Glossary of Geological Terms

Carbonate Rock Types:
The pure carbonate rocks are composed of varying admixtures of particles and matrix. Local production of carbonate particles eliminates effective use of grain size and sorting as significant factors as defining features in the vast majority of cases. Therefore, the classification, organization and emphasis of rock types are based dominantly upon the relative abundance of particles and their packing. (Dunham, R. J. 1960), as follows:

Mudstone - Mud supported, with less than 10% particles
Wackestone - Mud supported, with more than 10% particles
Packstone - Particles supported, with more than 10% mud
Grainstone - Particles supported, with less than 10% mud

Ooids - A spherical or subspherical rock particle, which has grown by accretion around a nucleus. The nucleus may be inorganic (e.g. sand grain). Their formation depends upon the nuclei being constantly agitated, so that the calcareous material is uniformly deposited. (oolitic)

Peloids - Are large *ooids*, about the size of a garden pea (3-6 mm in diameter). Algae commonly play a significant role in their formation (pelitic).

Bioturbated - Is the reworking of sediments through the various burrowing, boring, and sediment ingesting activities of organisms. *Borers* such as algae, mollusks, and echinoids are capable of penetrating hard surfaces. *Burrowers* such as shrimp, anemones and polychaete worms are capable of excavating unconsolidated particles and *Browsers,* such as sea cucumbers and gastropods ingest sediment in a nonselective manner and extract nutrients from the substrate.

Benthonic - Those animals that live on the sediments on the sea floor, including both mobile and non-mobile forms. The free living (mobile) forms move to their food, whereas the sessile (non-mobile) forms, which may or may not be fixed, wait for their food to come to them. The characteristic of the second group is radial symmetry and complex food gathering organs e.g. Echinodermata: Crinoids (generally fixed), Sea Urchins, Sea Cucumbers, Star Fish, and Brittle Stars.

Facies - The sum total of features of a given environment, which are characteristic of that environment, such as rock type, fossil assemblages and fauna. Facies, which are particularly characterized by their rock type, are referred to as *lithofacies,* whereas those especially characterized by their fauna are called *biofacies.*

Xerophytes - Are plants that structurally adapted for life and growth with a limited water supply. These plants have developed mechanisms that limit transpiration, or provide for the storage of water.

Hydric - Soil that is wet enough to periodically produce anaerobic conditions, thereby influencing the growth of plants.

Hydrophytic - Any plant growing in water or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content.

Karst topography is a three-dimensional landscape shaped by the dissolution of a soluble layer or layers of bedrock, usually carbonate rock such as limestone or dolomite.

Epikarst – the upper surface of karst, consisting of a network of intersecting fissures and cavities that collect and transport surface water and nutrients.

Source KES 2007

Table 4-1 Facies Composition and Distribution in the Bahama Banks

Litho-facies	Habitat	Characteristics	Community (Biofacies)
Coralgal	Reef (outer reef of shelf margin)	High diversity community including about 30 coral species: coral frames bound by coralline algae. Niches in frame colonized by mollusks, echinoids, foraminereans, hydrocorrallines, annelids, alcyonariains and fish. Spur and groove development. Optimum growth conditions extend from 1 m to 50 m depth. Comprises the windward reefs in the Bahamas.	*Aeropora palmata*
	Rock pavement	Occurs in back-reef areas, local patch reefs attached to rock bottom covered by blanket of ephemeral lime-sand. Corals (eg *Montastrea* and *Diploria*) with gorgonaceans and plexaurid sea-whips. Biota dominated by strongly cemented and encrusting species.	Plexaurid
	Inshore rocky shoreline	Areally restricted and strongly zoned. Dominated by cemented or closely attached biota and includes green algae, coralline algae, sponges barnacles, chitons, gastopods, bivalves, and echinoids. Rather variable depending on tidal range and degree of exposure.	Littorina
	Rock ledges and prominences	Subtidal rock ledges along exposed shorelines. Transitional with Plexaurid community. Many mollusks from the reef and rocky shoreline are found here. Corals include rock pavement species plus the hydrozoan *Millepora*. Mostly attached and encrusting species.	*Millepora.*
	Subtidal unstable sand	Found on the outer Bank margin and immediate back reef area. Lime sand only partially stabilized by marine grasses. Bottom is rippled and there is much sediment movement, providing a high stress habitat. The conch *Strombus* , burrowing bivalves and sand-dollars are the typical fauna	*Strombus samba*
Oolite and Grape-stone	Vegetation-stabilized sand	Is the most widespread habitat with the most diverse biota. The community develops in the sheltered waters of the back-reef and open lagoonal areas adjacent to the Bank edge. There is about 89% of non-skeletal sand grains in the oolitic facies and about 83% in the grapestone facies. These grains are composed of feacal pellets, mud aggregates, grapestone, and ooids. Green and red algae are common, mollusks are abundant (especially burrowers). Stabilization is either by algae or grass.	*Strombus costatus*
Oolite	Intertidal, bank-edge unstable oolite	Contemporary oolite is forming and the facies contains about 90% of ooids. These sand shoals provide extremely mobile and grass-free habitats that are localized to actively growing intertidal oolite bars. Almost devoid of biota apart from active burrowing clam *Tivela*.	*Tivela abaconis*
Mud and Pellet Mud	Muddy-sand with normal to hyper-salinities	Located away from the shelf edge and transitional to the muddy shorelines and tidal flats. It is transitional between *S. costatus* and a euryhaline mangrove association. Members of the biota include green algae, grasses, the bryzoan *Schizoporella*, a coral *(Manicina)* , a few echinoids, mollusks. and *Didemnum*, a tunicate.	*Didemnum*
	Subtidal variable salinity, muddy bottom	Occurs nearshore with a low-diversity salinity-tolerant biota, in areas receiving rain water runoff. The mollusk *Ceritidea* and *Pseudocyrena* are present with the non-calcareous alga *Batophora*, and miliolid and peneroplid foraminiferans.	*Ceritidea costata*
	Intertidal and supratidal mangrove association	Muddy intertidal shorelines and supratidal flat are colonized by red and black mangrove (*Rhizophora mangle* and *Avicenna nitida)*. Sheltered marshes, mud flats and lagoonal shores support this community. The sediments are stromatolitic and rich in grazing gastropods, *Fasciolaria* and *Batillaria.*	*Fasciolaria - Batillaria.*

Source: Sedimentary Environments and Facies. (Reading., 1979)

Table 4-2 Bahamas Hurricane and Tropical Storm Frequency 1871 - 1987

Location	May	June	July	Aug	Sept	Oct	Nov	Totals
Bahamas	1/1	0/3	2/3	5/14	25/19	12/15	5/10	50/65
Grand Bahama	1/0	0/0	2/0	0/4	5/3	8/7	2/1	18/15
Great Abaco	0/0	0/1	1/0	1/2	4/1	1/4	1/0	8/8
Andros	0/0	0/0	0/1	3/2	7/2	7/7	1/4	18/16
New Providence	0/0	0/1	2/0	1/1	4/1	2/1	0/2	9/6
Eleuthera	0/0	0/0	2/0	0/4	6/1	0/6	2/2	10/13
Cat Island	0/0	0/1	2/0	1/5	5/3	3/1	0/1	11/11
San Salvador	0/0	0/0	0/0	2/5	3/5	3/2	1/0	10/12
Long Island	0/0	0/0	0/0	1/3	7/2	0/1	1/2	9/8
Great Exuma	0/0	0/0	0/0	1/2	7/1	0/1	1/1	9/5
Rum Cay	0/0	0/0	0/1	1/1	1/0	1/0	1/0	4/2
Samana Cay	0/0	0/0	1/0	2/3	5/1	2/1	1/1	11/6
Crooked Island	0/0	0/0	1/1	1/3	6/1	0/2	1/3	9/10
Ackline	0/0	0/0	1/0	1/3	8/3	1/2	1/5	12/13
Mayaguana	0/0	0/0	1/0	0/2	3/2	2/4	0/1	5/9
Great Inagua	0/0	0/0	0/0	2/0	3/2	2/1	1/2	8/5

Source: Weather and Climate, San Salvador Island, 1996

1/1 First number indicates the number of hurricanes that made landfall in the Bahamas or on an individual island
Second number indicates the number of tropical storms that made landfall in the Bahamas or on an individual island

Table 4-3 Geologic Time Scale

SUB DIVISIONS				M.Yrs	Bahamas Section
Phanerozoic	Cenozoic Era	Quaternary Period	Holocene Pleistocene	2	?
		Tertiary Period	Pliocene Miocene Oligocene Eocene Paleocene	63	Missing
	Mesozoic Era	Cretaceous	Late Cret. Early Cret.	138	Beds
		Jurassic Period		205	
		Triassic Period		240	Basement
	Paleozoic Era	Permian Period		290	?
		Carboniferous Period	Pennsylvanian	330	
			Mississippian	360	
		Devonian Period		410	
		Silurian Period		435	
		Ordovician Period		500	
		Cambrian Period		570	
Protozoic	Late Prot.	Pre Cambrian			
	Middle Prot.				
	Early Prot.				

Source: US Geological Survey, 1984

Table 4-4 Stratigraphic Model for Bahamas Geology

Age	Formation	Member	Characteristics
Holocene	Rice Bay	Hanna Bay	Intertidal carbonate facies and eolianites deposited in equilibrium with modern sea-level, beach rock.
		North Point	Consists entirely of eolianites with foreset beds which extend below modern day sea-level. Weakly developed ooids, predominantly peloidal and bioclastic limestones.
Pleistocene	Grotto Beach	Cockburn Town	Subtidal and intertidal carbonate facies overlain by regressive eolianites Eolianites formation, with ooids dominant.
		French Bay	Transgressive eolianites which in some places is marked by an erosional platform on which stillstand fossil corals are found. Ooid limestones dominant.
	Owl's Hole		The eolianites of this unit are predominantly bioclastic limestones. Ooids are rare.

Source: Carew and Mylroie, 1985

Table 6.1 Pineland Common Vegetation

Common Name	Scientific Name	Protected Status		Observed		Comments
		P	E	Yes	No	
Caribbean pine	*P. caribaea var. bahamensis*	x		x		Co-dominant ground cover.
Bracken	*Pteridium aquilinum*			x		Co-dominant ground cover.
Poisonwood	*M. toxiferum*			x		
Wild guava	*Tetrazygia bicolor*			x		Exotic species.
Lead tree	*Leucaena leucocephala*			x		
Five fingers	*Tabebuia bahamensis*			x		
Morning glory	*Ipomoea sp.*			x		
Greenbrier	*Smilax sp.*			x		
Love vine	*Cassytha filiformis*			x		
Silver top palm	*Coccothrinax argentata*				x	

E = Endangered -

Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

P = Protected -

Conservation and Protection of the Physical Landscape of the Bahamas (Declaration of Protected Trees) Order, 1997

Table 6-2 Mangrove Common Vegetation

Common Name	Scientific Name	Protected Status		Observed		Comments
		P	E	Yes	No	
Red mangrove	*R. mangle*			x		Dominant
Black mangrove	*A. germinans*			x		
White mangrove	*L. racemosa*			x		
Green buttonwood	*C. erectus*			x		
Black olive	*Bucida buceras*			x		
Sawgrass	*C. jamaicense*			x		
Seagrape	*C. uvifera*			x		
Glasswort	*Salicornia sp.*			x		

E = Endangered -

Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

P = Protected -

Conservation and Protection of the Physical Landscape of the Bahamas (Declaration of Protected Trees) Order, 1997

Table 6-3 Coppice Common Vegetation (page 1 of 2)

Common Name	Scientific Name	Protected Status		Observed		Comments
		P	E	Yes	No	
Poisonwood	*M. toxiferum*			x		
Gumbo limbo	*Bursera simarouba*			x		
Mahogany	*Swietenia mahogani*	x	x	x		
Steel wood	*Randia aculeate*			x		
Wild mamee	*Clusia rosea*			x		
Quina	*Antirhea lucida*			x		
Black olive	*Bucida buceras*			x		
Torchwood	*Amyris elemifera*			x		
Cinnecord	*Acacia choriophylla*			x		
Lead tree	*L. leucocephala*			x		
Seagrape	*C. uvifera*			x		
Trema	*Trema lamarckiana*			x		
Mango	*Mangifera indica*			x		
Custard apple	*Annona reticulata*			x		
Bahamas pigeon plum	*Coccoloba tenuifolia*			x		
Cocoplum	*Chrysobalanus icaco*			x		
Common snake bark	*Colubrina arborescens*			x		
Cork tree	*Thespesia populnea*			x		

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Conservation and Protection of the Physical Landscape of the Bahamas (Declaration of Protected Trees) Order, 1997

Table 6-3 Coppice Common Vegetation (page 2 of 2)

Common Name	Scientific Name	Protected Status		Observed		Comments
		P	E	Yes	No	
Wild tamarind	*Lysiloma latisiliquum*			x		
Joewood	*Jacquinia sp.*			x		
Papaya	*Carica papaya*			x		
Wild coffee	*Psychotria pubescens*			x		
Gray nicker bean	*Caesalpinia bonduc*			x		
Sword bush	*Phyllanthus epiphyllanthus*			x		
Lancewood	*Nectandra coriacea*			x		
Bush fleabane	*Pluchea symphytifolia*			x		
Blue porterweed	*Stachytarpeta jamaicensis*			x		
Wild hibiscus	*Phymosia abutiloides*			x		
Smutgrass	*Sporobolus indicus*			x		
Wild bamboo	*Lasiacis divaricata*			x		
Bidens	*Bidens sp.*			x		
Tassel flower	*Emilia fosbergii*			x		
Dogfennel	*Eupatorium capillifolium*			x		
Centella	*Centella asiatica*			x		
Morning glory	*Ipomoea sp.*			x		

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Conservation and Protection of the Physical Landscape of the Bahamas (Declaration of Protected Trees) Order, 1997

Table 6-4 Ironshore Common Vegetation

Common Name	Scientific Name	Protected Status		Observed		Comments
		P	E	Yes	No	
Sandfly bush	*R. americana*			x		Dominant
Sea purslane	*Sesuvium portulacastrum*			x		
Sea ox eye	*Borrichia sp.*			x		
Silver and green buttonwood	*C. erectus*			x		

E = Endangered -
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

P = Protected -
Conservation and Protection of the Physical Landscape of the Bahamas (Declaration of Protected Trees) Order, 1997

Table 7-1 Benthic Macroinvertibrates and Fish Species Observed

Phylum	Class	Scientific Name	Common Name	Habitat
Annelida	Polychaeta	*Bispira brunnea*	Social feather duster	Rock
Arthropoda	Crustacea	Unidentified	Crab	Burrows in seagrass beds
Chordata	Actinopterygii	*Thalassoma bifasciatum*	Bluehead	Rock/sand
		Hypoplectrus gemma	Blue hamlet	Rock/sand
		Chromis insolata	Sunshinefish (juvenile)	Rock/sand
		Caranx crysos	Blue runner	Sand flat seagrass beds
		Haemulon sp.	Grunt (juvenile)	Rock/sand flat
		*Sphyraena barracuda**	Barracuda (juvenile)	Rock/sand flat
		Abudefduf saxatilis	Sergeant major	Rock/sand flat
	Ascidiacea	*Symplegma viride*	Encrusting social tunicate	Rock
	Chondrichthyes	*Ginglymostoma cirratum**	Nurse shark	Rock/sand flat
Cnidaria	Anthozoa	*Diploria stringosa*	Symmetrical brain coral	Sand flat
		D. clivosa	Knobby brain coral	Sand flat
		Porites astreoides	Mustard hill coral	Sand flat
		Montastraea annularis	Boulder star coral	Sand flat
		P. porites	Finger coral	Sand flat
		Agaricia sp.	Lettuce coral	Sand flat
	Hydrozoa	*Millepora alcicomis*	Fire coral	Sand flat
	Scyphozoa	*Aurelia aurelia*	Moon jellyfish	Sand flat seagrass beds
Echinodermata	Asteroidea	*Oreaster reticulatus*	Cushion sea star	Seagrass beds
		Linckia guildingii	Common comet star	Seagrass beds
	Echinoidea	*Mellita sexiesperforata*	Six-keyhole sand dollar	Seagrass beds
		Diadema antillarum	Ling-spined urchin	Seagrass beds
		Clypeaster rosaceus	Inflated Sea biscuit	Seagrass beds
	Holothuroidea	*Holothuria mexicana*	Donkey dung sea cucumber	Sand flat
Mollusca	Gastropoda	*Fasciolaria tulipa**	True tulip	Rock
		*Strombus gigus**	Queen conch	Harvested
Porifera	Demospongia	*Ircinia strobilina*	Black-ball sponge	Rock
		Tedania ignis	Fire sponge	Sand flat

* Marine organisms observed at Spencer's Bight location.

Table 7-2 Observed Taxa of Macroalgae and Seagrass

Phylum	Scientific Name	Common Name	Habitat
Angiospermae	*Thalassis testudinum*	Turtle grass	Seagrass beds
	Syringodium filiforme	Manatee grass	Seagrass beds
Chlorophyta	*Penicillus dumetosus*	Bristle ball brush	Seagrass beds
	Penicillus pyniformis	Flat-top bristle brush	Seagrass beds
	Dasycladus vermicularis	Fuzzy finger alga	Sand flat
	Caulerpa cupressiodes	Cactus tree alga	Sand flat
	Caulerpa prolifera	Oval-blade alga	Seagrass beds
	Avrainvillea sp.	Blade alga	Sand flat/Seagrass beds
	Caulerpa sertularioides	Green feather alga	Seagrass beds
	Halimeda opuntia	Watercress alga	Rock/Seagrass beds
	Rhipocephalus phoenix	Pinecone alga	Rock
Phaeophyta	*Sargassum* sp. (attached)	Sargassum seaweed	Sand flat
	Dictyota ciliolata	Serrated strap alga	Rock
Rhodophyta	*Porolithon* sp.	Reef cement	Rock

Table 7-3. Stony Coral Species 15 cm or Greater

Coral ID #	Scientific Name	Common Name
1	*Diploria clivosa*	Knobby brain coral
2	*Diploria stringosa*	Symmetrical brain coral
3	*Diploria clivosa*	Knobby brain coral
4	*Diploria stringosa*	Symmetrical brain coral
5	*Diploria stringosa*	Symmetrical brain coral
6	*Diploria clivosa*	Knobby brain coral
7	*Diploria clivosa*	Knobby brain coral
8	*Diploria stringosa*	Symmetrical brain coral
9	*Diploria clivosa*	Knobby brain coral

Inventoried Stony coral that are potentially transplantable if in conflict with the proposed catwalk

Table 8-1 Summary of Potential Concerns

Map ID	Ecological Concern	Length of Impact	Estimated area of Impact	Mitigation Measures
Adjacent Wilson City Road				
1	Pineland	0.92 miles	4.46 Acres	Direct impact to Pineland unlikely to adversely effect listed species
2	Mangrove Wetland	0.12 Miles	0.58 Acres	Direct impacts may not jeopardize listed species, Best Management Practices (BMP) should be employed during construction e.g. the use of dewatering settling ponds, silt fences and turbidity booms. Also there may be some opportunity to directly re-connect some degree of tidal flow under the historic Wilson City Road as a partial mitigation measure
3	Coppice	0.06 miles	0.29 acres	Direct impact to Coppice unlikely to adversely effect listed species. Additional approvals may be required if old growth mahogany in conflict
4	Mangrove Wetland	0.06 miles	0.29 acres	Direct impacts may not jeopardize listed species, BMP should be employed during construction e.g. the use of dewatering settling ponds, silt fences and turbidity booms.
5	Dead Coppice	0.54 miles	2.61 acres	Direct impact to Coppice unlikely to adversely effect listed species. Additional approvals may be required if old growth mahogany in conflict
6	Coppice	0.57 miles	2.76 acres	Direct impact to Coppice unlikely to adversely effect listed species.Additional approvals may be required if old growth mahogany in conflict
Spencer's Bight				
7	Shoreline /bay	700 ft		Retaining wall proposed, BMP use during construction, Biologist on-hand if construction proposed during shark mating season
Dock Road Extension				
8	Coppice	0.45 miles	2.18 acres	Direct impact to Coppice unlikely to adversely effect listed species.Additional approvals may be required if old growth mahaogany in conflict
Proposed Dock				
9	Coppice (Dock)		2 acres	Direct impact to Coppice unlikely to adversely effect listed species. Additional approvals may be required if old growth mahogany in conflict. If possible flag and work around.
10	Ironshore (Dock)		unknown	Direct impact to Ironshore unlikely to adversely effect listed species.
Sea of Abaco (Proposed 150 ft Catwalk)				
11	Sand Flats	109 ft	dia. of piles	Marine BMP, turbidity curtains and relocate Stony coral (as required) if in conflict with construction
12	Patchy Sea Grass	30 ft	dia. of piles	Marine BMP, turbidity curtains and relocate Stony coral (as required) if in conflict with construction
13	Dense Turtle Grass	11 ft	dia. of piles	Operational SPCC Plan and marine monitoring. Area is genereally outside of the proposed construction of the 150 ft cat walk
Cultural Impacts				
14	Wilson City Artifacts		Unknown	Flag and identify any Wilson City artifacts exposed by construction and have preservationists available to make a determination.

Source: kes 2009

Table 11-1 Impacts Determination Summary

The impact of the construction utility easement is generally of limited concern. The following is a summary of unavoidable negative impacts and project benefits.

I. Land Use	Impact determination	Description
Be compatible with existing land use?	Potential Significant Beneficial Impact	The project ROW located in undeveloped Crown Land, consisting of Pine and Coppice Uplands. The generation of reliable power is of benefit to the people of Abaco
Be compatible with zoning and other land use requirements?	Potentially Significant Beneficial Impact	The proposed industrial land use is consistent with the development of Wilson City during the 1906-1916 lumber era and the subsequent sugar use between 1950 and 1970 in the site vicinity
Be compatible with environmental laws, regulations applicable to the project or required of the proponent?	Potentially Adverse Impact	It is BEC's policy and position to operate the facility in accordance with Bahamas environmental rules and regulations, with the goal of promoting and ensuring good environmental and ecological stewardship.
Include unique or unusual landforms in the immediate project area (project foot print)?	No Impact	No unique or unusual landforms are located within the project footprint. Not applicable to project
Include unique or unusual landforms in the immediate project area (surrounding area)?	No Impact	No unique or unusual landforms are located in project vicinity. Not applicable to project

II. Geology	Impact determination	Description
Include activities such as construction that will disturb the soil.eg. (excavation) ?	Potentially Adverse impact	Site clearing of trees in conflict with the project and trenching required is required. At the completion of improvements, the corridor will be graded.
Result in subsidence of the land	No Impact	Not anticipated.
Influence land slides or mud flows	No Impact	Site consists of Lucayan Limestone, generally considered to be hard and stable. Not applicable to project
Be located in a seismically active area	No Impact	No record of seismic activity in the area. Not applicable to project

Table 11-1 Impacts Determination Summary

III. Water Quality	Impact determination	Description
Alter the quality, amount, direction, or rate of flow of groundwater?	No Impact	No alteration to groundwater flow is anticipated by ROW project
Affect any municipal or private drinking water supplies?	No Impact	ROW project is located outside of the e Lake City-Marsh Harbour aquifer No impacts anticipated from ROW project
Alter the exposure of certain sensitive receptors to water pollutants?	Potentially Adverse Impact	Mangroves will be impacted during construction, but anticipated to recover following completion of ROW
Alter the drainage flow/patterns or absorption rates of surface water ?	Potentially Adverse Impact	The dock site will be graded, asphalted and landscaped. Surface flow regimes across the site will be altered. Storm water flow will be directed to onsite appurtenance via oil/water separators prior to discharge. The loss of drainage via infiltration will not impact areas or ecology adjacent to the site and site water management is beneficial to the project.
Occur within a floodplain?	No Impact	Not located in a flood plain, but as with all of the island, is susceptible to tropical storms
Result in discharge to surface water (both fresh and saltwater) and alter surface water quality	No Impact	No surface water discharges are proposed for the project.
Result in siltation to surface water (both freshwater and marine water areas)?	Potentially Adverse Impact	A potential for increase sedimentation is anticipated during the construction phase of the dock and pipeline. Both are anticipated to be of local significance and short duration. The impacts will be minimized by use of BMPs, during construction, incorporating the use of silt curtains, buoys, and sedimentation barriers.

Table 11-1 Impacts Determination Summary

IV. Biological Resources	Impact determination	Description
Affect globally, regionally, or locally rare plant or animal species of their habitats?	Potentially Adverse Impact	14-acres of upland habitat will be lost to the project. Tree removal as required by the project will be conducted with permit approval. Potential for Mahogany trees to be present and in conflict. Exotic and opportunistic flora along the pipeline ROW route and dock site will be removed.
Affect the overall biodiversity of the affected ecosystem(s)?	Potentially Adverse Impact	Little or no impact are anticipated to fauna e.g. birds, which are mobile and will relocate. Other animals (if any) will also relocate into the adjacent areas of undisturbed Crown Land and further south to the Abaco National Park
Affect coral reef communities?	Potentially Adverse Impact	Stony Corals were identified potentially in conflict with project and will require relocation. In addition, dock construction will result in impacts that are local and of short duration (if any).
Affect Mangroves?	Potentially Adverse Impact	During pipeline trenching and installation the use of silt curtains and sedimentation barriers is required of the BMP to reduce and/or eliminates potential impacts to the mangrove area that intercepts the pipeline route. One acre of mangroves directly impacted. Mangroves at Spencer's Bight to be protected by silt curtains
Affect sea grass beds ?	Potentially Adverse Impact	Sea grass was observed proximal to Wilson City dock. Use of BMP applicable. Impacts should be local and short duration (if any)
Affect dunes?	No Impact	Not applicable to project
Affect other sensitive coastal environments (e.g. parks, wildlife refuge, and marine sanctuaries)?	Potentially Adverse Impact	The proposed industrial use of the dock has raised concerns of impacts to the sensitive environments in the Sea of Abaco. These concerns are mitigated by implementation of EMPs and BMPs, for the power plant and the operation of commerce in accordance with Bahamas Maritime Authority mandates. The power needs of Abaco outweigh any potential local adverse impacts (if any). However, Significant Adverse Impact is a concern should a discharge occur adjacent to Pelican Cay National Park.
Affect freshwater, riparian, or other coastal wetlands (i.e. Non-mangrove areas, such as salt marshes)?	No Impact	No salt marshes present. Not applicable to project
Affect Upland habitats?	Potentially Adverse Impact	14-acres of pine and coppice habitat will be lost to the project. Caribbean Pine and Mahogany (if any) removal as required by the project will be conducted with permit approval.

Table 11-1 Impacts Determination Summary

Affect protected areas (e.g. Parks, wildlife refuges, marine sanctuaries)?	Potentially Adverse Impact	No impacts are anticipated to Abaco National Park located 23-miles to the south. No direct impact to Pelican Cays Land and Sea Park. However, it is acknowledged that commercial ships using North Bar Channel to enter the Sea of Abaco will traverse PSLSP
Affect fish, shellfish or other commercially important marine species?	Potentially Adverse Impact	It has been suggested that the industrial use of the dock to service the power plant, has the potential to impact the ecosystem in the Sea of Abaco. However, the offshore concerns are mitigated through the mandates of the Bahamas Maritime Authority.

V. Air Quality	**Impact determination**	**Description**
Alter the local air quality directly (e.g. from construction activities, or the nature of the project)?	Potentially Adverse Impact	Any potential impacts during construction or operation are mitigated by the remote location of the site and the distance from the closest potentially sensitive receptor.
Alter the local air quality indirectly (e.g. from an increase in cars, boats, parking lots)?	Potentially Adverse Impact	Fugitive emissions are anticipated during construction. These are anticipated to be localized and of short duration.
Alter the exposure level of certain sensitive receptors to air pollutants?	No Impact	No combustion associated with ROW. Not applicable to project

Table 11-1 Impacts Determination Summary

VI. Cultural Resources	Impact determination	Description
Disturb known archeological resources?	Potentially Significant Beneficial Impact	Construction of the new road will make the ruins at Wilson City accessible to cultural investigators and preservationist, and therefore a potential beneficial impact.
Likely disturb undiscovered archeological resources?	Potentially Significant Beneficial Impact	Construction of the new road will make the ruins at Wilson City accessible to cultural investigators and preservationist, and therefore a potential beneficial
Disturb historical resources and places of historical significance?	Potentially Significant Beneficial Impact	Construction of the new road will make the ruins at Wilson City accessible to cultural investigators and preservationist, and therefore a potential beneficial
Disturb religious resources and /or affect the current or future use of those resources?	No Impact	Not applicable to project.

VII. Energy	Impact determination	Description
Be consistent with existing energy conservation plans?	Potentially Significant Beneficial Impact	The Bahamas is a member of the Caribbean Renewable Energy program, which seeks to identify sustainable renewable energy resources, such as wind. However, the size of the Bahamian economy and its immediate needs dictates the reliance of oil fired electricity generation. Noting the high cost of fuel imports, efficiencies in fuel use are required by replacement of old generators and continued evaluation of alternative fuels
Involve renewable resources	No Impact	Not applicable to project
Involve non-renewable resources (e.g. mineral) that could be of future value to the region?	No Impact	Not applicable to project

Table 11-1 Impacts Determination Summary

VII. Socioeconomics	Impact determination	Description
Directly or indirectly result in increased population growth in the project vicinity?	Potentially Significant Beneficial Impact	New Road may promote additional recreational opportunities. Abutting and adjacent lands are crown lands and are undeveloped.
Affect unemployment/job availability?	Potentially Significant Beneficial Impact	Some short tem opportunities associated with construction of ROW and road improvements.
Directly or indirectly result in additional (i.e., non-project related) economic growth in the project vicinity)?	Potentially Significant Beneficial Impact	Potential indirect impact as an economic center might occur as local venders seek to service the power plant, based in part on its remote location, and the distance of Spring City and Marsh Harbour
Affect local housing availability?	No Impact	No housing developments are adjacent to the property. Not applicable to project
Displace or otherwise affect existing housing developments, especially involving minority and low-income communities?	No Impact	No housing developments are adjacent to the property. Not applicable to project
Impact public health and safety due to the intentional; or unintentional release of hazardous substances, flammable liquids, toxic pollutants, etc?	Potentially Adverse Impact	No impacts to public safety are anticipated. In the event of an unintentional release at the dock, spill containment protocols well be used and, emergency response contractors mobilized in the event of a catastrophic event.
Impact worker health and safety due to the intentional; or unintentional release of hazardous substances, flammable liquids, toxic pollutants, etc?	Potentially Adverse Impact	Worker occupational health & safety was not specifically addressed in this EIA. However, the construction vender will be required to have available and implement a Health & Safety Plan for construction.

Table 11-1 Impacts Determination Summary

IX. Community Service	Impact determination	Description
Affect availability of, or demand for, fire protection services?	Potentially Adverse Impact	In the case of a small fire, fire containment will be performed by onsite personnel, with the use of available extinguisher providing there is no risk of injury. In the event of an uncontrollable forest fire, the Marsh Harbour fire department is a volunteer force that would be severely stressed to manage a fuel-based fire.
Affect availability of, or demand for, police protection services?	No Impact	No demand for police protection services is anticipated. Not applicable to project
Affect availability of, or demand for, medical and health care services?	No Impact	The demand for medical services will be no greater that that currently required for Marsh Harbour power station. Not applicable to project
Affect availability of, or demand for, public water services, including municipal wastewater supplies and storm water drainage	No Impact	All water use and disposal systems will be located onsite and are purpose built to satisfy the needs of the project. No demands or access to public systems is required or anticipated. Not applicable to project
Affect availability of, or demand for, public waste water services	No Impact	All water use and disposal systems will be located onsite and are purpose built to satisfy the needs of the project. No demands or access to public systems is required or anticipated. Not applicable to project
Affect availability of, or demand for, schools and related educational support services?	No Impact	Not applicable to project
Affect availability of, or demand for, communication systems?	No Impact	Not applicable to project
Affect availability of, or demand for, power	Potential Significant Beneficial Impact	The objective of the ROW project is to provide fuel to the plant which will generated reliable and affordable electricity to support the needs and economy of the Abacos
Affect availability of, or demand for, solid waste disposal services	No Impact	GC will be responsible for properly managing all waste streams during construction

Table 11-1 Impacts Determination Summary

X. Aesthetics	Impact determination	Description
Result in objectionable odors to surrounding areas?	Potentially Adverse Impact	The transmission of heavy fuel oil will result in a potentially objectionable odor at the dock However, the closest sensitive receptor is more that eight miles from the site, and no impacts are anticipated at Spring City
Affect local noise standards (or existing conditions)?	Potentially Adverse Impact	Based upon the remoteness of the site, any potential noise exceedance beyond the sites property line is mitigated by the distance of the closest sensitive receptor
Affect scenic views?	No Impact	The ROW at completion will be grade and camouflaged by vegetation. At completion the dock will be observable from the Sea of Abaco
Create light or glare?	No Impact	Low-level security lighting at night anticipated.

XI. Recreation	Impact determination	Description
Affect the quality of land –based recreational opportunities?	Potentially Significant Beneficial Impact	Proposed improvements to Wilson City Road, and construction of the dock, will increase the potential for land based recreational opportunities, provides access to the Wilson City cultural resource and beaches
Affect the quality of water–based recreational opportunities?	Potentially Significant Beneficial Impact	Proposed improvements to Wilson City Road, and construction of the dock, will increase the potential for water based recreational opportunities, who access the water from the bays proximal to the dock
Increase the demand for recreational facilities or opportunities?	No Impact	Not applicable to project
Affect the quantity or quality of open space?	Potentially Adverse Impact	Loss of 14 acres of upland is an unavoidable consequence of the project. However, the removal of this land, will not impact the quality of the remaining crown lands or the land protected by Abaco National Park

Table 11-1 Impacts Determination Summary

XII. Transportation	Impact determination	Description
Affect the local roadway infrastructure directly or indirectly (i.e. congestion/quality)?	Potentially Beneficial Impact	Some increase in local traffic use should be anticipated as a direct consequence of the project.
Affect the local waterway infrastructure directly or indirectly (i.e. congestion/quality)?	Potentially Significant Beneficial Impact	The frequency of commercial docking use is anticipated to be no more than three times per week, subsequent to the completion of the plant. And no greater than existing commercial shipping providers servicing the vicinity settlements and cays.
Alter emergency access to the project area and surrounding areas (i.e. during natural disaster events)?	Potentially Significant Beneficial Impact	In the event of a natural disaster, construction of the dock may make the facility indispensable for disaster relief efforts.
Create hazards for pedestrians, bicyclist, commercial boats, pleasure craft etc.?	Potentially Adverse Impact	No terrestrial hazards are anticipated, although concern has been raised with respect to pleasure craft and commercial shipping. The dictates of the Bahamas Maritime Authority, which include mandates designed to reduce the potential for collision, will mitigate offshore concerns.
Affect the likelihood of transportation accidents, including oil spills, highway collisions?	Potentially Significant Beneficial Impact	The benefit of the fuel pipeline will eliminate the potential for overland transportation accidents and spills, and highway collisions.

Source: KES 2009

DEFINITIONS

Potentially significant Beneficial impact – Indicates that there is substantial evidence that an effect is significant and beneficial
Potentially Beneficial impact – Indicates that there is evidence that an effect is beneficial, but the evidence is not substantial and/or the beneficial impact is not significant
No Impact – Indicates that the impact does not apply to the project
Potentially Adverse Impact – Indicates that there is evidence that an effect is adverse, but the evidence is not substantial and /or the adverse impact is not significant.
Potentially significant Adverse impact – Indicates that there is substantial evidence that an effect is significant and adverse