinia reticulata*
72	No Known Common Name	*Cassia lineata*
73	No Known Common Name	*Cyperus croceus*
74	No Known Common Name	*Erithalis fruticosa*
75	No Known Common Name	*Erythroxylum reticulatum*
76	No Known Common Name	*Lepidaploa arbuscula*
77	No Known Common Name	*Varronia bahamensis*
78	No Known Common Name	*Vernonia bahamensis*
79	Old Man’s Beard	*Tibisia farcta*
80	Pain-in-back	*Trema lamarckianum*
81	Panic Grass	*Megathyrsus maximus*
82	Prickly Bush	*Oplonia spinosa*
83	Para Grass	*Urochloa mutica*
84	Pepper Bush	*Croton humilis*
85	Pigeon Plum	*Coccoloba diversifolia*
86	Pineland Snowberry	*Chiococca parvifolia*
87	Pineyard Pink	*Bletia purpurea*
88	Poison Wood	*Metopium toxiferum*
89	Pond Apple	*Annona glabra*
90	Pork and Dough Boy	*Acacia acuifera*
91	Prince Wood	*Exostema caribaeum*
92	Ram's Horn	*Pithecellobium keyense*

	Common Name	***Scientific Name***
93	Sabal Palm	*Sabal palmetto*
94	Salt Marsh Agalinis	*Agalinis maritima*
95	Salt Marsh Aster	*Aster subulata*
96	Salt Marsh Rush	*Juncus roemerianus*
97	Sand Cyperus	*Cyperus planifolius*
98	Satin Leaf	*Chrysophyllum oliviforme*
99	Saw Grass	*Cladium jamaicense*
100	Scale-leaved aster	*Symphyotrichum adnatum*
101	Sea Grape	*Coccoloba uvifera*
102	Seashore Rush Grass	*Sporobolus virginicus*
103	Serpent Fern	*Phlebodium aureum*
104	Shaggy Crab Grass	*Digitaria villosa*
105	Shortleaf Rosegentian	*Sabatia brevifolia*
106	Shyleaf	*Aeschynomene americana*
107	Silver Leaf	*Thouinia discolor*
108	Silver Top	*Coccothrinax argentata*
109	Sleepy Morning	*Waltheria indica*
110	Slender Panic Grass	*Panicum tenerum*
111	Smooth Sesban	*Sesbania herbacea*
112	Smooth Wild Coffee	*Psychotria ligustrifolia*
113	Snowberry	*Chiococca alba*
114	Sour Grass	*Digitaria insularis*
115	Southern Colic Root	*Aletris bracteata*
116	Southern Crab Grass	*Digitaria ciliaris*
117	Southern Grass Pink	*Calopogon tuberosus*
118	Southern Shield Fern	*Thelypteris augescens*
119	Spike Rush	*Eleocharis cellulosa*
120	Spider Pea	*Macroptilium atropurpeum*
121	St. Andrews Cross	*Hypericum hypericoides*
122	Stinking Pea	*Senna chapmanii*
123	Stinking Pea Root	*Ateleia gummifera*
124	Strong Back	*Bourreria ovata*
125	Thatch Palm	*Leucothrinax morrisii*
126	Vanilla Vine	*Vanilla barbellata*
127	Virginia Creeper	*Parthenocissus quinquefolia*
128	Viscid Pencil-Flower	*Stylosanthes scabra*
129	West Indian Pink	*Spigelia anthelmia*

	Common Name	***Scientific Name***
130	West Indian Thyme	*Clinopodium brownei*
131	White-headed Rush	*Rhynchospora floridensis*
132	White Ink Berry	*(Scaevola taccada*
133	White Stopper	*Eugenia axillaris*
134	Wild Bush Bean	*Macroptilium lathyroides*
135	Wild Dilly	*Manilkara bahamensis*
136	Wild Ipecac	*Asclepias curassavica*
137	Wild Grape	*Vitis rotundifolia var. munsoniana*
138	Wild Guava	*Tetrazygia bicolor*
139	Wild Potato	*Echites umbellatus*
140	Wild Yam	*Dioscorea microphylla*
141	Yellow Alder, Buttercups	*Turnera ulmifolia*
142	Yellow Top	*Flaveria linearis*
143	Yellow wood	*Zanthoxylum flavum*

Overall, the vegetative cover at the site is highly segmented by human activities (quarry mining, land clearing, dumping, residences/buildings/structures, unpaved roads/trails), with approximately 21 acres of intact Pine Woodland in the north and center of the site. Other smaller areas of pine (less than 10 acres) were observed in the northwest and southwest areas of the site.

The open canopy of the pine woodland is dominated by mature Bahamian Pine (*Pinus caribaea var. bahamensis*) trees ranging in height from 6.5 feet (3 meters) to 25 feet (7.6 meters). The shrub layer throughout the site is generally 3.28 feet (1 meter) to 8.2 feet (2.5 meters) in height. The understory is dominated by a variety species including Sabal Palm (*Sabal palmetto)*, Silver Thatch (*Coccothrinax argentata)* and *Metopium toxiferum (Poisonwood).* Some areas on the site had an overgrown mid-story likely resulting from an absence of a regular fire regime.

The understory across the site varied between palm dominated, *Metopium toxiferum* dominated and multi-species shrub layers. The dominant understory species observed throughout the pine woodland were Granny Bush *(Varronia bahamensis),* Golden Creeper (*Ernodea littoralis)* (see Figure 3-5), Bahama Brasiletto *(Caesalpinia bahamensis),* and Sabal Palm (*Sabal palmetto)*.

Large areas in the north, northwest, and eastern quadrant, representing more than half of the 124-acre human altered layer, have been significantly cleared in recent years (See Figure 3-6). Mature pine was observed in the eastern quadrant and was scattered throughout the area with little to no understory. The eastern area could not be surveyed due to safety reasons, but the pine canopy appears to range in height from 15 to 38 feet (5 to 9 meters) and in areas where understory was present, it appeared to be bare ground or generally less than 3.28 ft (1 meter) in height.

Figure 3-4: Vegetative cover map of Carmichael Village microgrid site

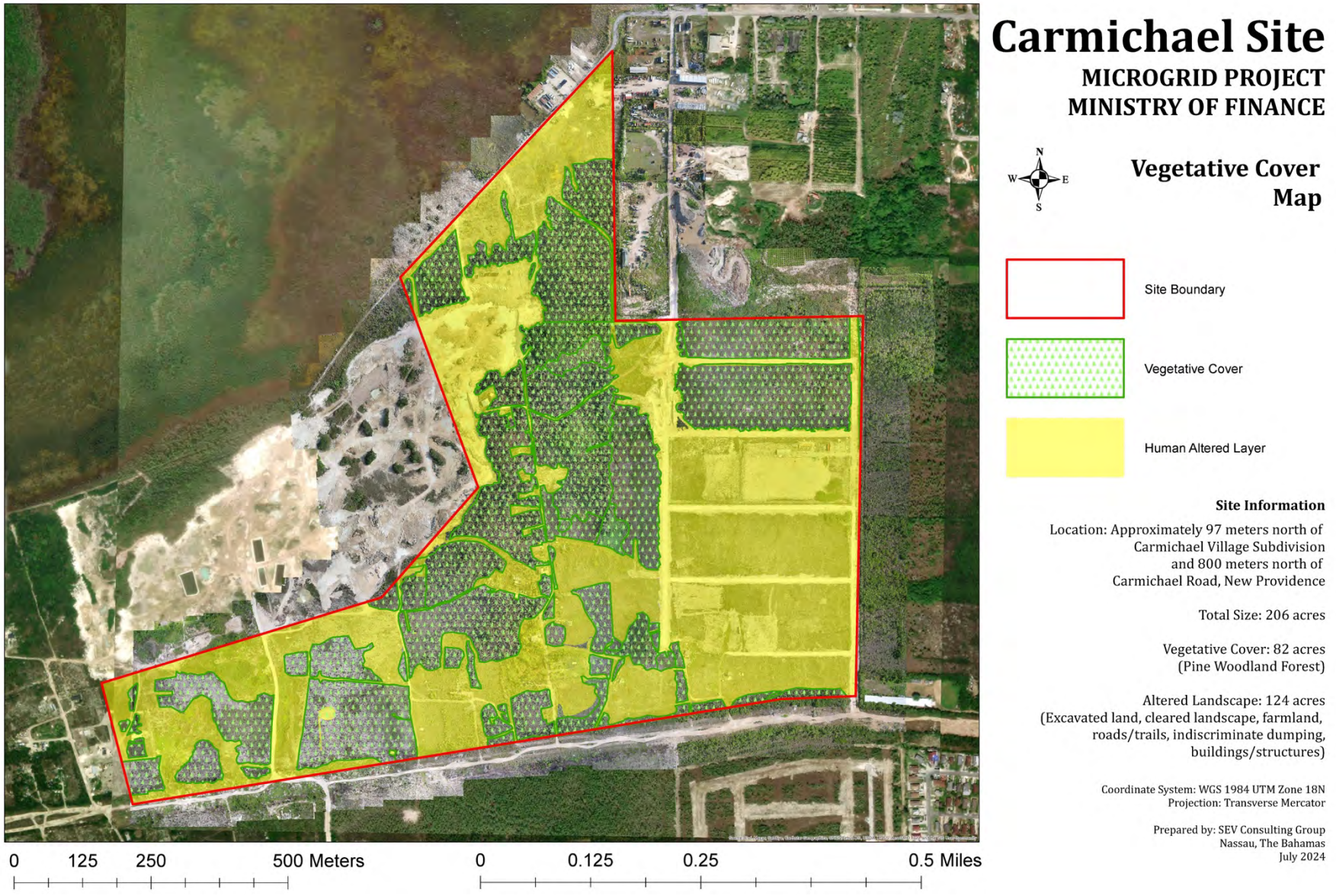


Figure 3-5: Golden Creeper (*Ernodea littoralis*)

Figure 3-6: Panoramic view of northern site boundary

(looking south)

The remaining area is human altered (approximately 59 acres) was distributed throughout the site and includes farmland, roads/trails, buildings/structures, and indiscriminate dumping. Vegetation, where present varied between crop species, naturalized species, and small areas of pine (less than 3x3 m), In the areas of expansive land clearing, it appears vegetation was cleared down to the limestone surface and as such little regeneration is present.

Evidence of fire in the pine woodland was observed across the site and mainly in the southern quadrant, where fire appeared to be recent (see Figure 3-7). Some evidence of previous fire was found along the northern boundary and in the interior of the site, in and around the existing hill/elevated land. In the latter area, pine seedlings and saplings were most abundant.

Figure 3-7: Recent fire in Pine Woodland

(Southern boundary, looking North)

Invasive species observed on site include Australian Pine (*Casuarina equisetifolia*), Jumbay (*Leucaena leucocephala*), Brazilian Pepper (*Schinus terebinthifolia*), and White Ink Berry (*Scaevola taccada*).

Vegetative Communities

The two vegetative communities observed at the proposed site were Dry Needle Leaf Evergreen Formation (Pine Woodland) and Human Altered[5]. The site is predominantly Pine Woodland with an emergent tree layer dominated by Bahamian Pine (*Pinus caribaea var. bahamensis*) and an open canopy.

Within the human altered layer, large areas have been cleared; this appears to have been done primarily for quarry mining and/or agriculture and cultivation. Two alliances for the Pine Woodland community were observed on site and classification of both communities are listed in Table 3-2 below.

[5] Areces-Mallea AE. et al.

Table 3-2: Vegetative communities & acreages at Carmichael Village site

Vegetative communities	Approximate area (acres)	Vegetative formations
Pine Woodland	82 acres	II.A.3.N.a. *Pinus caribaea var. bahamensis* Woodland Alliance (*Pinus caribaea bahamensis* woodlands, on limestone)
Human Altered Layer	124 acres	
Total	206 acres	

Pine Woodland
Class: II. Woodland
Subclass: II.A. Evergreen woodland
Group: II.A.3. Tropical or subtropical needle-leaved (or needle-stemmed) evergreen woodland
Subgroup: II.A.3.N Natural/Semi-natural

***II.A.3.N.a. Pinus caribaea var. bahamensis* Woodland Alliance (Pinus caribaea bahamensis woodlands, on limestone)**
This alliance represents dry pine barrens on limestone, with essentially monospecific canopy of *Pinus caribaea var. bahamensis* (see Figure 3-8). These communities occur near the boundary between Lake Killarney and upland areas. Species observed on site include Silver Thatch (*Coccothrinax argentata), Vernonia bahamensis, and Duranta repens.*

Figure 3-8: Panoramic view of Pine Woodland

(West, near vegetation plot 4)

***II.A.3.N.d. Pinus caribaea var. bahamensis* Woodland Alliance (Pinus caribaea bahamensis saturated woodlands)**

This alliance represents seasonally wet pineyards on honeyconbed limestone, with essentially monospecific canopy of *Pinus caribaea var. bahamensis*. Dominant species observed on site was *Sabal palmetto* (see Figure 3-9).

Figure 3-9: Panoramic view of Pine Woodland

(West, near vegetation plot 2)

Human Altered Layer (Disturbed Area)

Non-agricultural Disturbed Areas

Human Altered Layer (Disturbed Area)

Extensive alteration of the land surface has taken place due to quarry mining and other activities occurring adjacent to and within the proposed site. Additionally, there has been extensive land clearing for residential and agricultural purposes on site. A network of unpaved roads and paths are located throughout the site, providing access to these areas of use (see Figure 3-10).

Figure 3-10: Panoramic view of eastern area of the site

(Road facing South)

The northern area of the site was likely once a wetland area, given the few freshwater and brackish water plant species observed and proximity to Lake Killarney; however, given the extent of the

clearing and land reclamation, proper classification could not be established with confidence (see Figures 3-11 and 3-12).

Figure 3-11: Panoramic view of northern boundary of the site
(facing South)

Figure 3-12: View of the northern boundary road
(facing West in May 2024; much of this was filled in by August 2024)

Protected Trees

The Bahamian archipelago has 89 endemic seed plant species. The Forestry (Declaration of Protected Trees) Order, 2021, ensures the protection of endemic, endangered, or threatened species, under Part I of the Order. Other protected plant species of cultural, historic, and economic importance are protected under Part II of the Order.

A total of twelve (12) species listed in the Forestry (Declaration of Protected Trees) Order were observed at the Carmichael site: four (4) from Part I and eight (8) from Part II. The species, approximate range of height, and images are provided in Tables 3-3 and 3-4. Only one individual Black mangrove (*Avicennia germinans*) tree was observed on site, in the northern quadrant where extensive land clearing has occurred (see Figure 3-13).

Figure 3-13: Black Mangrove observed on the site

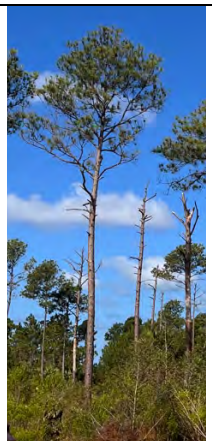
(Northern boundary)

Table 3-3: Protected trees observed on site – Part I of Forestry (Declaration of Protected Trees) Order

Botanical Name	Common name	Height range or area size (approx.)	Tree (T)/ Shrub (S)/ Herb (H)	Image
Euphorbia cayensis	Bahama Spurge	0.3 to 0.35 in (0.76 to 0.9 cm)	H	
Erythroxylum reticulatum	No Known Common Name	1.5 to 3 feet (0.91 to 0.46 meters)	S	
Passiflora bahamensis	Bahama Passion Flower	Area: approximately 0.25 acre	H	
Varronia bahamensis	No Known Common Name	1.5 to 3.5 feet (0.5 to 1 meter)	S	

Table 3-4: Protected trees observed on site – Part II of Forestry (Declaration of Protected Trees) Order

Botanical Name	Common name	Height range or area size (approx.)	Tree (T)/ Shrub (S)/ Herb (H)	Images
Avicennia germinans	Black Mangrove	5.5 feet (1.7 meters)	T	
Bursera simaruba	Gammalamme	7 to 25 feet (2 to 8 meters)	T	
Caesalpinia bahamensis	Bahama Brasiletto	1 to 3 (0.3 to 0.91 meters)	S	

Botanical Name	Common name	Height range or area size (approx.)	Tree (T)/ Shrub (S)/ Herb (H)	Images
Coccothrinax argentata	Silver Thatch	3 to 25 feet (0.91 to 8 meters)	T	
Pinus caribaea var. bahamensis	Bahamian Pine	3 to 30 feet (0.91 to 9 meters)	T	
Sabal palmetto	Sabal Palm	3 to 20 feet (0.91 to 6 meters)	T	
Senna chapmanii	Stinking Pea	1 to 3 (0.3 to 0.91 meters)	H	

Botanical Name	Common name	Height range or area size (approx.)	Tree (T)/ Shrub (S)/ Herb (H)	Images
Swietenia mahagoni	Madeira, Mahogany	25 feet (8 meters)	T	

Protected species observed on site, but not within vegetative survey plots include:

- Bahama Spurge (*Euphorbia cayensis)*
- Mahogany *(Swietenia mahagoni); and*
- Black Mangrove *(Avicennia germinans)*

3.2.2 Terrestrial habitats - Birds

The birds observed during the surveys are described based on their range of occurrence, and their conservation or management status. Range is described as:

- Permanent Resident Breeding (**PRB**) for birds that remain in The Bahamas throughout the year and reproduce;
- Resident Non-Breeding (**RNB**) birds occur within The Bahamas throughout the year with the exception of their breeding period;
- Summer Resident Breeding (**SRB**) birds only occur in The Bahamas during their breeding season which is during the summer (from April to October);
- Winter Resident (**WR**) birds occur in The Bahamas throughout the winter months from October to May and leave to breed in North America;
- Endemic birds (**E**) occur only within The Bahamas or Caribbean; and
- Migrant species (**MI**) pass through The Bahamas during migration, but do not stay for extended periods.

Conservation status is based on the International Union for the Conservation of Nature (IUCN) classifications and specific regulations of the species in the Laws of the Bahamas. IUCN classifications include:

- Species of Least Concern (**LC**) for whom no conservation intervention or management is required and the species is not expected to decline or be lost in the foreseeable future;
- Near Threatened (**NT**) species whose populations may decline drastically without significant protection or constant management;
- Vulnerable (**VU**) species are likely to become endangered if the risks facing the species in the wild are not addressed; and
- Unassessed (**UA**) species have not received a formal evaluation from the IUCN and are generally not considered species of conservation concern.

Through the terrestrial survey, the bird species observed are outlined in Table 3-5. Bird observations were conducted between May 22nd and June 3rd, 2024 in the mornings and afternoons for 18 hours of active avian survey, including 4.42 miles of transects. A total of twenty-three (23) species were observed during the survey period at the project site and in the surrounding Carmichael Village area (see Tables 3-5 and 3-6).

Seventeen (17) of the recorded species are permanent resident species which breed in the islands of The Bahamas and are of low conservation concern.

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

Based upon observations of the Hairy Woodpecker, the Caribbean Pine trees on site are being used by this particular species for shelter and food. While this species is known to lay eggs in pine trees, no evidence of nesting on site was found.

The Mangrove Cuckoo, a species that prefers the thickness of the coppice, was also observed every day during the survey period.

The Killdeer is a species known to utilize disturbed areas and open fields. The eggs of the Killdeer are laid out in the open on the ground. Depending on the colour of the ground, the eggs can be very difficult to see. It is possible that they are laying eggs in the open fields on the property based on their behaviour.

The Red-winged Blackbird was observed in the wetland areas near the site.

The Belted kingfisher was observed perched high up in the Caribbean Pine trees, possibly looking for food down in the wetland areas.

The American Kestrel is known to eat rodents and other weak or sick bird species. They prefer to stalk prey either from high up in pine trees or low down on mangrove roots.

The White-crowned Pigeons were seen in high numbers during the morning and evening surveys. They utilize the coppice for food and shelter.

During the migratory season, more species may possibly use the project site for rest and food, obtaining energy for their journey ahead.

Table 3-5: Bird species observed on Carmichael Village project site

Common Name	**Scientific Name**	**Classification[6]**
American Kestrel	*Falco sparverius*	PRB, LC
Black-faced Grassquit	*Melanospiza bicolor*	PRB, LC
Black-necked Stilt	*Himantopus himantopus*	RNB, LC
Common Ground Dove	*Columbina passerina*	PRB, LC
Gray Kingbird	*Tyrannus dominicensis*	SRB, LC
Great Blue Heron	*Ardea herodias*	RNB, LC
Gull-billed tern	*Gelochelidon nilotica*	PRB, LC
Killdeer	*Charadrius vociferus*	PRB, LC

[6] PRB – Permanent Resident Breeding; LC – Least Concern; SRB – Summer Resident Breeding; RNB – Resident Non-Breeding; MI – Migratory.

Common Name	Scientific Name	Classification[6]
Mangrove Cuckoo	*Coccyzus minor*	PRB, LC
Neotropic Cormorant	*Phalacrocorax brasilianus*	PRB, LC
Northern Mockingbird	*Mimus polyglottos*	PRB, LC
Smooth-billed Ani	*Crotophaga ani*	PRB, LC
Thick-billed Vireo	*Vireo crassirostris*	PRB, LC
White-crowned Pigeon	*Patagioenas leucocephala*	PRB, LC

Table 3-6: Bird species observed in Carmichael Village area

Common Name	Scientific Name	Classification
Belted Kingfisher	*Megaceryle alcyon*	RNB, LC
Common Gallinule	*Gallinula galeata*	PRB, LC
Eurasian-collared Dove	*Streptopelia decaocto*	PRB, LC
Glossy Ibis	*Plegadis falcinellus*	RNB, LC
Green Heron	*Butorides virescens*	PRB, LC
La Sagra's flycatcher	*Myiarchus sagrae*	PRB, LC
Mourning Dove	*Zenaida macroura*	PRB, LC
Red-winged Blackbird	*Agelaius phoeniceus*	PRB, LC
Solitary Sandpiper	*Tringa solitaria*	MI, LC

Figure 3-14: Photos of bird species observed

Mangrove Cuckoo

Common Ground Dove

Great Blue Heron

White-crowned Pigeon

Thick-billed Vireo

American Kestrel

Glossy Ibis

Killdeer

3.2.3 Terrestrial habitats – other animals

A survey of other animals was completed for the site in addition to the avifaunal survey. All species observed during the survey are outlined in Table 3-7.

Table 3-7: Animal species observed on Carmichael Village site

Common Name	Scientific Name
Bark Anole	*Anolis distichus*
Cloudless Sulphur	*Phoebis sennae*
Cuban Brown Anole	*Anolis sagrei*
Cuban Crescent butterfly	*Anthanassa frisia*
Eastern Pondhawk (male & female)	*Erythemis simplicicollis*
Long-horn Beetle	*Plinthocoelium spp.*
Mexican Fritillary	*Euptoieta hegsia*
Needham's Skimmer	*Libellula needhami*
White Peacock	*Anartia jatrophae*

Figure 3-15: Photos of other animal species observed

Eastern Pondhawk male

Eastern pondhawk femaie

Cuban Brown Anole

Needham's Skimmer

3.2.4 National parks and protected areas

The closest protected area to the project site is the Harold and Wilson Pond National Park which is approximately 2.8 km (1.7 miles) away. Established in 2002 by the Government of The Bahamas and managed by the Bahamas National Trust, this national park is 250 acres of freshwater wetlands. It is vital habitat for birdlife on New Providence.

This protected area is not expected to be impacted by the Carmichael Village microgrid project.

3.3 Socioeconomic aspects

3.3.1 Communities, demography and economy

The Carmichael Village microgrid project site is located in the Carmichael constituency. According to the 2022 census, Carmichael has a population of 11,932 (Bahamas Department of Statistics, 2023). This district has seen significant growth in recent years, contributing to the overall population increase in New Providence. Spanning an area of 2.22 square miles, Carmichael has a population density of approximately 5,377 persons per square mile (Bahamas Department of Statistics, 2023), indicating a densely populated area within New Providence.

The population of The Bahamas is approximately 362,000, with an average of 65.3 persons per square mile. Over 70% of the population reside on the 80 square mile island of New Providence. This equates to 3,079 persons per square mile, making New Providence the most densely populated island in the archipelago (Department of Statistics, 2012).

The total number of occupied households in The Bahamas is 102,862, with an average household size of 3.4. New Providence has approximately 70,000 occupied households and the average household size is 3.5. Carmichael comprises 3,186 households, with an average household size of 3.75 persons (Bahamas Department of Statistics, 2023). This average is slightly higher than the national household size of 3.38, suggesting that households in Carmichael tend to be larger than the national average. The gender ratio in New Providence, including Carmichael, shows a slight predominance of females, with 93 males per 100 females (Bahamas Department of Statistics, 2010). This distribution aligns with broader sex ratio trends observed in New Providence.

Carmichael is part of New Providence, the economic hub of the Bahamas. Economic activities in the district are diverse, ranging from small businesses and retail operations to professional services. Employment rates and types of occupations in Carmichael mirror those of the larger New Providence area, with significant contributions from sectors such as tourism, finance, and public services (Bahamas Department of Statistics, 2010). Educational facilities in Carmichael cater to the local population's needs, including several primary and secondary schools. The literacy rate in New Providence is high, and Carmichael benefits from the educational infrastructure available in the capital (Bahamas Department of Statistics, 2010).

Carmichael is well-served by New Providence's infrastructure, including road networks, public transportation, healthcare facilities, and utilities. The district benefits from comprehensive public services, contributing to the quality of life for its residents (Bahamas Department of Statistics, 2010). Despite its growth and development, Carmichael faces several challenges, such as managing urbanization pressures, maintaining infrastructure, and ensuring adequate public services to meet the needs of its expanding population. Addressing these challenges requires coordinated efforts between local authorities and the community (Bahamas Department of Statistics, 2010).

Carmichael is a densely populated and rapidly growing district in New Providence. It has a higher-than-average household size and reflects the economic diversity and vitality of the capital. While it enjoys robust infrastructure and services, ongoing efforts are needed to manage growth and sustain the quality of life for its residents (Bahamas Department of Statistics, 2010).

Tourism is the number one industry in The Bahamas, accounting for 20% of the labour force, and contributing 60% of the GDP. Financial services sector is the second major industry in The Bahamas and includes commercial and private banking institutions.

The Bahamas Government, commercial industries and businesses throughout New Providence serve as major employers. The key employment sectors include tourism (hotel, cruise, and related tour operations), transportation (by air, land, and sea), vendor/supplier products and services, banking, medical, education, and the civil service.

The economy of The Bahamas has been in perpetual rebound mode in recent years due to several catastrophic events. In October 2016, Hurricane Matthew swept through The Bahamas, followed in September 2019 by the most destructive extreme weather event in modern Bahamian history, Hurricane Dorian. Estimated damages and losses attributed to Dorian totaled in excess of $3.4 billion dollars, representing one third of the country's GDP (IDB, 2019). Since the devastation of Hurricane Dorian, over 3,000 persons have relocated to New Providence, significantly impacting demographics on the island (Dept of Statistics, 2019). The COVID-19 pandemic also had significant negative impacts on the economy.

Enrollment in school is mandatory in The Bahamas for youth between the age of 5 and 16. Approximately 75,120 students are enrolled at the preschool school to secondary school levels and between 8,000 - 9,000 enrolled at the tertiary level. Carmichael Village Senior High School is adjacent to the project site.

Educational, medical, financial services, utilities, retail outlets, and numerous other services are easily accessible on New Providence. New Providence has a network of roads that allow access across most of the island. East Street, which runs along the western boundary of the site is the main thoroughfare connecting transportation routes in the South Beach area of New Providence to other routes in the southern part of the island.

The nearest hospital, Princess Margaret Hospital is about 9.4 km (5.8 mi) from the project site and the nearest public clinic is about 2.8 km (1.7 miles) away – Flamingo Gardens Clinic.

3.3.2 Transportation and other services

Infrastructure and services on the island of New Providence include:

- Roads – constructed by the Ministry of Public Works
- Potable water - provided by the Water & Sewerage Corporation or private wells
- Telecommunications - provided by the Bahamas Telecommunications Corporation
- Cable television and Internet - provided by Cable Bahamas
- Electricity - provided by Bahamas Power and Light
- Medical clinics - managed and operated by the Department of Public Health
- Hospitals – the main hospitals on New Providence are Princess Margaret Hospital managed by the Public Hospitals Authority and Doctors Hospital, a private facility
- Docks/ports – these are managed by the Port Department and include the cruise ship port in Downtown Nassau
- International airport – The Lynden Pindling International Airport is located in western New Providence.

Power generation for the Carmichael Village microgrid Project will be via solar panels. Potable water provision and wastewater treatment will be via Water and Sewerage Corporation.

3.4 Cultural aspects

No historical or archaeological resources were observed at the project site.

3.5 Legal and regulatory

Relevant laws and regulations that will need to be considered for the project include:

Conservation and Protection of the Physical Landscape of The Bahamas Act 1997

This Act prohibits all significant excavation, landfill operation, quarry mining or mining of physical natural resources (such as sand) without permission of the Director of Physical Planning. The Act also gives the Director the authority to request an Environmental Impact Assessment (EIA) for any excavation or land reclamation activities.

Environmental Health Services Act 1987

This Act promotes conservation and maintenance of the environment and also addresses the control of contaminants and pollutants that may adversely affect the environment and human health. The Act also outlines regulations with respect to water supplies, solid and liquid waste, beaches, seaports, harbours and marinas.

Environmental Health Services (Collection and Disposal of Waste) Regulations 2004

These regulations provide for the collection and disposal of domestic, commercial and construction waste. Commercial waste includes ashes, refuse and rubbish. Construction waste includes any waste materials from construction, renovation, repairs and demolition.

Environmental Impact Assessment Regulations 2020

These regulations were developed under the Environmental Planning and Protection Act 2019. They provide guidance on the EIA process for The Bahamas including the Certificate of Environmental Clearance (CEC) application and review process and what information should be included in an EIA and an EMP.

Environmental Planning and Protection Act 2019

This Act provides a legal framework for the protection, enhancement and conservation of the environment. It also provides for the prevention and mitigation of pollution in order to maintain the quality of the environment. It established the Department of Environmental Planning and Protection to regulate and oversee the review of Environmental Impact Assessments and Environmental Management Plans.

Forestry Act 2010

This Act provides for the:

- Setting of royalty fees, permits, leases, and licence fees for utilization of forest produce and non–timber forest produce from the forest estate;
- Management, conservation, control and development of forests, and the promotion and regulation of forest industries;
- Promotion of the conservation and management of wildlife and wildlife habitat in forest reserves, protected forests and conservation forests; and
- Protection of trees that are rare and of historical significance.

Health and Safety At Work Act 2002

The Act provides for:

- Securing the health, safety and welfare of persons at work;
- Protecting persons other than persons at work against risks to health or safety arising out of the activities of persons at work; and
- Controlling the keeping and use of explosive, highly flammable or other dangerous substances and preventing the unlawful acquisition, possession and use of such substances.

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;
- Efficient and orderly provision of infrastructure and services to the built environment;

- Planning processes that are fair by making them open, accessible, timely and efficient;
- Recognition of the decision-making authority and accountability of the Government in land use planning; and
- Planning for the development and maintenance of safe and viable communities.

The Act provides for regulating activities such as quarrying, mining, road construction and subdivision development.

Water and Sewerage Corporation Act 1976

This Act establishes the Corporation. Functions of this organization include the application of appropriate standards and techniques for investigation, use, control, protection, management and administration of water. The Corporation is also mandated to oversee waste disposal, water treatment and water quality.

Wild Animals (Protection) Act 1968

This Act prevents the taking, capture or export of any wild animal without the permission of the Minister of Agriculture & Fisheries. These animals include wild horses, the hutia and iguanas.

Wild Birds Protection Act 1952

This Act provides for the protection of wild birds. The Act lists several species including the White-crowned Pigeon, Whistling Duck and Yellow-crowned Night Heron.

3.6 Government agencies

Government agencies that will be involved with aspects of approval and permitting of this component of the project include:

Department of Environmental Planning and Protection (DEPP)

Formerly the BEST Commission, the Department of Environmental Planning and Protection (DEPP) is responsible for developing the Government of The Bahamas' (GOB) environmental and natural resource management policies. As mandated under the 2019 Environmental Planning and Protection Act and 2020 EIA Regulations, DEPP is responsible for the administration of the EIA process, overseeing the technical review of EIAs, coordinating the public review of EIAs, and various national plans for natural resource management.

DEPP is responsible for various environmental matters, including biodiversity, climate change, wetlands, land degradation, and persistent organic pollutants. In this role, DEPP has established committees, drawing on appropriate staff from different government agencies, for promoting actions to implement the specific requirements of the various multilateral environmental conventions of which The Bahamas is a Party.

Department of Environmental Health Services (DEHS)

Under the *Environmental Health Act* of 1987, and the Environmental Health Regulations, the DEHS mandate is to promote and protect public health and ensure conservation and maintenance of the

environment. One role of the DEHS is to regulate, monitor, and control actual and likely contamination and pollution of the environment and establish minimum standards required for a clean, healthy, and pleasing environment.

For proposed projects, the DEHS evaluates the effectiveness of pollution control measures and initiatives to protect the health and safety of workers, and the natural environment. DEHS also issues the necessary effluent discharge and emissions permits.

Department of Labour

The Department of Labour oversees labour relations and occupational health and safety. The Department is the lead agency for regulating occupational health and safety under the *Health and Safety at Work Act* (2002). Through its Inspection Unit, the Department also conducts inspections to ensure adequate worker safety and compliance with regulations.

Department of Physical Planning

The Department authorizes activities such as dredging, filling, harvesting or removal of protected trees, and any work that will affect coastlines. It also administers the new Planning and Subdivision Act of 2010, which includes ensuring the preparation of land use plans and other physical planning activities.

Ministry of the Environment and Natural Resources

The Ministry of the Environment and Natural Resources oversees conservation of wild animals, birds, and plants, as well as forests. It administers the Wild Birds and Wild Animals Protection Acts.

Ministry of Public Works

The Ministry oversees and maintains physical infrastructure in the country. It is entrusted with the administration of the Building Control Act (BCA) and Regulations.

Water and Sewerage Corporation (WSC)

The WSC, with its Water Resources Management Unit (WRMU), has responsibility for optimal development of the country's water resources and the control of water quality. It shares (with DEHS) the responsibility for monitoring water quality. WSC issues water supply franchises to developers in areas where the supply of water is impractical for the GOB or its agencies to undertake.

3.7 Non-governmental organizations

Non-governmental organizations (NGOs) that are active in New Providence include:

Bahamas National Trust (BNT)

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

Bahamas Reef Environment Educational Foundation (BREEF)

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

4.0 Environmental and social impacts

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

Severity is given a numerical rating of 1 for low impact, 3 for medium impact and 5 for high impact:
1. Low Impact (score 1) - There is little or no impact on the environment.
2. Medium Impact (score 3) - There is impact on the environment that falls within regulatory guidelines. The impact is considered short-term and reversible.
3. High Impact (score 5) – There is high and lasting impact on the environment.

Table 4-1 below summarizes the environmental impacts that can result from the Carmichael Village microgrid project.

The most significant environmental impacts from the Carmichael Village microgrid project will be land clearing for construction. While the project is not expected to have an adverse impact on marine resources, mitigation measures are recommended in chapter 5.0 related to sediment control during dock construction.

Table 4-1: Summary of Environmental Impacts

	Severity of Impact	**Environmental Impacts**
Materials	1	Construction materials can potentially be toxic or hazardous to the environment and human health if not managed properly, particularly in the marine environment.
Air quality and dust	3	Illegal construction activities, such as burning of waste, can negatively impact air quality. Poorly maintained construction equipment can also impair air quality, such as diesel fumes emissions. Construction activities can generate significant quantities of dust that impair air quality and negatively impact human health if proper management techniques are not employed.
Waste management	3	Improperly managed waste can negatively impact the environment and human health, through attracting pests which are disease vectors, introducing toxic/hazardous substances into the air, soil or groundwater and posing safety hazards to small children.

	Severity of Impact	Environmental Impacts
Landscape and visual	3	Construction for the project will occur in areas already cleared, minimizing the need for any additional land clearing. If construction waste is not disposed of in a timely manner, this can impair visual aspects of the site for long periods of time.
Water resources	1	Groundwater resources can be polluted by fuel or chemical spills at the project site. Over-extraction of groundwater resources can result in salt-water intrusion, thus destroying these resources.
Ecology	3	The project site is already heavily impacted by quarry mining and other anthropogenic activities. Overall ecology of the area can be further impaired by construction activities if proper mitigation measures are not put in place.
Avifauna	5	The noise levels generated by the project have the potential to deter birds from utilizing the site and adjacent areas during construction activities.
Noise and vibration	3	Construction activities can raise noise to levels that disturb bird and animal species at the project site and in its vicinity where these species nest or find shelter. Prolonged, elevated noise levels from construction activities can also negatively impact human health. Prolonged exposure to noise levels above 70dB may cause hearing damage. Loud noises above 120 dB can cause immediate damage (CDC, 2019).
Traffic and transport	3	Traffic and transport during construction can introduce invasive species to a project site and result in spills/accidents at the site if proper care and precaution are not taken inclusive of safe handling of equipment and vehicles. Disruption to traffic flow can create nuisances for neighbouring residents and businesses.
Contaminated land	5	During construction, there is the potential to contaminate lands from improper disposal of hazardous materials.
Occupational health and safety	3	Workers can be put at risk during construction through failure to wear protective personal

	Severity of Impact	Environmental Impacts
		equipment (PPE), improper handling of equipment and materials, and not adhering to standard safety procedures. These failures can result in loss of life or permanent physical damage.
Impacts on neighbouring businesses	3	Construction activities can impact neighbouring businesses through disruption of traffic, increased noise levels, impairment of air quality, and contamination of land and water resources. Depending on the severity of impacts, such as noise, air pollution and groundwater pollution, they can impair health in the long-term.

5.0 Proposed mitigation measures

Table 5-1 below summarizes the mitigation measures that are recommended to minimize or eliminate any negative environmental impacts from the project.

Table 5-1: Summary of Environmental Mitigation Measures

	Mitigation Measures
Materials	Any toxic or hazardous chemicals to be utilized on site can be done so according to Material Safety Data Sheet (MSDS) guidance and safety protocols can be established by project management. Construction materials containing hazardous substances, such as paint, will be safely removed and properly disposed of to prevent any risks to human health. Fuel will be dispensed on impervious surfaces with clean up and disposal equipment available in the event of a spill.
Air quality and dust	Impairment to air quality can be reduced when no illegal construction activities occur on the project site. Construction equipment will be properly maintained to ensure they do not impair air quality. Construction methodologies and best practices will be employed to minimize generation of quantities of dust that can impair air quality including watering of the site on a regular basis.
Waste management	All waste will be properly disposed of according to regulations and standards of the Department of Environmental Health Services (DEHS) and the Water and Sewerage Corporation (WSC). Solid waste will be stored in a designated area and picked up regularly for proper disposal at a licensed landfill. Waste management will need to include proper disposal of any hazardous waste from construction activities.
Landscape and visual	Construction activities will be organized to be completed in shortest timeframe possible to reduce any landscape or visual impacts. The solar panels and any planned new buildings will be constructed on already cleared land. Native, endemic and protected plant species will be maintained on the project site. Landscaping of the site will utilize native, endemic and protected plants and trees. No invasive plant species will be utilized in landscaping. Construction waste will be properly disposed of in a timely manner.

	Mitigation Measures
Water resources	Chemical and fuel management of the site will ensure that groundwater and surface water resources are not negatively impacted. Spill response protocols will be established for effectively dealing with spills in the event of an accident to minimize any pollution of water resources. Hazardous waste from construction will be properly disposed of. Potable or fresh water will be provided by tie-in to the Water and Sewerage Corporation municipal distribution mains, so there will not need to be extraction of groundwater resources.
Ecology	The use of already cleared land should minimize any negative impacts to plant and animal species as well as habitats for birds and other animals that utilize the site for food and shelter. The areas on the project site that are still vegetated (i.e. Pine Woodland) will be maintained. Any protected tree species on the project site will be maintained. Efforts will be made to maintain native trees and plants, especially where they are clustered so that they can continue to function as wildlife corridors. No invasive plant species will be introduced to the project site. Any invasive species found on the site will be removed.
Avifauna	While noise levels during construction may deter birds from the area, it is expected that once the project is complete, the birds will return. Ceasing the indiscriminate clearing that is presently occurring on the site will also aid in maintaining Pine Woodlands as important bird habitat. There are vegetated areas neighbouring the project site that can also be utilized by birds during active construction. Every effort will be made to maintain native, endemic and protected trees on the project site to be utilized by birds when construction is not occurring. Protected trees will be marked prior to construction so they can be retained. Staff will be advised on the importance of not interfering with or harming bird species which are all protected under Bahamian law. This will include not harming or interfering with bird nests.
Noise and vibration	Construction activities will be for a limited time period to minimize disturbance to birds and other animals at the project site and areas nearby. Once construction is completed in as short a timeframe as possible, the animals

	Mitigation Measures
	should return to habitats nearby which they normally utilize. They are not likely to return to the project site if there is significant clearing of vegetation. Construction workers will wear appropriate PPE (i.e. earplugs or ear muffs). Nearby residents are not expected to be exposed to high noise levels as there will be no work occurring during the evening and night. Nearby businesses will need to be advised on times when elevated noise levels are expected so they can plan accordingly.
Traffic and transport	All workers utilizing vehicles and equipment will have adequate training and skills in their proper and safe handling. Equipment to be utilized for this project moving from other sites will be inspected and cleaned, as necessary, to ensure they do not introduce invasive plant material, such as seeds. Flagmen will be utilized to safely direct traffic if there is a need to move heavy equipment or construction materials on East Street. Such movements should be avoided during peak traffic hours, i.e. 7:30 am – 9:00 am and 3:00 pm to 5:00 pm.
Contaminated land	Any toxic or hazardous chemicals to be utilized on site will be done so according to Material Safety Data Sheet guidance and safety protocols as established by project management. Staff will be trained in spill response measures to effectively handle such incidents. Hazardous waste will be safely handled and properly disposed of.
Occupational health and safety	Workers will be provided with appropriate protective personal equipment (PPE) for their assigned tasks. All workers will receive training in proper handling of equipment and materials as a part of their orientation before being admitted to the site during construction and before starting work on site. There will be regular reinforcement of occupational health and safety procedures during weekly meetings. Information on health and safety procedures (e.g. Material Safety Data Sheets) will be accessible to staff during working hours. At least one staff member will be assigned to ensuring health and safety procedures are being followed during construction activities.

	Mitigation Measures
Impacts on neighbouring businesses	Regular communication with neighbouring businesses and communities will occur so they are informed of any potential disruptions to traffic and can plan accordingly. They will also be advised when noise levels may be elevated so they can choose to leave the area or wear appropriate protective equipment, such as noise-cancelling headphones. The site will be managed following best management practices to reduce or eliminate impacts related to noise, air pollution as well as land, marine and groundwater contamination, so there are no long-term negative impacts on human health. A mechanism for neighbouring businesses to contact project management will be established to ensure communication is facilitated.

6.0 Public consultation

Section to be completed once consultation as determined by DEPP has been concluded.

7.0 Conclusions

Employment of appropriate design and planning methodologies can result in execution of the Carmichael Village microgrid project in a more sustainable manner. Utilizing the recommended mitigation measures can minimize any negative environmental and socio-economic impacts.

The Ministry of Finance Project Execution Unit (PEU) has expressed its commitment to implementing the recommended mitigation measures to minimize negative environmental and socio-economic impacts from the project.

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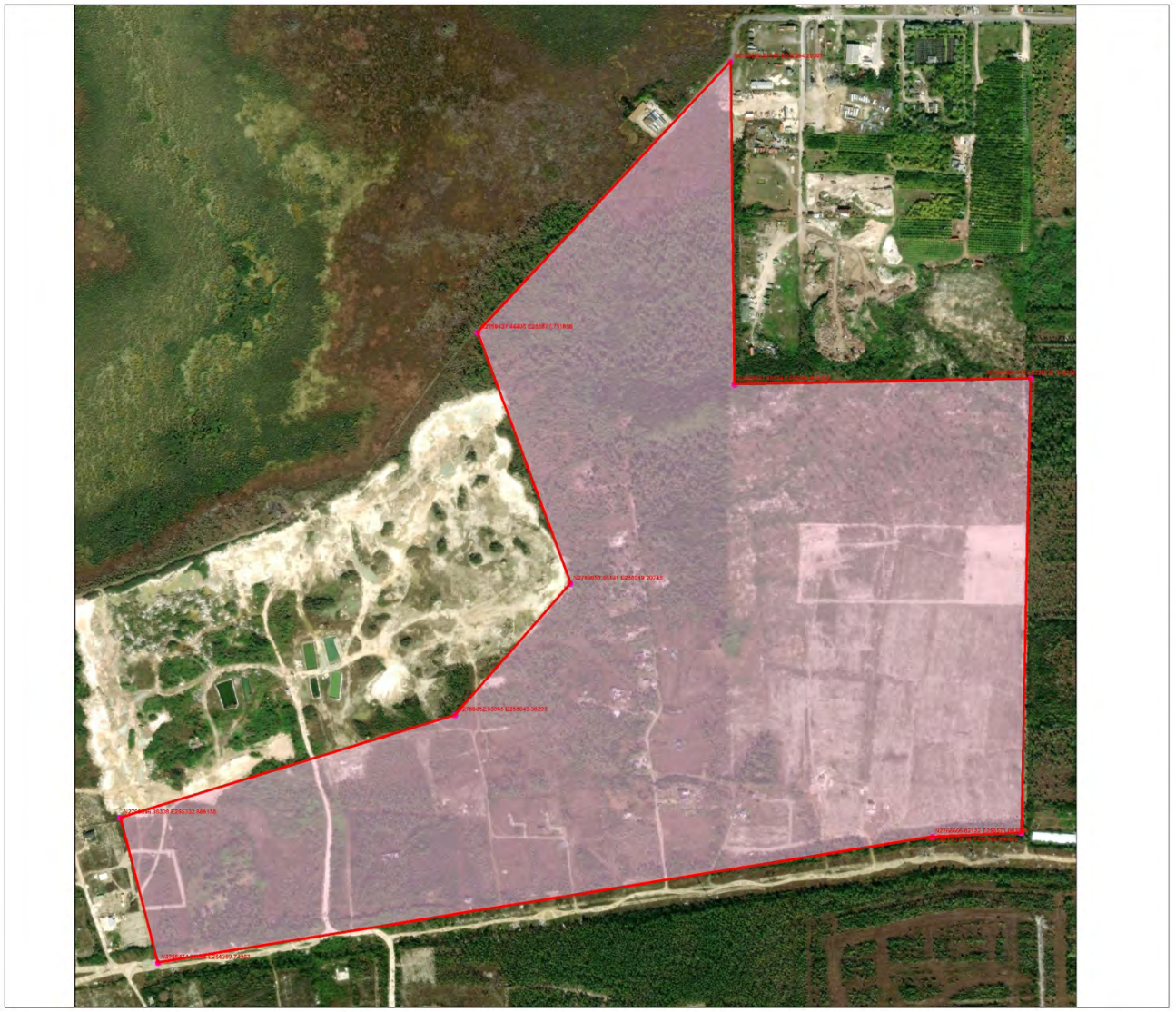
Appendix 1: Boundary map of the Carmichael Village microgrid project site



Carmichael Site

MICROGRID PROJECT
MINISTRY OF FINANCE

N
W E
S

Site Boundary Map

Site Boundary

Site Boundary Waypoints

1 N2769850.92193 E256264.29307
2 N2769357.85934 E256269.842205
3 N2769053.46191 E256019.20745
4 N2768852.93385 E255843.36203
5 N2768696.38338 E255332.886138
6 N2768474.86758 E255389.74953
7 N2768672.72738 E256706.936442
8 N2768666.82122 E256571.083068
9 N2769366.7183 E256721.702356
10 N2769357.85934 E256269.842205

0 125 250 500 Meters

0 0.125 0.25 0.5 Miles

Coordinate System: WGS 1984 UTM Zone 18N
Projection: Transverse Mercator

Prepared by: SEV Consulting Group
Nassau, The Bahamas
July 2024

Appendix 2: Topographic survey of the Carmichael Village microgrid project site

NOTES:

Reference(s) were made to:

1. DLS Plan No. 1328, 211, 2479, 547, 796 & 965 New Providence.

LEGEND:

Denotes Survey marker set

Denotes Survey marker found

Denotes Fence Post

Denotes Concrete Pillar

Denotes Edge of tarmac

Denotes Chain Linked Fence

Denotes Concrete Block wall

Denotes Utility Pole

SURVEY PLAN

SHOWING

208.30 ACRES OF LAND

SITUATE

TO THE NORTH OF A ONE (100) FEET WIDE B. P. L. EASEMENT

IN THE VICINITY OF CARMICHAEL VILLAGE SUBDIVISION

IMMEDIATELY SOUTH OF FIRE TRAIL ROAD WEST

NEW PROVIDENCE — BAHAMAS

Surveyed at the instance of the --------

Date: APRIL, 2024.

DIVINE TECHNICAL SERVICES

TEL.: (242) 427-8621

P. O. BOX N-10265 NASSAU, NP. BAHAMAS

250 Ft. 125 0 250 500 750 1000 1250 Ft.

Scale: 1 inch = 250 feet

Appendix 3: Personnel involved in EIA

Stacey Helena Moultrie

Proposed Position:	Consultant
Date of Birth:	1 September 1971
Nationality:	Bahamian
Certifications and Membership in Professional Societies:	GHG Inventory Expert, UNFCCC Roster of Experts Chartered Institution of Water and Environmental Management (CIWEM), United Kingdom Chartered Scientist, Science Council, United Kingdom Member, American Planning Association (APA) Lifetime Member, Delta Epsilon Iota Academic Honor Society

Education

2016	University of Florida (USA), Master of Urban Planning – Sustainability
1998	Dalhousie University (Canada), Master of Marine Management
1995	University of the West Indies (Mona Campus, Jamaica), B.Sc. (*Upper Second Class Honours*) Zoology – Marine Science & Fisheries

Certificates

2020	IDB INDES (USA), Behavioral Economics for Better Public Policies
2020	SCRUMstudy (USA), Scrum Master Certified (SMC) in Project Management
2020	SCRUMstudy (USA), Scrum Fundamentals Certified (SFC) in Project Management
2020	GHG Management Institute (USA), Proficiency Certificate in UNFCCC Online IPCC Guidelines
2007	Conservation Strategy Fund, Stanford University (USA), Economic Tools for Conservation

Countries of Work Experience

The Bahamas
Regional projects involving Antigua and Barbuda, Bahamas, Barbados, Belize, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Saint Lucia, St. Kitts and Nevis, St. Vincent and the Grenadines, Suriname, Trinidad and Tobago, and Venezuela.

Languages

	Speaking	*Reading*	*Writing*
English	Excellent	Excellent	Excellent

Key Qualifications

Mrs. Moultrie is an environmental planner. Her employment history in the environmental arena spans more than 25 years, including 18 months with the Department of Environmental Health Services and 7 years with the BEST Commission. Her experience involves work in project management, international negotiations, tourism, development of environmental education materials, environmental policy development, project proposal development for international funding, assessing environmental impacts of development projects, and environmental management and planning. Her role at the BEST Commission included advising the Government of The Bahamas on the environmental impacts of large private development projects, Government-led development projects, and policy decisions. She negotiated on behalf of the Bahamas Government in the following fora – Convention on Biological Diversity, Cartagena Protocol on Biosafety, Stockholm Convention on Persistent Organic Pollutants, United Nations Framework Convention on Climate Change, Rotterdam Convention on Prior Informed Consent and United Nations Convention on Desertification and Drought. She also provided policy guidance to the Ministry of Foreign Affairs on the Law of the Sea Convention and its various protocols.

Born and raised in The Bahamas with considerable work experience in the environmental sector, Mrs. Moultrie is well versed in the regulatory and policy aspects of natural resource management.

Employment Record

From 2007	**To Present**
Employer	SEV Consulting Group (Nassau, The Bahamas)
Position Held and Description of Duties	Environmental Planner Mrs. Moultrie is responsible for business development, project management, staff management, and client service delivery in the areas of environmental policy, planning and management as well as EIA and EMP development, coordination of internationally funded projects and development of environmental education, awareness and training materials.
From 2019	**To Present**
Employer	The Islands Laboratory, University College London (London, United Kingdom)
Position Held and Description of Duties	Researcher Mrs. Moultrie is a researcher with the Islands Laboratory which focuses on innovative solutions to tackle climate change and assess scenarios for disaster risk reduction and resilience for islands globally. Her research focuses on sustainability indicators, resilience, resource nexus and energy reform.

From 2000	**To 2007**
Employer	Bahamas Environment, Science and Technology (BEST) Commission (Nassau, The Bahamas)
Position Held and Description of Duties	Senior Environmental Officer Mrs. Moultrie was responsible for project management, staff management and advice to the Government of The Bahamas in the areas of biodiversity conservation, environmental impacts from development, mitigation for development activities, policy development, international negotiations, drafting environmental legislation, developing national strategies for environmental issues (included development of National Environmental Policy and National Environmental Management and Action Plan) and securing international funding for environmental projects. She was also responsible for management of environmental aspects of development of the islands of New Providence, Exuma, Eleuthera, Abaco, Long Island and Paradise Island.

Work Experience in Environmental Planning and Management

Degree of Integrated Water Resources Management Implementation (SDG 6) in The Bahamas – The Bahamas, October 2020 – November 2020 (National Consultant)
Funded by the Economic Commission for Latin America and the Caribbean (ECLAC), the project involved an analysis of institutional arrangements for integrated water resources management (IWRM) in The Bahamas and the country's progress in implementation of SDG 6 of the 2030 Agenda. Mrs. Moultrie served as the national consultant for The Bahamas. The consultancy also involved analysis of the effectiveness of national cross-sector coordination mechanisms, identification of gaps, the identification of successful mechanisms and development of lessons learned or identification of success factors that could be replicated in other countries. Tasks included consultation with several Government and non-Government agencies, including the Water and Sewerage Corporation (WSC). The final deliverable was a national report submitted to ECLAC to form a part of the Caribbean regional report.

Department of Environmental Planning and Protection, Preparation of the Third National Communication (TNC) and First Biennial Update Report (BUR1), September 2020 – Present (National Consultant, joint consultancy with the Islands Laboratory at University College London)
Funded by the Global Environment Facility (GEF) and the Bahamas Government, the project will involve development of the TNC and BUR1 reports to the UNFCCC Secretariat. SEV in cooperation with UCL Islands Laboratory will develop chapters on National Circumstances, Integration of Climate Change into National Development Priorities, Education, Training and Public Awareness, Information and Networking, and Capacity-Building. The work will entail data collection, data analysis, stakeholder consultations and training workshops on policy development and climate change integration into development planning.

Bahamas Power and Light, Environmental Impact Assessment and Environmental Management Plan – New Providence, The Bahamas, March 2020 – Present (Consultant)
Project involves construction of a power plant in New Providence. Mrs. Moultrie is responsible for development of an EIA and EMP for the project inclusive of coordinating all field teams, data collection, preparation of reports and liaising with BEST Commission and other Government agencies as necessary prior to construction works commencing.

Central Bank of The Bahamas, Environmental Impact Assessment and Environmental Management Plan – New Providence, The Bahamas, February 2020 – May 2021 (Consultant)
Project involved demolition of several buildings in New Providence. Mrs. Moultrie was responsible for development of an EIA and EMP for the project inclusive of coordinating all field teams, data collection, preparation of reports and liaising with BEST Commission and other Government agencies as necessary prior to construction works commencing. She also served as Lead Environmental Monitor for the project through completion of demolition activities.

Nassau Cruise Port, Environmental Management Plan and Environmental Monitoring – New Providence, The Bahamas, January 2020 – Present (Consultant)
Project involves construction of cruise port facilities in New Providence. Mrs. Moultrie is responsible for development of an EMP for the project inclusive of development of detailed mitigation measures, a hurricane preparedness plan and an environmental, health and safety training manual for construction staff. She is also Lead Environmental Monitor on the project responsible for managing on-site monitors and liaising with DEPP.

Bill Simmons Construction, Environmental Monitor – New Providence, The Bahamas, December 2018 – June 2019 (Consultant)
Project involved provision of potable water infrastructure and road reinstatement for western New Providence. Mrs. Moultrie was responsible for development of environmental checklist and biweekly environmental inspections to ensure compliance with Ministry of Works and Water and Sewerage Corporation standards. She also provided environmental, health and safety training for all construction staff prior to construction works commencing.

Shell Bahamas LNG Project, Environmental Permitting and Environmental Impact Assessment – New Providence, The Bahamas, December 2018 – May 2021 (Consultant)
Project involved development of an LNG pipeline and power plant by Shell in cooperation with Bahamas Power and Light (BPL). Mrs. Moultrie was responsible for providing guidance on environmental, health and safety legislation, regulations and standards the project will need to adhere to as well as assisting with liaising with the Department of Environmental Planning and Protection (DEPP). Mrs. Moultrie's responsibilities also involved field work and chapter creation for developing an EIA for the project.

By The Ocean Development, Environmental Impact Assessment – Eleuthera, The Bahamas, April 2018 – December 2018 (Team Leader)
Project involved development of an EIA hotel and luxury home development with an organic farm component. Preparing the EIA involved terrestrial and hydrological surveys to assess the impacts of

the development. The EIA also recommends mitigation measures to be undertaken to eliminate or minimize negative environmental impacts. Mrs. Moultrie was responsible for preparing of the EIA, coordinating the team of consultants, and liaising with Government agencies during the EIA review to obtain no-objection for the development to proceed.

Caribbean Community Climate Change Centre, Capacity Building of National Designated Authority (NDA) and Preparation of Country Strategic Framework – The Bahamas, February 2018 – December 2018 (National Consultant, team member with Acclimatise)
Funded by the Green Climate Fund (GCF), Caribbean Community Climate Change Centre (CCCCC) and the Bahamas Government, the project sought to strengthen the capacities of the Ministry of Environment and Housing as the National Designated Authority for the GCF, develop operational guidelines for engagement of the NDA with the GCF, and prepare a Country Strategic Framework for The Bahamas (including a portfolio of climate change projects). Mrs. Moultrie is responsible for stakeholder engagement and assisting with development of project reports and the Country Strategic Framework along with communication materials about the GCF.

Caribbean Development Bank, Water Supply Improvement Project – The Bahamas, December 2016 – April 2018 (Socio-Environmental and Climate Specialist)
Funded by the Caribbean Development Bank (CDB) and the Bahamas Government, the project sought to improve existing and develop new infrastructure for water supply on six islands in The Bahamas. Mrs. Moultrie was responsible for developing ESMPs for five of the islands and monitoring compliance with the ESMPs during construction. A key component of the project was ensuring infrastructure is resilient to climate change.

Inter-American Development Bank, Environmental and Social Analysis and Management Plan – The Bahamas, July 2016 – September 2016 (Socio-Environmental and Climate Specialist)
Funded by the Inter-American Development Bank (IDB) and the Bahamas Government, the Skills for Current and Future Jobs in The Bahamas project involved finding a location for the Department of Labour. Mrs. Moultrie was responsible for advising on the environmental and social impacts of three scenarios – repair of Clarence A. Bain building, demolition of the building and construction of a new building at the same site, and rental of space in an existing building. She developed an Environmental and Social Analysis (ESA) of related demolition, construction and operation activities for the various scenarios. She also developed an Environmental and Social Management Plan (ESMP) to guide demolition, construction and operation, depending on the scenario selected.

Inter-American Development Bank, Feasibility Studies for a Climate Risk-resilient Coastal Zone Management Investment Program in The Bahamas – Preparation of a National ICZM Policy Framework, February 2016 – October 2016 (SEV Team Leader)
Funded by the Inter-American Development Bank, the project sought to prepare a national integrated coastal zone management (ICZM) policy framework for The Bahamas, support the Government of The Bahamas in communicating with the public on relevant issues and enhance knowledge and capacities in innovative aspects of ICZM for the Government and other key stakeholders. SEV Consulting Group, along with Caribbean Coastal Services, was selected to support the project through development of technical briefs on thematic areas including policy, governance and planning, environment and climate

change adaptation as well as develop a draft ICZM National Policy Framework. Mrs. Moultrie was responsible for ensuring all SEV team members completed their tasks in a timely manner and served as liaison with other consulting teams on the project as well as Government and IDB staff. She led all tasks related to policy development, including drafting of the ICZM Policy Framework and participation as a presenter in the training workshop, and assisted with other tasks.

Cotton Bay Development Golf Course, Eleuthera – Environmental Impact Assessment Addendum and Environmental Management Plan, July 2015 – September 2016 (Project Lead)
Project involved development of an EIA Addendum for the golf course component under Phase 2. Preparing the Addendum involved terrestrial and hydrological surveys to assess the impacts of the golf course construction. The Addendum also recommends mitigation measures to be undertaken to eliminate or minimize negative environmental impacts. Subsequent to the approval of the EIA Addendum, an EMP was developed to guide construction and operation.

Inter-American Development Bank, Ecosystem-based Development for Andros Island, The Bahamas – Outreach and Capacity-Building, July 2015 – March 2017 (Team Leader)
Funded by the Inter-American Development Bank and Office of the Prime Minister, the project sought to complete an analysis of ecosystem services and future development scenarios as well as development of a master plan for the island of Andros. SEV was selected to support the project through development of outreach and capacity building activities including development of a communications strategy, facilitation of public consultations, assessment of technical capacity of decision-making agencies and delivery of a training workshop on several topics including ecosystem services and economic valuation. Mrs. Moultrie was responsible for ensuring all team members completed their tasks in a timely manner and served as liaison with other consulting teams on the project as well as the IDB staff. She led the tasks on stakeholder consultations and training workshop.

Publications

- Wells-Moultrie, S. (2020). Assessing sustainability in small island developing states: A comparative analysis of sustainability assessment tools and their applicability to small island developing states. Chapter 10. In *Tourism Development, Governance and Sustainability in The Bahamas*. Abingdon, Oxon; New York, N.Y: Routledge.
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- Wells, Stacey. (1998). *A Marine Environmental Policy Proposal for The Bahamas*, Halifax, Canada: Dalhousie University.

Sharrah Moss-Hackett

Profession:	Environmental Planning Specialist
Date of Birth:	31 August 1979
Nationality:	Bahamian

Education

2013 Miami University (USA), Master of Environmental Science – Environmental Management
2001 University of Arkansas (USA), Bachelor of Science – Environmental Soil and Water Science

Countries of Work Experience

The Bahamas
Regional projects involving Grenada, Saint Lucia, St. Kitts and Nevis, and St. Vincent and the Grenadines.

Languages

Speaking	*Reading*	*Writing*	
English	Excellent	Excellent	Excellent

Key Qualifications

Mrs. Moss-Hackett specializes in stakeholder engagement, project management, geographic information systems andmapping, and technical support for environmental impact assessments. Her professional history inthe environmental field spans 16 years, having held positions with the BEST Commission, The Bahamas National Trust and The Nature Conservancy. Her work experiences include coordinatingmultilateral funded projects, engaging local communities in conservation, documenting land and sea use throughout The Bahamas. She has worked throughout The Bahamas and in the region. She has spent her entire professional career in The Bahamas, working for government and non- profit entities. Mrs. Moss-Hackett was born and raised on the island of New Providence.

Employment Record

From 2016	**To 2019, 2021 - Present**
Employer	SEV Consulting Group (Nassau, The Bahamas)
Position Held and Description of Duties	Environmental consultant (Project Management, stakeholder engagement and GIS) Mrs. Moss-Hackett serves as a project coordinator for environmental projects, analyses GIS for planning purposes, conducts terrestrial and marine surveys, engages local communities, and develops materials for public awarenessand education.

From 2014	**November 2016**
Employer	Ministry of Environment and Housing, Government of TheBahamas ‘ (Nassau, The Bahamas)
Position Held and Description of Duties	Project Coordinator, Feasibility Studies for a Climate Risk Resilient Coastal Zone Management Program. Mrs. Moss- Hackett was responsible for the launch and successful execution of the ICZM Program. Her duties included the technical review of project documents and reports, preparation, execution, and management of contract and contractors, coordination of the technical advisory committee,liaison between the Ministry of Environment and Housing andthe Inter-American Development Bank (IDB), and management of the financial recording and reporting to the IDB and the Ministry of Environment and Housing. Additionally, Mrs. Moss-Hackett worked with the Technical Advisory committee to identify potential priority sites for future ICZM projects and communicate member feedback to consultants and the IDB.
From 2009	**June 2011**
Employer	The Nature Conservancy (Northern Caribbean Program,Nassau, The Bahamas)
Position Held and Description of Duties	Conservation Planner Mrs. Moss-Hackett was responsible for supporting the management of the TNC GIS database for The Bahamas and the execution of the GEF-funded Integrated Watershed and Coastal Areas Management project. She engaged key stakeholders on Andros Island, promoted the GEF-funded IWCAM project to the public, and visited every community on Andros. Mrs. Moss-Hackett also managed contracts for experts conducting assessments of existing land (and sea) useand evaluating the economic impact of natural resources on the economy of Andros. She coordinated and facilitated over 30 stakeholder consultations (public meetings) numerous interviews, surveys, and field research team activities. Mrs. Moss-Hackett was responsible for submitting all financial andproject reports to the GEF.

From 2005	**To 2006**
Employer	Bahamas National Trust (Nassau, The Bahamas)
Position Held and	Community Liaison and Planning Officer
Description of Duties	Mrs. Moss-Hackett planned and facilitated workshops designed to engage stakeholders in management planning forprotected areas, developed the first draft of the San Salvador National Park proposal based on stakeholder input and worked with a variety of local and international experts to establish resource management goals. She was also responsible for making presentations about conservation and important species to schools and community groups, andassisted in the development and revision of managementplanning documents for National Parks.
From 2004	**To 2005**
Employer	Exuma Resource Centre (Exuma, The Bahamas)
Position Held and	Community Education and Outreach Officer
Description of Duties	Mrs. Moss-Hackett provided guidance for the Exuma Foundation on the development of its newly established Environmental Education Program. She assisted teachers withincorporating the newly developed science curriculum into teaching plans, planned and conducted environmental activities for students and the public, and provided support andexecuted presentations, about the Bahamian environment, to the public.

From 2002	**To 2004**
Employer	Bahamas Environment, Science and Technology (BEST)Commission (Nassau, The Bahamas)
Position Held and Description of Duties	Technical Officer Mrs. Moss-Hackett was responsible for the technical review of Environmental Impact Assessments for majordevelopments across The Bahamas and on liquefied natural gas projects. Additionally, she was responsible for the organization and implementation of the contamination assessment for all corridors near Service Stations within The New Providence Road Improvement Project (NPRIP). Mrs. Moss-Hackett assisted with the development andimplementation of National Programs related to InternationalEnvironmental Agreements and Conventions.

Work Experience

- **FACTOR, UNFCCC TNC/BUR Vulnerability and Adaptation Chapter**, 2021 – Present (Stakeholder Engagement Specialist) – Mrs. Moss-Hackett serves as the stakeholder engagement specialist on the SEV-Factor team responsible for development of the Vulnerability and Adaptation chapter of the UNFCCC Third National Communication/Biennial Update Report. She is responsible for coordinating stakeholder engagement activities, including validation workshops with national stakeholders.

- **Bahamas Power and Light, Environmental Impact Assessment and Environmental Management Plan – New Providence, The Bahamas,** March 2020 – March 2022 (Consultant)
  Project involves construction of a power plant in New Providence. Mrs. Moss-Hackett is responsible for contributing to the development of an EIA and EMP for the project inclusive of terrestrial and socioeconomic data collection, preparation of reports and liaising with DEPP and other Government agencies as necessary.

- **Central Bank of The Bahamas, Environmental Impact Assessment and Environmental Management Plan – New Providence, The Bahamas,** February 2020 – May 2021 (Consultant)
  Project involved demolition of several buildings in New Providence. Mrs. Moss-Hackett was responsible for protected tree surveys and socioeconomic data collection for the development of an EIA and EMP for the project.

- **Shell Bahamas LNG Project, Environmental Permitting and Environmental Impact Assessment**, December 2018 - May 2021 (Stakeholder Engagement Specialist) - Project involved development of an LNG pipeline and power plant by Shell in cooperation with Bahamas Power and Light (BPL). Mrs. Moss-Hackett was responsible for socioeconomic data collection inclusive of stakeholder survey development and execution as well as related chapter creation for development of an ESHIA for the project.

- **Bahamas National Trust – Moriah Harbour Cay National Park Management Plan**, 2017-2018 (Planning Consultant) - Mrs. Moss-Hackett was responsible for writing the management plan for the Moriah Harbour Cay National Park on the island of Exuma. She executed numerous stakeholder consultations across the island and incorporated stakeholder input into the draft and final versions of the plan. She also compiled GIS data and designed maps to describe the geographical context, key habitats and species, stakeholder uses and management zones within the park.

- **The Nature Conservancy – Integrated Watershed and Coastal Areas Management (IWCAM) Project – Andros Demonstration Site**, 2017 (Consultant) - Mrs. Moss-Hackett was responsible for assisting TNC with planning and executing the EGA stakeholder workshop, giving presentations to stakeholders, facilitating the event, moderating small group sessions at the workshop, data gathering through stakeholder input, and preparation of the final workshop report.

- **Caribbean Development Bank, Water Supply Improvement Project – The Bahamas,**December 2016 – April 2018 (Assistant to Socio-Environmental and Climate Specialist) Funded by the Caribbean Development Bank (CDB) and the Bahamas Government, the project seeks to improve existing and develop new infrastructure for water supply on sixislands in The Bahamas. Mrs. Moss-Hackett was responsible for monitoring compliancewith the ESMPs during construction.

- **Inter-American Development Bank, Feasibility Studies for a Climate Risk-resilient Coastal Zone Management Investment Program in The Bahamas.** September 2014 – November 2016 (Project Coordinator). A technical cooperation between the Government of The Bahamas and the Inter-American Development Bank (IDB). The Programme was executed by the Ministry of Environment and Housing and guided by the Technical Advisory Committee. As Project Coordinator, Mrs. Moss-Hackett was responsible for thedevelopment of the project implementation plan, which included the workplan, schedule, and procurement plans for the life of the program. Financial management of all aspects ofthe project, including financial reporting, disbursement requests and day-to-day finances as per the IDB Procurement Policy we also the responsibility of the Project Coordinator. Additionally, Mrs. Moss-Hackett served as the point of contact between the IDB and the Ministry of Environment and Housing and managing communications on behalf of the executing agency. She organized meetings and documented minutes for the Technical Advisory Committee, and was responsible for identifying linkages and potential synergies between the ICZM Program and other national and international programmes and initiatives.

Other Work Experience
Interim National Project Coordinator, GEF-funded Pine Islands - Forest/Mangrove Innovation and Integration (Grand Bahama, New Providence, Abaco and Andros) Project

Publications

- Bahamas Ecological Gap Analysis. BEST Commission, 2014.
- Land and Sea Use Plan for the Island of Andros. The Nature Conservancy, 2010.
- Andros: Living of the Land and Sea. DVD. The Nature Conservancy, 2010.
- Bahamas Environment Science and Technology Commission (2006). Road Map forScience and Technology in The Bahamas. BEST, Nassau, The Bahamas, 40pp.
- Lasker, H.R. 2006. High Fertilization Success in a Surface-Brooding Caribbean Gorgonian. Biology Bulletin 2006 210: 10-17.
- Bahamas Environment Science and Technology Commission (2003), The National Invasive Species Strategy for The Bahamas. BEST, Nassau, The Bahamas, 35pp.
- Bahamas Environment Science and Technology Commission (2005), National Capacity Needs Self-Assessment (NCSA) Project. BEST, Nassau, The Bahamas, 145pp.
- Bahamas Environment Science and Technology Commission, National Biodiversity Enabling Activities to the Convention on Biological Diversity - Third National Report (2003). BEST, Nassau, The Bahamas, 142pp.

David Dean

Position Title and No.	Ornithologist
Name of Expert:	David Dean
Country of Citizenship/Residence	The Bahamas

EDUCATION

2014	Carmichael Village Senior High School – High School Diploma
2011	CH Reeves Junior High School – BJC Certificate

EMPLOYMENT RECORD

Period	Employing organisation and title/position. Contact information for references	Country	Summary of activities performed relevant to the Assignment
2021 - Present	SEV Consulting Group *Ornithologist* S. Helena Moultrie hmoultrie@sevconsulting.com	The Bahamas	Successfully completed bird surveys for following development projects - Adelaide Pines, Exuma Yacht Club, Bel Air Hotel & Residences, and East Grand Bahama school Complex.
2020 - 2021	Science and Perspective *Field Assistant for bird surveys* Dr. Ancilleno Davis ancilleno@scienceandperspective.com	The Bahamas	Mr. Dean worked as a field assistant to Dr. Davis completing bird surveys for various projects across The Bahamas, including bird surveys for BPL Station D Power Plant project and Shell LNG storage facility project.
2019-2020	Ardastra Gardens and Zoos Park Attendant	The Bahamas	Mr. Dean worked with animals at Ardastra including various bird species.

Language Skills

- English (Speaking, Reading, Writing); Very Good

Mayer G. Murphy

EDUCATION

Bachelor of Environmental Studies Sept 2019-May 2023 University of Prince Edward Island, Charlottetown, PE

- Within a 4th year course, conducted an environmental impact assessment for aquaculture farms in PEI resulting in helping improve wastewater practices; identified sustainable alternatives to disposing of aquaculture waste and sustainable transportation, the project concluded with a proposed policy agreement
- Researched and presented a variety of papers and presentations using Microsoft Word, Excel, PowerPoint, and Access
- Adaptability skills further developed by having to adjusted to online learning during the COVID-19 pandemic

WORK EXPERIENCE

SEV Consulting Group
June 2023 – Present
Position: Environmental Technician

Ms. Murphy is responsible for field data collection on terrestrial and marine species as well as assisting with preparation of EIAs and EMPs. She also works as an environmental monitor for projects under construction as per monitoring requirements of each project's EMP.

VOLUNTEER WORK EXPERIENCE

Internship Sept 2021-Present
Hunter-Clyde Watershed Group, Charlottetown, PE

- Developed listening and interpersonal skills through weekly check-ins where feedback was given to help support and further develop learning skills and knowledge during internship with the Hunter Clyde Watershed Group
- Assigned and conducted field research on Brook Trout to determine if there were any size differences; results were then added to the website
- Work both independently and as part of a group while assisting with field work such as planting trees, checking water quality and redd surveying of Brook Trout; learned and conducted test water quality

1. Intern, Boat Registration Department July – Aug 2021
   Bahamas Port Department, Nassau, Bahamas
2. Sorted boat registration records into spreadsheets using Microsoft Access; assisted with answering phone calls
3. Conducted a research project to identify ways boats could be better equipped to handle hurricanes

CERTIFICATIONS

PADI Open Water and Advanced Open Water Diver	2023
Valid Standards of Training, Certification and Watchkeeping for Seafarers	2019
Valid Emergency First Aid and CPR Training	2019