FOCOL DIESEL & NATURAL GAS

Pipelines Terrestrial Assessment

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Prepared For: Client

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1.0 Introduction

1.1 Site Description

The FOCOL Diesel and Natural Gas Pipelines project is a proposed 13.5-mile Pipelines project in Nassau, New Providence, The Bahamas (See Figure 1). The site is located between the BPL Clifton Power Plant and the BPL Blue Hills Power Plant. The proposed site is not currently inhabited but is near established roadways, agricultural lands, and populated urban areas. Illegal dumping of construction waste materials and derelict vehicles was also observed on the proposed project site (See Photo 1). The proposed works include the construction of a modern Diesel and Natural Gas Pipelines and associated infrastructure.

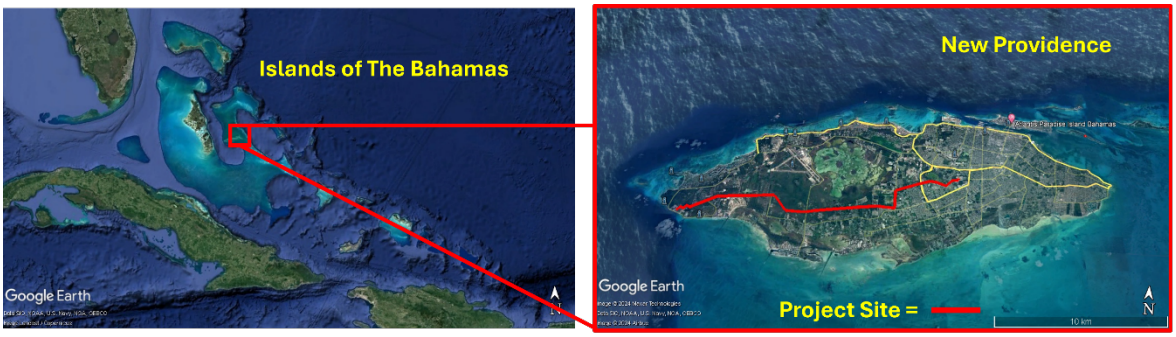

Figure 1: FOCOL Diesel and Natural Gas Pipelines Project site location.

Photo 1: Illegal dumping observed on the proposed project site.

1.2 Protected Area

The FOCOL Diesel and Natural Gas Pipelines project does not fall within the boundary of a national park but is located north of the Primeval Forest National Park (PFNP) and south of the Harold and Wilson Ponds National Park (HWPNP) (See Figure 2). The Primeval Forest national park is 7.5-acres of old growth dry broadleaf evergreen forest with poignant karst features. Harold and Wilson Ponds national park is 237 acres of inland freshwater wetland habitat. These sites are managed by The Bahamas National Trust.

Figure 2: Project site location running parallel to Primeval Forest & Harold and Wilson Ponds National Parks.

2.0 Botanical Survey

Field studies were conducted from the 16th through the 21st of July 2024. The study's purpose was to map vegetation types, determine floristic diversity, identify the presence and abundance of invasive species, and conduct a protected species survey in the proposed works' areas.

2.1 Methodology

Vegetation types were mapped and verified by walking along the interior and the perimeter of the site using existing roadways. Vegetation Type taxonomy was based on Areces et al. (1999). Vascular plant species occurring in each vegetation type were recorded and used to compile a floral list (See Table 1). Plant taxonomy was based on Correll and Correll (1982). The presence, location, and abundance of vascular species listed under the National Invasive Species Strategy for The Bahamas (2013), and the Protected Trees Order (2021) were noted when encountered.

The primary objective of protected species potential estimations is to approximate the total protected species potential across the site as per DEPP regulations. The Department of Forestry requirements for conducting a protected species survey in The Bahamas stipulate that one (1) 0.1-acre plot must be surveyed for every ten (10) acres of vegetation to be impacted, assuming that the vegetation is homogenous across those ten (10) acres. The total area of the proposed project site was calculated using the standard area formula (Length x Width). The project length of 13.5 miles and width of 100 feet was converted to meters and multiplied to produce the total area of the site, 662,212.86912 square meters. This area was converted to acres using the conversion of 1 square meter = 0.000247 acre. The estimated area in acres of the proposed site was calculated to be approximately 165 acres. To assess the relative abundance of protected species recorded, Google Earth software was used to select areas for twenty (20) 66ft x 66ft square sampling plots on the site (See Figure 4). The plot was sized using a string line on a reel and a 100-meter measuring tape. Once the plot was established, the number of protected species observed within the plot was recorded (See Table 4). Logger's tape was used to determine the diameter at breast height of mature trees and a hypsometer was used to determine each tree's height. To avoid double counting or missing a plant, flagging tape was placed on individual plants when counted. In areas with a high number of small species, inappropriate for flagging, the botanist counted per quadrant to avoid double counting or missing a plant.

2.2 Habitat Description

The terrestrial site spans 13.5 miles or approximately one hundred and sixty-five (165) acres and contains one (1) terrestrial ecosystem, Interior Upland. There were two (2) vegetation classes observed on the site, Human Altered Environment, and Inland Freshwater Wetland. The site topography can be described as relatively flat, except for pit caves, solution holes, and an eolian ridge (east-west) in the southwestern section of the site (See Photo 2). The ridge runs parallel to the Frank Watson Roadway and continues eastwards for 3.5 miles. Soil type can be described as limestone substrate throughout the proposed project site. Vegetation growth can be described as secondary growth due to disturbance by human activity.

Photo 2: Eolian ridge and pit cave observed on the project site.

2.2.1 Interior Upland

There were two (2) interior upland vegetation classes observed on the project site, a Human Altered Environment and an Inland Seasonal Wetland.

2.2.1.1 Human Altered Environment Habitat

Human-altered environments are defined as areas in which the natural habitat has been altered or degraded by human activities. These areas consist of mainly regenerating, pioneer, and invasive species. A human-altered environment is present throughout the proposed project area due to subsequent clearing events. Before clearing this area would have encompassed three (3) native vegetation classes, Dry Broadleaf Evergreen Forest, Pine Woodland, and Inland Freshwater Wetland. Human activity has created five (5) distinct human-altered habitats.

HAE-1: *Casuarina equisetifolia-Bursera simarouba- Megathyrsus maximus* Mixed Forest Alliance

This is present in the western section of the site and would have previously been a mature dry broadleaf evergreen forest before disturbance. This area still consists of native DBEF-indicating species such as *Chioccoca alba* (Snow Berry), and *Sideroxylon foetidissimum* (Mastic). This area is now dominated by invasive and pioneer species such as *Casuarina equisetifolia* (Australian Pine), and *Megathyrus maximus* (Guinea Grass). It extends eastward to a remnant of a Pine Woodland.

Photo 3: *Casuarina equisetifolia-Bursera simarouba- Megathyrsus maximus* Mixed Forest Alliance.

HAE-2A: *Leucaena leucocephala-Trema lemarckiana-Baccharis dioica* Scrubland Alliance

This is present throughout the interior of the site and would have been previously a pine woodland habitat. This area still contains common pine species such as *Agalinis harperi* (No Common Name), *Bletia purpurea* (Pine yard Pink), *Chioccoca parvifolia* (Pine Snowberry), *Linum bahamense* (Bahama Flax), and *Rhynchospora floridensis* (White-head Rush). Additionally, there are subsections of this alliance that still contain *Pinus caribaea var. bahamensis* (Bahamian Pine).

Photo 4: *Leucaena leucocephala-Trema lemarckiana-Baccharis dioica* Scrubland Alliance.

HAE-2B: *Schinus terenbinthifolia-Baccharis dioica-Bidens alba* Shrubland Alliance

This habitat would have also previously been a pine woodland habitat. It is present in highly disturbed areas on the southeastern perimeter of the Frank Watson roadway and the edges of the agricultural lands east of Coral Harbour Road and west of Gladstone Road. These areas also contain species such as *Megathyrus maximus* (Guinea Grass), *Scaevola taccada* (White Ink Berry), *Spathodea campanulata* (African Tulip Tree), and *Albizia lebbeck* (Woman's Tongue). This extends to pockets of a disturbed inland freshwater pond.

Photo 5: *Schinus terenbinthifolia-Baccharis dioica-Bidens alba* Shrubland Alliance.

HAE-3: *Cladium mariscus-Eleocharis geniculata-Tiedemannia filiformis* Scrubland Alliance

This area would have previously been a part of an inland freshwater wetland before disturbance by human activities. It is present in small patches at the edges of the pine woodland east of Frank Watson, Coral Harbour, and Gladstone Roads. Additionally, this vegetation class would have existed north of Fire Trail Road East as part of the Harold & Wilson Ponds swash system. These small patches of disturbed wetland contain hydrophytic species such as *Phyla nodiflora* (Capeweed), Centella *asiatica* (Marsh Pennywort), *Eustoma exaltatum* (Marsh Gentian), *Conocarpus erectus* (Buttonwood), *Chrysobalanus icaco* (Coco Plum), *Anonna glabra* (Pond Apple), and *Sabal palmetto* (Sabal Palm).

Photo 6: *Cladium mariscus-Eleocharis geniculata-Tiedemannia filiformis* Scrubland Alliance.

HAE-4: Bare Road/Paved Surface

These areas are cleared completely of all vegetation either due to recent clearing (Bare Road) or due to it being an established public roadway (Paved Surface).

Photo 7: Bare Road/Paved Surface.

2.2.1.2 Inland Freshwater Pond/Wetland

Inland freshwater wetlands are inland ponds characterized by standing freshwater and hydrophytic plants that are replenished through seasonal rains. An inland freshwater wetland is located within the eastern section of the site and contains hydrophytic botanical species such as *Cladium mariscus* (Saw Grass), and *Sabal palmetto* (Sabal Palm).

Photo 8: Inland Freshwater Pond/Wetland.

2.2.2 Vegetation Map

The size of the proposed project site dictates that the site be shown in sections, west, central, and east in order to properly depict the vegetation type distribution.

2.2.2.1 Western section vegetation type distribution-Clifton Powerplant to Frank Watson Roadway East

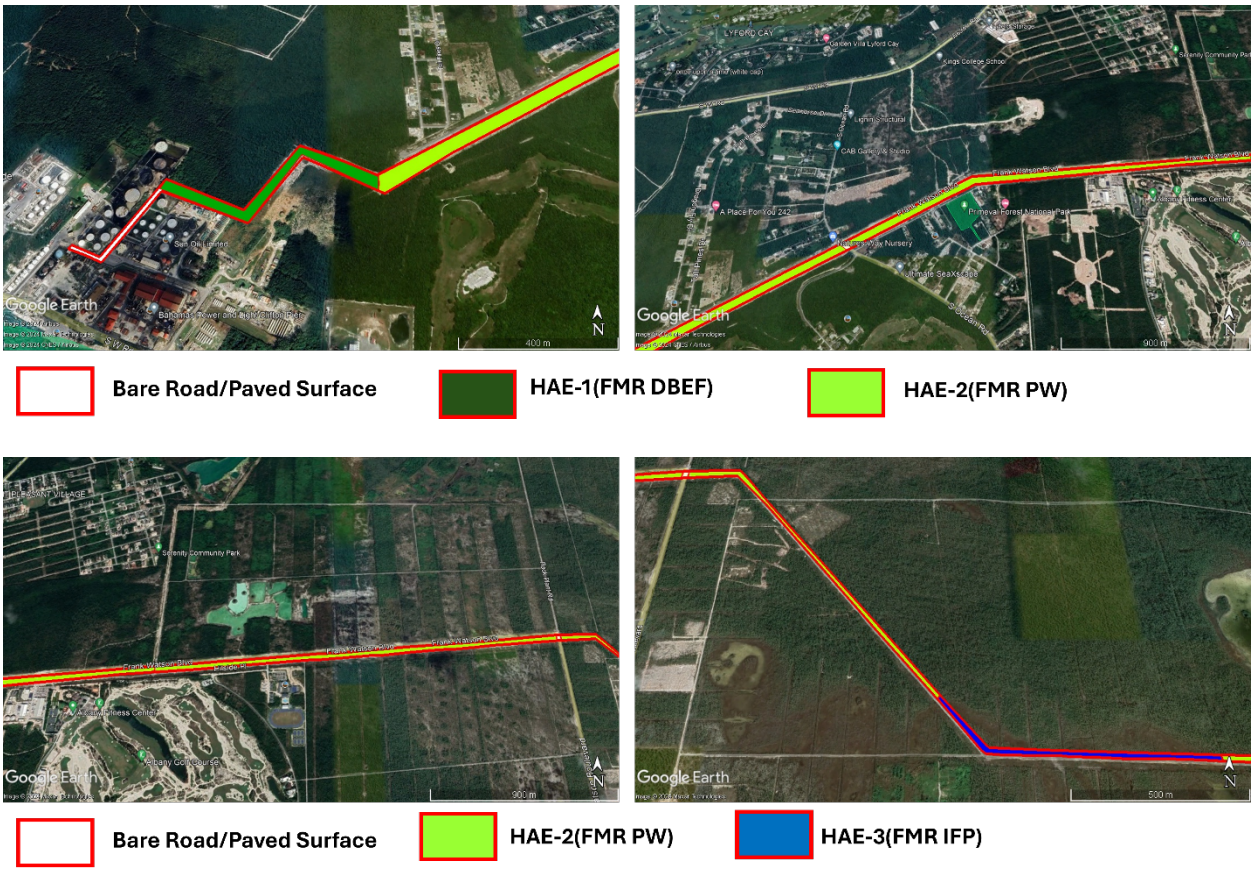

Figure 3: Vegetation type distribution in the western section of the FOCOL Proposed Diesel and Natural Gas Pipelines project site.

2.2.2.2 Central section vegetation type distribution-East of Frank Watson Roadway, across Coral Harbour Roadway to Carmichael Village.

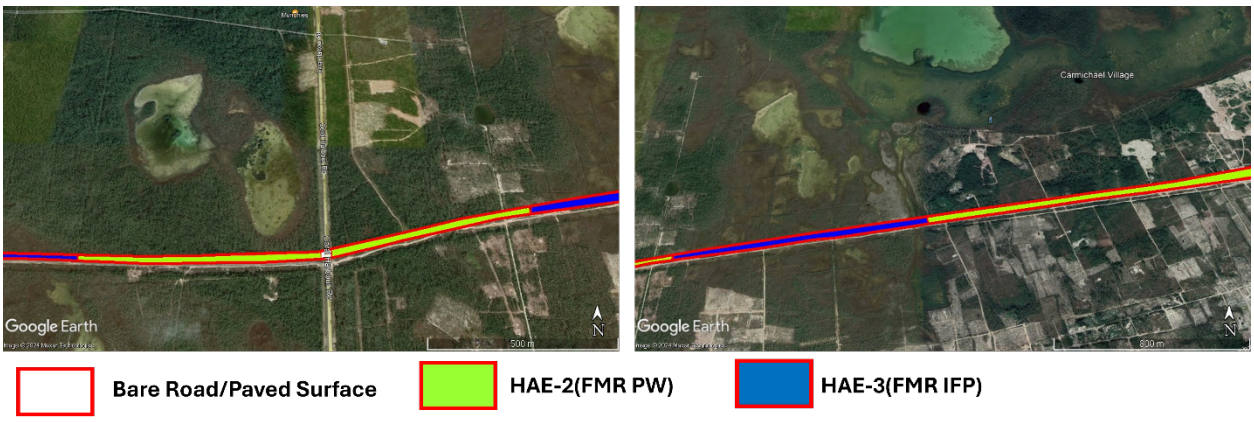

Figure 4: Vegetation type distribution in the central section of the FOCOL Proposed Diesel and Natural Gas Pipelines project site.

2.2.2.3 Eastern section vegetation type distribution-Carmichael Village to Blue Hill Powerplant

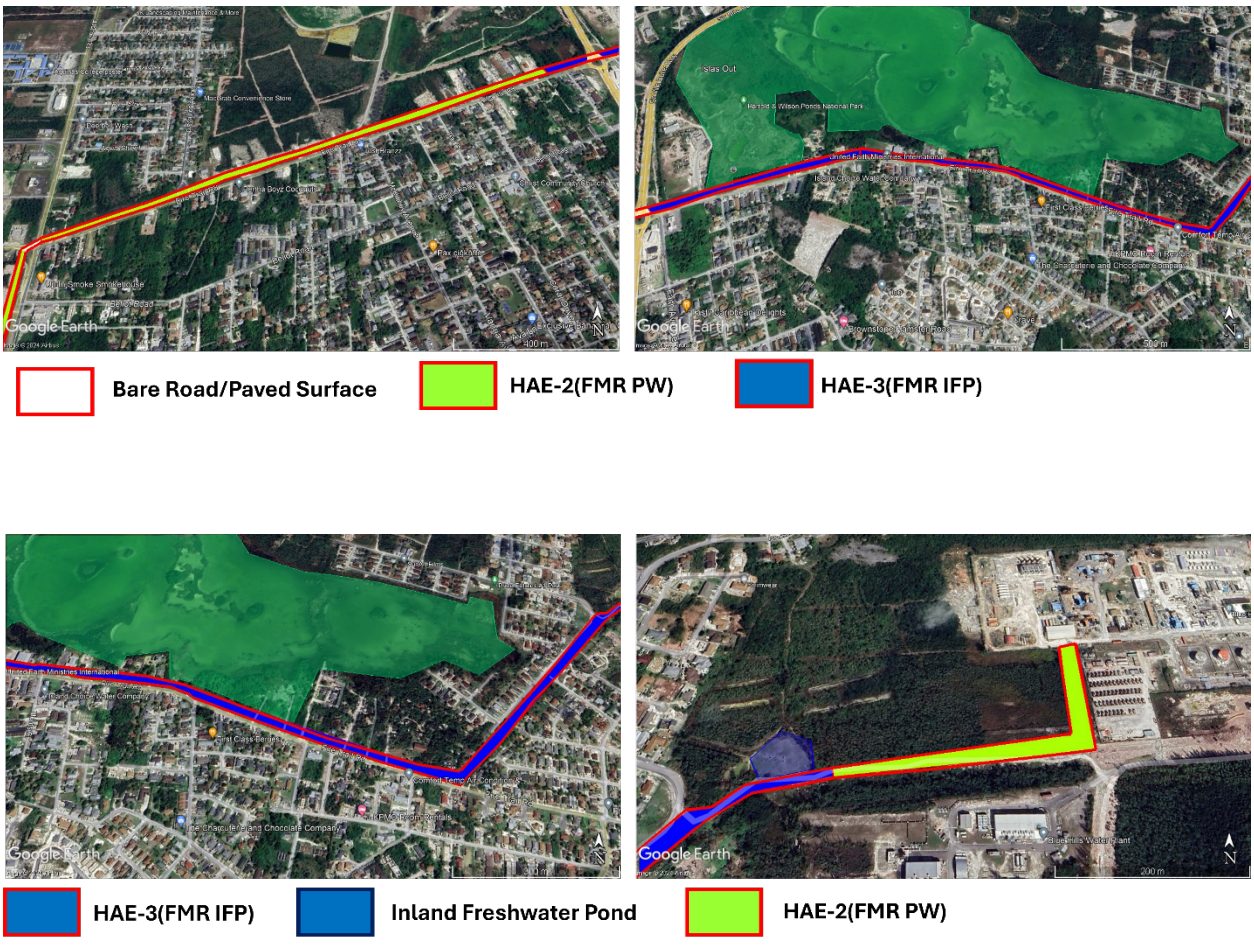

Figure 5: Vegetation type distribution in the eastern section of the FOCOL Proposed Diesel and Natural Gas Pipelines project site.

2.2.3 Vascular Plant Diversity

Species diversity and richness on the site are in line with what is expected of a site that consists of one (1) terrestrial ecosystem, and two (2) vegetation classes, a human-altered environment, and an inland freshwater wetland. However, the project area previously encompassed three (3) other natural vegetation types, dry broadleaf evergreen forest, pine woodland, and another inland freshwater wetland before disturbance due to human activities. Species diversity reflects the project's transition across these now highly disturbed areas. A total of one hundred and ten (110) species were recorded on the site, including eighteen (18) protected species and twelve (12) invasive species (See Table 1). * Denotes protected species observed on the site.

Table 1: Vascular plant species recorded on the FOCOL Proposed Diesel and Natural Gas Pipelines project site, Nassau, New Providence, The Bahamas

Table 1 Key: **HAE-1** = Former Dry Broadleaf Evergreen Forest, **HAE-2 =** Former Pine Woodland, **HAE-3** = Former Inland Freshwater Pond, **IFP =** Inland Freshwater Pond

Family	**Botanical Name**	**Common Name**	**Location**			
			HAE-1	**HAE-2**	**HAE-3**	**IFP**
Fabaceae	*Albizia lebbeck*	Woman's Tongue	✓	✓		
Picramniaceae	*Alvaradoa amorphoides*	Alvaradoa	✓	✓		
Annonaceae	*Annona glabra*	Pond Apple			✓	✓
Asteraceae	*Baccharis dioica*	Broom Bush	✓	✓		

Asteraceae	*Bidens alba*	Shepherd's Needle	✓	✓		
Orchidaceae	*Bletia purpurea**	Pineyard Pink		✓		
Boraginaceae	*Bourreria succulenta*	Strong Back	✓	✓		
Orobanchaceae	*Buchnera floridana*	Blue Heart		✓		
Burseraceae	*Bursera simaruba**	Gum Elemi	✓	✓		
Malpighiaceae	*Byrsonima lucida*	Guanaberry	✓	✓		
Fabaceae	*Caesalpinia bahamensis**	Bahama Brasiletto		✓		
Lauraceae	*Cassytha filiformis*	Love Vine	✓	✓		
Casurinaceae	*Casurina equisetifolia*	Australian Pine	✓	✓		
Poaceae	*Cenchrus echinatus*	Southern Sand Burr	✓	✓		
Apiaceae	*Centalla asiatica*	Marsh Pennwort			✓	✓
Rubiaceae	*Chiococca alba*	Snow Berry	✓			
Rubiaceae	*Chiococca parvifolia*	Pineland Snowberry		✓		
Chrysobalanaceae	*Chrysobalanus icaco*	Coco Plum			✓	

Sapotaceae	*Chrysophyllum oliviforme*	Satin Leaf	✓	✓		
Verbenaceae	*Citharexylum spinosum*	Fiddle Wood	✓	✓		
Cyperaceae	*Cladium mariscus*	Saw Grass			✓	✓
Clusiaceae	*Clusia rosea*	Autograph Tree	✓			
Polygonaceae	*Coccoloba diversifolia*	Pigeon Plum	✓	✓		
Polygonaceae	*Coccoloba swartzii*	Tie Tongue	✓	✓		
Combretaceae	*Conocarpus erectus**	Buttonwood			✓	✓
Tiliaceae	*Corchorus hirsutus*	Wooly Booger	✓	✓	✓	
Fabaceae	*Delonix regia*	Royal Poinciana	✓			
Dioscoreaceae	*Dioscorea microphylla*	Wild Yam	✓	✓		
Ebenaceae	*Diospyros crassinervis*	Feather Bed	✓	✓		
Convolvulaceae	*Distimake quinquefolius*	Rock Rosemary	✓	✓		
Verbenaceae	*Duranta erecta*	Golden Dewdrop	✓	✓		
Apocynaceae	*Echites umbellatus*	Devil's Potato	✓	✓		

Cyperaceae	*Eleocharis geniculata*	Capitate Spike Rush			✓	✓
Rubiaceae	*Ernodea littoralis*	Golden Creeper		✓		
Erythroxylaceae	*Erythroxylum areolatum*	False Cocaine	✓	✓		
Myrtaceae	*Eugenia axillaris*	White Stopper	✓	✓		
Myrtaceae	*Eugenia foetida*	Spanish Stopper	✓	✓		
Orchidaceae	*Eulophia maculate*	African Spotted Orchid	✓			
Sapindaceae	*Exothea paniculata*	Butter Bough	✓			
Fabaceae	*Galactia spiciformis**	Spiciform Milk Pea	✓	✓		
Nyctaginaceae	*Guapira discolor**	Small Leaved Blolly	✓	✓		
Nyctaginaceae	*Guapira obtusata*	Big Leaf Blolly	✓	✓		
Rubiaceae	*Guettarda scarbra*	Velvet Berry	✓	✓		
Euphorbiaceae	*Gymnanthes lucida*	Crab Wood	✓	✓		

Boraginaceae	*Heliotropium angiospermum*	Rooster's Comb	✓	✓		
Convolvulaceae	*Ipomoea indica*	Morning Glory	✓	✓		
Oleaceae	*Jasminum fluminense*	Azores Jasmine	✓	✓		
Asteraceae	*Koanophyllon villosum*	Jack-Ma-Da	✓	✓		
Verbenaceae	*Lantana bahamensis*	Wild Sage	✓	✓		
Verbenaceae	*Lantana involucrata*	Big Sage	✓	✓		
Poaceae	*Lasiacis divaricata*	Wild Bamboo Grass	✓			
Asteraceae	*Lepidaploa arbuscula**	Vernonia		✓		
Fabaceae	*Leucaena leucocephala*	Jumbay	✓	✓		
Arecaceae	*Leucothrinax morrisii**	Thatch Palm	✓	✓		
Linaceae	*Linum bahamense**	Bahama Flax		✓		
Fabaceae	*Lysiloma latisiliquum**	Wild Tamarind	✓	✓		
Poaceae	*Megathyrsus maximus*	Guinea Grass	✓	✓	✓	

Myrtaceae	*Melaleuca quinquenervia*	Paper Bark Tree			✓	
Asteraceae	*Melanthera nivea*	No Common Name	✓	✓		
Anacardiaceae	*Metopium toxiferum*	Poison Wood	✓	✓		
Melastomataceae	*Miconia bicolor*	Wild Guava	✓	✓		
Fabaceae	*Mucuna puriens*	Monkey Tamarind	✓	✓		
Boraginaceae	*Myriopus volubilis*	Soldier Vine	✓	✓		
Apocynaceae	*Neobracea bahamensis*	No Common Name		✓		
Vitaceae	*Parthenocissus quinquefolia*	Virginia Creeper	✓	✓		
Passifloraceae	*Passiflora bahamensis**	Bahama Passion Flower		✓		
Apocynaceae	*Pentalinon luteum*	Wild Alamanda		✓		
Peraceae	*Pera bumeliifolia**	Brown Ebony	✓			
Lamiaceae	*Petitia domingensis*	Bastard stopper	✓	✓		
Fabaceae	*Peltophorum pterocarpum*	Yellow Flame Poinciana	✓	✓		

Verbenaceae	*Phyla nodiflora*	Capeweed			✓	✓
Pinaceae	*Pinus caribea var. bahamensis**	Caribbean Pine		✓		
Fabaceae	*Piscidia piscipula*	Dogwood	✓			
Nyctaginaceae	*Pisonia aculeata*	Cat's Claw	✓	✓		
Fabaceae	*Pithecellobium keyense*	Ram's Horn	✓	✓		
Rubiaceae	*Psychotria ligustrifolia*	Smooth Wild Coffee	✓	✓		
Dennstaedtiaceae	*Pteridium aquilinum*	Bracken Fern		✓		
Rubiaceae	*Randia aculeata*	Box Briar	✓	✓		
Cyperaceae	*Rhynchospora floridensis*	White Top		✓	✓	✓
Arecaceae	*Roystonea regia*	Royal Palm			✓	
Arecaceae	*Sabal palmetto**	Sabal Palm			✓	✓
Goodeniaceae	*Scaevola taccada*	White Ink Berry	✓	✓		
Anacardinaceae	*Schinus terebinthifolia*	Brazillian Pepper	✓	✓		
Cyperaceae	*Scleria lithosperma*	Slender Nut Rush	✓			

Sapotaceae	*Sideroxylon foetidissimum*	Mastic	✓			
Sapotaceae	*Sideroxylon salicifolium*	Willow Bustic	✓			
Smilacaceae	*Smilax havanensis*	Chaney Briar	✓	✓		
Solanaceae	*Solanum erianthum*	Salve Bush	✓	✓		
Solanaceae	*Solanum americanum*	Poke Weed	✓	✓		
Solanaceae	*Solanum bahamense*	Canker Berry	✓			
Bignoniaceae	*Spathodea campanulata*	African Tulip		✓		
Asteraceae	*Sphagneticola trilobata*	Creeping Ox-Eye	✓	✓		
Poaceae	*Sporobolus domingensis*	Drop Seed Grass	✓	✓		
Verbenaceae	*Stachytarpheta jamaicensis*	Blue Flower	✓	✓		
Meliaceae	*Swietenia mahagoni**	Mahogany	✓	✓		
Bignoniaceae	*Tabebuia bahamensis*	Five Finger	✓	✓		
Bignoniaceae	*Tabebuia rosea*	Pink Poui			✓	
Thelypteridaceae	*Thelypteris reptans*	Walking Wood Fern	✓	✓		

Sapindaceae	*Thouinia discolor**	Silver Leaf	✓	✓		
Apiaceae	*Tiedemannia filiformis*	Water Dropwort			✓	✓
Celtidaceae	*Trema lamarckiana*	Pain-in-Back	✓	✓		
Malvaceae	*Triumfetta semitriloba*	Burr Bush	✓	✓		
Passifloraceae	*Turnera ulmifolia**	Bahamian Buttercup	✓	✓		
Fabaceae	*Vachellia choriophylla*	Cinnecord	✓	✓		
Boraginaceae	*Varronia bahamensis**	Granny Bush		✓		
Sterculiaceae	*Waltheria bahamensis*	Bahamian Waltheria	✓	✓		
Sterculiaceae	*Waltheria indica*	Sleepy Morning	✓	✓		
Zamiaceae	*Zamia integrifolia*	Bahamian Coontie		✓		
Rutaceae	*Zanthoxylum fagara*	Wild Lime	✓	✓		
Rhamnaceae	*Ziziphus jujuba*	Jujube		✓		

2.2.4 Invasive Species Survey

Twelve (12) invasive species were observed on the site. These species are outlined below along with their occurrence, abundance on the site, and recommendation for control (See Table 2). Species that are recommended for control are species whose richness and distribution are too enormous to eradicate but whose spread can be stifled through various mitigative measures.

Whereas species recommended for eradication are species whose richness and distribution are relatively small and hence can be eradicated.

Table 2: Invasive species recorded on the FOCOL Proposed Diesel and Natural Gas Pipelines project site, Nassau, New Providence, The Bahamas

Species	Occurrence & Abundance	*Recommendations
Albizia lebbeck, Woman's Tongue.	1-20ft seedlings and 20-25ft mature trees on the proposed project site.	Control
Casuarina equisetifolia, Australian Pine.	1-20ft seedlings and 20-50ft tall trees within the HAE-1 & HAE-2 on the proposed project site.	Control
Ipomoea indica, Morning Glory.	Clusters of vines are distributed sporadically throughout HAE-1 & HAE-2 on the project site.	Control
Jasminum fluminense, Jasmine Vine.	Clusters of vines are distributed sporadically throughout HAE-1 & HAE-2 on the project site.	Not Listed
Leucaena leucocephala, Jumbey.	1-6ft tall trees in HAE-1 & HAE-2 on the proposed project site.	Control
Megathyrsus maximus, Guinea Grass.	1-3ft tall plants within the HAE-1, HAE-2, & HAE-3 on the proposed project site.	Not Listed
Melaleuca quinquenervia, Paper Bark Tree.	1-3ft tall seedlings within the HAE-3 on the proposed project site.	Eradication

Mucuna pruriens, Monkey Tamarind.	Clusters of vines are distributed sporadically throughout HAE-1 & HAE-2 on the project site.	Eradication
Scaevola taccada, White Inked Berry.	1-3ft tall plants within HAE-1 & HAE-2 on the proposed project site.	Eradication
Schinus terebinthifolius, Brasillian Pepper Berry.	1-20ft seedlings and 20-25ft trees within HAE-1 & HAE-2 on the proposed project site.	Eradication
Spathodea campanulata, African Tulip	1-20ft seedlings and 20-25ft trees within the HAE-2 on the proposed project site.	Control
Sphagneticola trilobata, Creeping Ox-Eye.	Clusters of vine-like plants within HAE-1 & HAE-2 on the project site.	Control

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

Photo 9: *Sphagneticola trilobata* (Creeping Ox-Eye).

2.2.5 Protected Species Survey

There were eighteen (18) protected species observed on the proposed project site. Seventeen (17) are listed in the Forestry Act Declaration of Protected Trees Order 2021 and one (1) is listed in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna & Flora (CITES).

2.2.5.1 Local/National Legislation & Policy

The Forestry Act Declaration of Protected Trees Order 2021 lists one hundred and twenty-seven (127) vascular plant species as protected. Eighty-six (86) species are listed as Endemic or Endangered or Threatened and forty-one (41) are listed as Cultural or Historical and Economic. Endemic species are species that are native and restricted to the archipelago, island groupings, or specific islands. Cultural or historical species are species that are of historical or cultural importance such as species utilized for boat building and straw work. Seventeen (17) species listed on the Forestry Act Declaration of Protected Trees Order 2021 were recorded at the site (See Table 3).

Endemic, Endangered, or Threatened Protected Trees

There were five (5) botanical species observed on the site that are listed under the subsection of Endemic or Endangered or Threatened Species (Schedule 1) in the Act. These species are *Linum bahamense* (Bahama Flax), *Lepidaploa arbuscula* (Vernonia), *Passiflora bahamensis* (Bahama Passionflower), *Thouinia discolor* (Quicksilver Bush), and *Varronia bahamensis* (Granny Bush).

Cultural, Historical, or Economic Protected Trees

Twelve (12) of the eighteen (18) species, *Bursera simarouba* (Gum Elemi), *Caesalpinia bahamensis* (Bahama Brasiletto), *Conocarpus erectus* (Buttonwood), *Galactia spiciformis* (Spiciform Milk Pea), *Guapira discolor* (Small leaved Blolly), *Leucothrinax morrisii* (Thatch Palm), *Lysiloma latisiliquum* (Wild Tamarind), *Pera bumeliifolia* (Brown Ebony), *Pinus caribaea var bahamensis* (Bahamian Pine), *Sabal palmetto* (Sabal Palm), *Switenia mahogani* (West Indian Mahogany), and *Turnera ulmifolia* (Bahamian Buttercup) are listed under the subsection Cultural or Historical and Economic (Schedule 2) in the Act.

2.2.5.2 International Legislation, Policy, & Agreements

The Convention on International Trade in Endangered Species of Wild Fauna & Flora (CITES) is a transnational treaty to conserve and protect endangered flora and fauna from the threats of international trade. CITIES have three (3) appendices (I, II, III) that contain lists of species that are provided with distinct types of protection from overexploitation. One (1) orchid species, *Bletia purpurea* (Pineyard Pink) is listed in CITIES Appendix II. This listing prohibits the harvesting and trade of native orchids.

Table 3: Protected Species recorded on the FOCOL Proposed Diesel and Natural Gas Pipelines project site, Nassau, New Providence, The Bahamas

#	Species Recorded		Location
	Botanical Name	**Common Name**	
1	*Bursera simarouba*	Gum Elemi	1-20ft tall seedlings/saplings and 20-25ft mature trees within HAE-1 & HAE-2 on the site.
2	*Caesalpinia bahamenis*	Bahama Brasiletto	1-4ft tall mature trees within the HAE-2 on the project site.
3	*Conocarpus erectus*	Buttonwood	1-6ft tall seedlings and saplings within the HAE-3 & IFP on the project site.
4	*Galactia spiciformis*	Spiciform Milk Pea	Clusters of vines are distributed sporadically throughout HAE-1 & HAE-2 on the project site.
5	*Guapira discolor*	Small-leaved Blolly	1-6ft tall seedlings and saplings within HAE-1 & HAE-2 on the proposed project site.

6	*Leucothrinax morrisii*	Thatch Palm	12-31in tall seedlings in addition to 31 in-72 in (6ft) tall mature trees within HAE-1 & HAE-2 on the project site.
7	*Lepidaploa arbuscula*	Vernonia	1-3ft tall trees within the HAE-2 on the project site.
8	*Linum bahamense*	Bahama Flax	6in-12in tall trees within the HAE-2 on the project site.
9	*Lysiloma latisiliquum*	Wild Tamarind	1-20ft seedlings and saplings within HAE-1 & HAE-2 on the project site.
10	*Passiflora bahamensis*	Bahamian Passionflower	Clusters of vines are distributed sporadically throughout the HAE-2 on the project site.
11	*Pera bumeliifolia*	Brown Ebony	1-3ft tall trees on the edges of the HAE-1 that transitions to DBEF on the project site.
12	*Pinus caribaea var bahamensis*	Bahamian Pine	1-3ft tall seedlings, 3-20ft tall saplings, and 20-50ft tall mature trees within the HAE-2 on the project site.
13	*Sabal palmetto*	Sabal Palm	12-31in tall seedlings in addition to 31 in- 48in (4ft) tall mature trees within the HAE-3 & IFP on the project site.
14	*Swietenia mahogani*	West Indian Mahogany	1-20ft tall seedlings within HAE-1 & HAE-2 on the project site.

15	*Thouinia discolor*	Quicksilver Bush	1-6ft tall trees within the regenerating Pine Woodland on the project site.
16	*Turnera ulmifolia*	Bahamian Buttercup	1-3ft tall herbaceous plants within the human-altered environment and regenerating Pine Woodland on the project site.
17	*Varronia bahamensis*	Granny Bush	1-6ft tall herbaceous plants within the human-altered environment, and regenerating Pine Woodland on the project site.

Photo 10: *Linum bahamense* (Bahama Flax).

Photo 11: *Lepidaploa arbuscula* (Vernonia).

2.2.5.3 Protected Species Count

Twenty (20) randomly selected plots were established to estimate the number of protected species on the project site (See Figure 3). The number of protected species per plot was determined using plot sampling methodology (See Table 4). The estimated number of individual protected species across the entire project area was also determined by considering the average number of trees per acre and multiplying the subsequent quotient by the total acres surveyed (See Table 5).

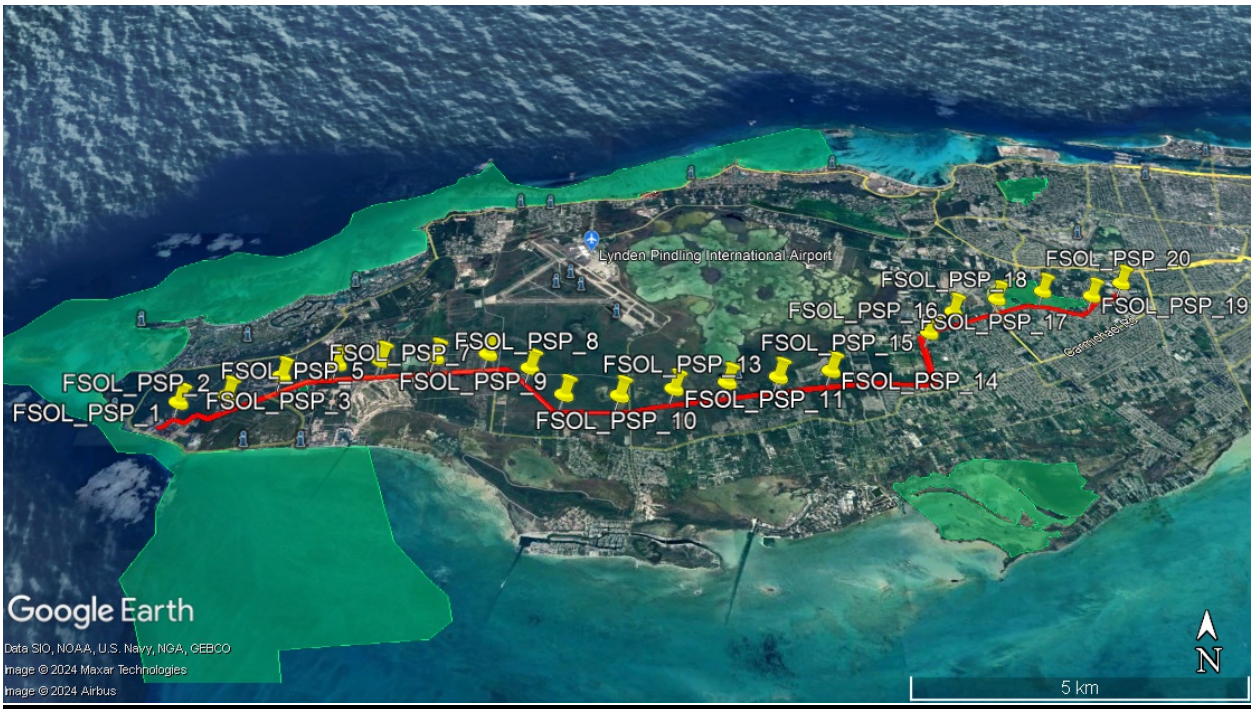

Figure 6: Protected Species Plot Map.

Table 4: Protected species survey plot results from the FOCOL Proposed Diesel and Natural Gas Pipelines project site, Nassau, New Providence, The Bahamas

Plot	Location	Species	#
1	25°00'25.75"N 77°32'19.37"W	*Bursera simarouba,* Gum Elemi	30
2	25°00'30.91"N 77°31'49.13"W	*Bursera simarouba,* Gum Elemi	2
		Linum bahamense, Bahama Flax	1
		Leucothrinax morrisii, Thatch Palm	4
		Lepidaploa arbuscula, Vernonia	2

		Turnera ulmifolia, Bahamian Buttercup	1
		Varronia bahamensis, Granny Bush	22
3	25°00'46.79"N 77°31'17.61"W	*Galactia spiciformis,* Spiciform Milk Pea	1
		Turnera ulmifolia, Bahamian Buttercup	1
		Varronia bahamensis, Granny Bush	9
4	25°00'57.42"N 77°30'42.77"W	*Linum bahamense,* Bahama Flax	1
		Pinus caribaea var. bahamensis, Bahamian Pine	2
		Varronia bahamensis, Granny Bush	26
5	25°01'00.24"N 77°30'14.27"W	*Bursera simarouba,* Gum Elemi	3
6	25°01'03.04"N 77°29'38.02"W	*Bursera simarouba,* Gum Elemi	18
		Galactia spiciformis, Spiciform Milk Pea	1
		Leucothrinax morrisii, Thatch Palm	10
		Lepidaploa arbuscula, Vernonia	11

		Pinus caribaea var. bahamensis, Bahamian Pine	72
		Varronia bahamensis, Granny Bush	15
7	25°01'05.91"N 77°29'02.37"W	*Guapira discolor,* Small leaved Blolly	1
		Linum bahamense, Bahama Flax	3
		Leucothrinax morrisii, Thatch Palm	12
		Pinus caribaea var. bahamensis, Bahamian Pine	67
		Varronia bahamensis, Granny Bush	3
8	25°00'53.91"N 77°28'33.14"W	*Caesalpinia bahamensis,* Bahama Brasiletto	8
		Leucothrinax morrisii, Thatch Palm	1
		Pinus caribaea var. bahamensis, Bahamian Pine	12
		Varronia bahamensis, Granny Bush	4
9	25°00'31.98"N 77°28'09.32"W	*Leucothrinax morrisii,* Thatch Palm	1

		Pinus caribaea var. bahamensis, Bahamian Pine	11
10	25°00'31.22"N 77°27'33.03"W	*Bursera simarouba,* Gum Elemi	3
		Leucothrinax morrisii, Thatch Palm	28
		Pinus caribaea var. bahamensis, Bahamian Pine	2
11	25°00'36.70"N 77°26'57.26"W	*Pinus caribaea var. bahamensis,* Bahamian Pine	2
12	25°00'41.92"N 77°26'21.85"W	*Sabal palmetto,* Sabal Palm	25
13	25°00'46.43"N 77°25'47.64"W	*Bursera simarouba,* Gum Elemi	8
		Leucothrinax morrisii, Thatch Palm	1
		Pinus caribaea var. bahamensis, Bahamian Pine	4
14	25°00'51.65"N 77°25'11.87"W	*Caesalpinia bahamensis,* Bahama Brasiletto	17
		Galactia spiciformis, Spiciform Milk Pea	1
		Leucothrinax morrisii, Thatch Palm	20
		Lepidaploa arbuscula, Vernonia	1

		Pinus caribaea var. bahamensis, Bahamian Pine	30
		Thouinia discolor, Quicksilver Bush	3
		Varronia bahamensis, Granny Bush	3
15	25°01'24.85"N 77°23'58.93"W	No protected species were observed.	0
16	25°01'44.39"N 77°23'37.71"W	*Caesalpinia bahamensis,* Bahama Brasiletto	3
		Lepidaploa arbuscula, Vernonia	7
		Thouinia discolor, Quicksilver Bush	2
		Varronia bahamensis, Granny Bush	5
17	25°01'56.41"N 77°23'03.73"W	*Conocarpus erectus,* Buttonwood	3
18	25°02'03.96"N 77°22'28.71"W	*Bursera simarouba,* Gum Elemi	2
19	25°01'59.28"N 77°21'54.79"W	No protected species were observed.	0
20	25°02'11.91"N 77°21'29.25"W	*Caesalpinia bahamensis,* Bahama Brasiletto	1

		Linum bahamense, Bahama Flax	1
		Leucothrinax morrisii, Thatch Palm	2
		Pinus caribaea var. bahamensis, Bahamian Pine	1
		Thouinia discolor, Quicksilver Bush	10
		Turnera ulmifolia, Bahamian Buttercup	3
		Varronia bahamensis, Granny Bush	1

Table 5: Estimated number of protected species potential on the FOCOL Proposed Diesel and Natural Gas Pipelines project site, Nassau, New Providence, The Bahamas

Protected Species	**Total # Recorded**	**Average per survey plot (#/20)**	**Total potential per acre (average x 10)**	**Total potential on site (# per acre x 164)**
Bursera simarouba, Gum Elemi.	64	3.2	32	5,248
Caesalpinia bahamensis, Bahama Brasiletto	29	1.45	14.5	2,378
Conocarpus erectus, Buttonwood	3	0.15	1.5	246

Galactia spiciformis, Spiciform Milk Pea	3	0.15	1.5	246
Guapira discolor, Small leaved Blolly	1	0.05	0.5	82
Lepidaploa arbuscula, Vernonia	21	1.05	10.5	1,722
Leucothrinax morrisii, Thatch Palm	79	3.95	39.5	6,478
Linum bahamense, Bahama Flax	6	0.3	3	492
Pinus caribaea var. bahamensis, Bahamian Pine	203	10.15	101.5	16,646
Sabal palmetto, Sabal Palm	25	1.25	12.5	2,050
Thouinia discolor, Quicksilver Bush	15	0.75	7.5	1,230
Turnera ulmifolia, Bahamian Buttercup	4	0.2	2	328

Varronia bahamensis, Granny Bush	88	4.4	44	2,816

While Table 5 provided estimated calculations based on the results of the sampling plots, the actual (more likely) abundance of protected species throughout the site might be lower based on observations as these species were only noted in the intact natural vegetated sections of the site and sporadically in the heavily altered areas of the proposed project site.

3.0 Avian Survey

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

3.1 Methodology

The assessment comprised 8 hours of active avian and ecological observations. Field studies consist of a summer avian survey (April-August), conducted on the 16th- 17th and the 20th- 21st of July 2024 between 8:00 am and 10:00 am. The avifauna of the area was assessed and recorded by walking along the perimeter of the site and within the interior of the site by utilizing established footpaths and roadways. Avifauna and fauna taxonomy is based on Currie et al (2019). Species numbers were recorded in the abundance categories, Single (1), Few (2-10), and Many (11-100). Species recorded were compiled for final abundance estimates. Status is based on the International Union for Conservation of Nature (IUCN).

3.2 Findings

3.2.1 Species Diversity

Twenty (20) species were recorded during the summer avian survey (See Table 6).

Table 6: Avifauna observed during the summer avian survey on the FOCOL Proposed Diesel and Natural Gas Pipelines project site, Nassau, New Providence, The Bahamas

Table Key:

Range	Status
PRB = Permanent Resident Breeding	**LC =** Least Concern (Conservation-IUCN)
	NT = Near Threatened (Conservation-IUCN)
SRB = Summer Resident Breeding	**IUCN =** International Union of Conservation of Nature
SRN = Summer Resident Non-Breeding	
WRN = Winter Resident Non-Breeding	
E = Endemic Species	
e = Endemic Subspecies	
I = Introduced Species	

Family	Scientific Name	Common Name	Master Observation	Range/ Conservation Status
Ardeidae	*Ardea alba*	Great Egret	Single	WRN/LC
Ardeidae	*Butorides virescens bahamensis*	Green Heron	Few	PRB/eLC
Charadriidae	*Charadrius vociferus*	Killdeer	Few	PRB/LC
Cuculidae	*Coccyzus minor*	Mangrove Cuckoo	Single	PRB/LC
Columbidae	*Columbina passerine bahamensis*	Common Ground dove	Abundant	PRB/LC
Cuculidae	*Crotophaga ani*	Smooth Billed Ani	Few	PRB/LC
Columbidae	*Ducula bicolor*	Pied Imperial Pigeon	Abundant	PRB/I/LC
Falconidae	*Falco sparverius sparveroides*	American Kestrel	Few	PRB/LC
Larinae	*Leucophaeus atricilla*	Laughing Gull	Single	PRB/LC

Thraupidae	*Melopyrrha violacea violacea*	Greater Antillean Bullfinch	Few	PRB/e/LC
Mimidae	*Mimus polyglottos polyglottos*	Northern Mockingbird	Abundant	PRB/LC
Ardeidae	*Nyctanassa violacea*	Yellow-crowned Night Heron	Single	PRB/LC
Columbidae	*Patagioenas leucocephala*	White Crown Pigeon	Abundant	PRB/LC
Picidae	*Picoides villosus maynardi*	Hairy Woodpecker	Single	PRB/e/LC
Threskiornithidae	*Plegadis falcinellus*	Glossy Ibis	Few	PRB/LC
Columbidae	*Streptopelia decaocto*	Ringed Necked Dove	Few	PRB/I/LC
Tyrannidae	*Tyrannus dominicensis*	Gray King Bird	Abundant	SRB/LC
Vireonidae	*Vireo altiloquus*	Black Whiskered Vireo	Few	SRN/LC
Vireonidae	*Vireo crassirostris crassirostris*	Thick-billed Vireo	Few	PRB/e/LC
Columbidae	*Zenaida macroura*	Mourning Dove	Single	PRB/LC

3.2.2 Range

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

3.2.2.1 Permanent Resident Breeding

Permanent Resident breeding (PRB) species refers to the resident species that live and breed year-round throughout the Bahama Islands. There were seventeen (17) PRB species (approximately 85%) of the species recorded during the survey.

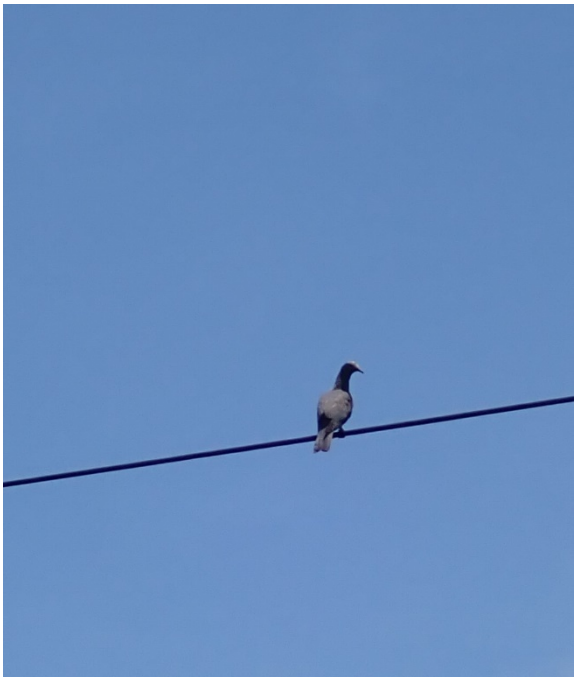

Photo 12: *Patagioenas leucocephala* (White-crowned Pigeon).

3.2.2.2 Summer Resident Breeding

Summer Resident Breeding (SRB) species refers to summer migrants from North & South America that utilize the Bahama Islands as their breeding/nesting grounds. One (1) of the species recorded on the site (approximately 5%) were SRB.

Photo 13: *Tyrannus dominicensis* (Gray Kingbird).

3.2.2.3 Summer Resident Non-Breeding

Summer Resident Non-Breeding (SRN) species refers to the summer migrants to the Bahama Islands from North and South America. One (1) species recorded on the site (approximately 5%) was SRN.

3.2.2.4 Winter Resident Non-Breeding

Winter Resident Non-breeding (WRN) species refers to the winter migrants to the Bahama Islands from North America. One (1) species observed, approximately 5% were WRN.

3.2.2.5 Endemic Species and Subspecies

Endemic species and subspecies are birds that exist only in The Bahamas. There was no endemic species observed on the proposed project site. However, four (4) endemic subspecies were observed on the site, *Butorides virescens bahamensis* (Green Heron), *Columbina passerina bahamensis* (Common Ground-Dove), *Picoides villosus maynardi* (Hairy Woodpecker) and *Vireo crassirostris crassirostris* (Thick-billed Vireo) approximately 20% of the species recorded.

3.2.2.6 Introduced Species

Introduced species are birds that were introduced to The Bahamas due to the illegal animal trade or human error. There were two (2) introduced species (approximately 10%) observed on the project site.

3.2.3 Conservation Status

3.2.3.1 Protected Species

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

3.2.3.2 Endangered Species

None of the species recorded are classed as endangered.

3.2.4 Habitat Utilization

Avifauna was observed flying across the project site or perching in trees within or on the periphery of the proposed project site. There was no feeding or nesting observed on the project site, but the site does contain species such as *Bursera simarouba* (Gum Elemi), *Bourerria succulenta* (Strongback), *Leucothrinax morrisii* (Thatch Palm), and *Varronia bahamensis* (Granny Bush) that contain flowers, fruits, and buds that can provide and attract food for avifauna. The site does provide seasonal habitats utilized by wading birds (Inland Freshwater Wetland/Pond & Seasonal Ponds) but does not provide habitats for sea birds (isolated rocks, intertidal zone). The descriptions of vegetation types and plant species observed are a fair representation of the botanical features on the site. While it is likely that additional species would be recorded with further field studies, the numbers and species are not likely to impact the results of this study for the purposes it is intended. Additional avian field studies repeated over a period are likely to record other species on the site, these species would likely utilize the site for perching, feeding, and nesting.

3.2.5 Additional Observations

Terrestrial ecosystems support a myriad of other fauna besides avifauna. These species depend on and aid in the overall health of the ecosystem. The proposed project site contains reptiles, amphibians, mollusks (gastropoda), and a myriad of arthropods (arachnids, insects, crustaceans, and hymenopterans) (See Table 7).

Table 7: Additional terrestrial fauna observed on the FOCOL Proposed Diesel and Natural Gas Pipelines project site, Nassau, New Providence, The Bahamas

Family	Scientific Name	Common Name
Nymphalidae	*Agraulis vanillae insularis*	Gulf Fritillary
Lepidoptera	*Anartia jatrophae guantanamo*	White Peacock
Polychrotidae	*Anolis sagrei ordinatus*	Brown Anole
Apoidea	*Apis mellifera scutellata*	Honey bee
Saturniidae	*Automeris io lilith*	Io Moth
Araneidae	*Nephila claivpes*	Banana spider
Araneidae	*Argiope argentata*	Silver Garden Spider
Canidae	*Canis lupus familiaris*	Feral dog
Araneidae	*Cyrtophora citricola*	Social Spiders
Cicadidae	*Diceroprocta bonhotei*	Bahamian Cicada
Nymphalidae	*Dryas iulia carteri*	Julia
Nymphalidae	*Euptoieta hegesia hegesia*	Mexican Fritillary
Pieridae	*Eurema dina helios*	Bush sulfur
Felidae	*Felis catus*	Feral Cat
Araneidae	*Gasteracantha cancriformis*	Crab Spider
Nymphalidae	*Heliconius charithonia*	Zebra Longwing
Cepolidae	*Hemitrochus spp.*	Seagrape snail
Lepidoptera	*Junonia evarete zonalis*	Caribbean buckeye
Tetragnathidae	*Leucauge argyra*	Long jawed Spider
Pseudophasmatidae	*Malacomorpha androsensis*	Bahama Stick Insect
Vespidae	*Mischocyttarus cubensis*	Wasp
Papilionidae	*Papilio andraemon*	Bahamian Swallowtail
Vespidae	*Polistes spp.*	Paper wasps
Hesperiidae	*Polygonus ico*	Hummer skipper
Rhinotermitidae	*Reticulitermes spp*	Subterranean Termite
Acrididae	*Schistocerca americana*	American Bird Grasshopper

Lycaenidae	*Strymon martialis*	Martial Scrub Hairstreak
Psychidae	*Thyridopteryx ephemeraeformis*	Bagworm
Hesperidae	*Urbanus proteus*	Longtail skipper

Photo 14: *Automeris io lilith* (Io Moth) Caterpillar.

3.2.5.1 Endemic Fauna

Endemic species and subspecies are fauna that exist only in The Bahamas. There was one (1) endemic fauna, *Malacomorpha androsensis* (Bahamian Stick Insect) observed on the proposed project site.

Photo 15: *Malacomorpha androsensis* (Bahamian Stick Insect).

3.2.5.2 Invasive Fauna

There were two (2) invasive fauna species observed on the proposed project site, *Canis lupus familiaris* (Feral Dog), and *Felis catus* (Feral Cat). All two (2) species are recommended for control in The Bahamas Invasive Species Strategy 2013.

Photo 16: *Canis lupus familiaris* (Feral Dog), and *Felis catus* (Feral Cat) observed on the proposed project site.

4.0 Environmental Impacts & Mitigative Measures

4.1 Environmental Impacts

4.1.1 Native Vegetation

Native vegetation inclusive of protected botanical species will be impacted by this development due to clearing that is needed for the establishment of the Pipelines infrastructure.

4.1.2 Inland Freshwater Wetland/Pond

The inland freshwater wetland/pond will be impacted by this development due to the clearing that is needed for the establishment of the Pipelines.

4.1.3 Avifauna and Other Terrestrial Fauna

All fauna recorded and any other species that may utilize the site currently or during other times of the year will be impacted by this development.

4.2 Mitigative Measures

4.2.1 Native Vegetation and Protected Species Management

Native vegetation inclusive of protected species is pivotal to maintaining and preserving biodiversity. Native vegetation, especially protected botanical species with a high relocation survivability rate should be relocated to either a holding site for future use in reforestation projects or replanted in national parks, schools, and other public-owned spaces.

4.2.2 Invasive Species Management

There were twelve (12) invasive species observed on the site, *Albizia lebbeck* (Woman's Tongue), *Casuarina equisetifolia* (Australian Pine), *Ipomoea indica* (Morning Glory), *Jasminum Fluminense* (Jasmine Vine), *Leucaena leucocephala* (Jumbey), *Megathyrsus maximus* (Guinea Grass), *Melaleuca quinquenervia* (Paper Bark Tree), *Mucuna pruriens* (Monkey Tamarind), *Scaevola taccada* (White Inked Berry), *Schinus terebinthifolius* (Brasillian Pepper Berry), *Spathodea campanulate* (African Tulip), and *Sphagneticola trilobata* (Wedelia). These plants should be completely removed, including the root system, and incinerated when appropriate. The invasive species should not be reused as mulch to reduce the spread of seeds and potential regrowth. The landscape palette should not include the use of any invasive species.

4.2.3 Management & Protection of the Inland Freshwater Pond

The protection and preservation of this important interior wetland is paramount. All efforts should be made to preserve these spaces as best as possible. Clearing should be done in a limited capacity around these spaces and silt-fencing should be employed to slow contamination or pollution by surface run-off or wind-blown debris.

4.2.4 Wildlife Management

Fauna that have adapted to or have become accustomed to Human-Altered Environments such as *Mimus polyglottos polyglottos* (Northern Mockingbird) will return after the construction phase. However, species such as *Vireo crassirostris crassirostris* (Thick-billed Vireo) that prefer native forested habitats may seek those habitats elsewhere.

4.2.4.1 Invasive Fauna Management

There were two (2) invasive fauna species observed on the project site, *Canis lupus familiaris* (Feral Dog), and *Felis catus* (Feral Cat). All efforts should be made to remove or control the population of both species on the project site. These species, due to their proliferation and habits pose a significant threat to native fauna. They should be held or confined to a specific area and not be allowed to roam in natural spaces without being on a leash. Additionally, they should be spade (if female) or neutered (if male) to stem the growth of both species' populations.

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