FINAL REPORT

Environmental Impact Assessment

Palmyra Resort and Spa

Rose Hall, St. James

Submitted to:

Palmyra Properties Ltd.
Rose Hall
St. James

Prepared by:

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EXECUTIVE SUMMARY

This document constitutes the Final Environmental Impact Assessment Report for the Palmyra Resort and Spa.

Rose Hall Developments Ltd. has been engaged in phased development of the coastal and landward component of the historic Rose Hall Estate since the 1960s, in keeping with an agreement with the Government of Jamaica.

This development is guided by a Conceptual Master Plan and has included sale of land to other developers, as well as specific development by Rose Hall including Spring Farm (housing) Estate, Holiday Inn Hotel, restoration of the Rose Hall Great House, The Palms (condominium), Wyndham Hotel and the Wyndham Golf Course, Rose Hall Beach Club, The Highlands (housing) Estate, Ritz Carlton Rose Hall Hotel, the eighteen hole White Witch international golf course, and most recently (2004) the construction of the Iberostar Rose Hall Resort and Spa.

The Palmyra Resort and Spa will be constructed in 3 phases:

Phase I

Phase I includes 2 condominium hotel buildings, 11 villas, the health spa and the gate house building. The number of units is 211 and the total number of rooms is 556.

Phase II

Phase II includes 2 condominium hotel buildings, 10 villas, the check in building and the clubhouse facility. The number of units is 306 and the total number of rooms is 780.

Phase III

Phase III includes 1 condominium hotel building, 4 villas, and the restaurant on the beach. The number of units is 112 and the total number of rooms is 280.

A comprehensive drainage plan has been prepared for the Palmyra Resort & Spa. This plan has been submitted to, and approved by the National Works Agency (NWA). The Drainage Layout General Arrangement Plan (C-01-2307) and the Sanitary Sewer Schematic Layout (P-1) are enclosed in the back pocket of this report.

This drainage plan will handle the drainage on the property ("internal" drainage). Drainage from the watershed area south of the development is not the responsibility of the developer ("external" drainage). However, the Northern Coastal Highway Improvement Programme will be increasing the capacity of the drains under their project. This improved capacity will be designed for a 25 year event.

Rose Hall Utility Co. Ltd. applied for and received a licence to construct and operate a sewage treatment facility in Rose Hall. A licence for this facility was granted by NEPA in 2004.

The irrigation system will utilize effluent discharge from the plant. Nursery Lake is a man-made reservoir located 5,500

feet south of the highway at an elevation of 455 feet. It has a storage capacity of 33 million gallons. Stable Lake, also to be constructed at 3,000 feet south of the highway and 165 feet above seal level will have a storage capacity of 25 million gallons.

ESL was contracted by Palmyra Properties Ltd. to conduct the EIA for submission to NEPA. A Permit Application and Project Information Form were submitted to NEPA on March 31, 2005.

In a letter from NEPA (May 6, 2005), NEPA requested that the scope of the EIA be confined to the following areas:

1. Drainage related impacts.
2. Impacts associated with the disposal of sewage – considering the effects of item 1.
3. Impacts associated with the development of shoreline modification works.
4. Construction, solid and human waste related impacts.

Methodology

Information was gathered on the existing physical environment, particularly as related to geology, topography, soils, drainage, water quality, air quality and noise.

The status of the flora and fauna of the study area was determined by a review of literature relevant to the area and field investigations for both the terrestrial and marine environments.

The marine environment for the coastal strip from the Ritz Carlton to the Wyndham was investigated by SCUBA diving and snorkelling along the coastline, in the offshore lagoon, in the back reef area and in the fore reef zone. This was done for the Strategic Environmental Assessment in April 2004. A qualitative assessment of area was conducted to provide a species list and an abundance (DAFOR) rating for each species.

A detailed survey of the proposed coastal engineering was commissioned separately and completed by Smith Warner International.

Rapid field appraisal techniques in conjunction with desk research were employed to investigations of the socio economic considerations within the project area, *viz*:

- population and settlement characteristics
- land uses and livelihoods
- developments underway
- water supply and other utilities
- waste management practices
- recreational activities

The Existing Environment

The climate of the study area is subtropical and typical of the island of Jamaica where the climatic conditions are largely determined by the north east trade winds and localised orographic features. Rainfall is the dominant climatic

parameter that in turn influences variations in temperature, humidity and evaporation. The major synoptic scale weather systems affecting the island are upper level troughs, cold fronts and tropical systems. Upper level troughs occur throughout the year but occur more frequently during the winter months.

Cold fronts typically affect the island between December to April and result from low pressure systems that form over the south-eastern USA. These cold fronts frequently become stationary over the north coast of Jamaica producing intense rainfall that can last for several days. Tropical systems including tropical waves, storm and hurricanes develop between June and November each year in the north Atlantis tropical cyclone basin. These systems traverse the Caribbean basin from east to west bringing with them high velocity winds, intense rainfall and storm surge.

The proposed site is located on a flat coastal strip extending from the limestone foothills in the south to the coastline. Figure 4.1.2 a. The property for the proposed project lies north of the east-west oriented main road. The land surface is relatively flat with a gentle slope of about 1:40 towards the sea as shown in the topographic survey Map 1 (back pocket).

The site is covered with soil and there are no rock outcrops. Geotechnical evaluations carried out by Qore Inc. (Appendix V), included the drilling of 18 boreholes for sample collection, subsurface soil and rock evaluation. Soils observed on the surface were classified as tan and brown silty clays with various sized limestone fragments. These soils are residual

soils formed by the in situ weathering of the underlying limestone rocks. The thickness of the soil varied between 8 to 21 feet with a sharp transition between the soil and the limestone bedrock.

The project site is exposed to the natural hazards associated with flooding, hurricanes, and earthquakes. Flooding from stormwater runoff and ponding due to high intensity and long duration rainfall can be a major problem along the north coast road and adjacent properties. Hurricane related hazards consist of high velocity winds, flooding from intense rainfall, and coastal flooding and erosion from storm surge. Earthquakes hazards include the effects of ground shaking and to a lesser extent coastal flooding from tsunami.

The results of the baseline sampling exercise for the SEA conducted in April 2004, showed that the water at all the stations sampled was well oxygenated with low bacterial levels. Phosphate levels were variable. High phosphate levels were recorded at the mouth of the Boyce Gully and Little River, significantly exceeding the National Environment and Planning Agency's (NEPA) interim ambient marine water quality standard. Lower levels were measured at the other three stations. Nitrate, biochemical oxygen demand and total suspended solids were high at all stations sampled.

Respirable particulates levels are at or above the recommended ambient air quality PM10 guidelines established by NEPA. The sampling stations are generally quite windy as indicated by the wind data. The stations are also subject to a significant amount of fugitive dust from the

roadway, vacant lot and coastal zone in their immediate vicinity.

The noise levels recorded at three of the stations monitored are currently above the NEPA guideline for perimeter noise. This noise would be from ambient sources including vehicular traffic on the main road, high velocity winds and ocean waves. Only one station has noise levels within the standard.

Storm surge analyses have been conducted for the Rose Hall Palmyra Development, by Smith Warner International Ltd. (SWIL), to ascertain water levels resulting from storm events. Storm surge resulting form a hurricane is an increase in ocean level due to a combination of:

Direct wind-driven water (wind setup),

Potential energy due to wave breaking (wave setup), and

Uplift induced by atmospheric pressure drop (inverse barometric pressure rise).

Based on the SWIL report the Mines and Geology Division (MGD) recorded a maximum storm surge height of 2.5m and a maximum inland surge distance of 138 metres during the passage of Hurricane Allen.

The storm surge from the simulations conducted (taking into consideration wave run-up) suggests inundation reaching as high as 4.2 metres above MSL and a set-back of 30 metres. The inundation level is higher than that recorded by MGD, however, the

inland distance is substantially lower than 138m measured by the MGD during Allen in 1981.

The marine area extending from the Wyndham Rose Hall Hotel to the Half Moon Hotel is quite uniform in its physical and biological characteristics. A fringing reef extends throughout the area, and is part of the north coast fringing reef system. It may be divided into two distinct areas – the back reef zone and the fore reef zone. These areas are not separated by an emergent reef crest; the back reef area slopes gently into the fore reef zone. The back reef zone is within 100 m of the shore, and is quite shallow.

The back reef is characterized by shallow (1.5 to 4 m), flat or gently sloping pavement covered by a thin layer of sand. Closer to shore the pavement is covered by a deeper layer of sand which merges with the beach. The sand in the back reef zone is white and of fine to medium grain, and covers approximately 50% of the substrate. The sand appears to contain fine limestone sediments carried by run-off water from further inland.

The Palmyra Resort and Spa site sits between the Wyndham Rose Hall and the Ritz Carlton. A long stretch of coastal flatlands lie to the west of Rose Hall Beach Club extending to Sea Castles condominium and Success Beach, the eastern boundary of the Rose Hall Master Plan site. On the landward side across the main road and to the east lies the sprawling community of Lilliput and Barrett Hall further east. Barrett town lies inland from Success, and could be considered part of the sphere of influence of the project.

The project is located within the larger regional setting of Rose Hall Developments and the Greater Montego Bay Area. Rose Hall Developments has been described above in Chapter 1, and it is important to reiterate that the development sits amidst significant

tourism development extending from Montego Bay through Falmouth and ultimately Ocho Rios. As indicated in Section 1.2 of this report conversion of the estate lands to urban/resort/residential uses has been occurring since the late 1960s when the Rose Hall Great House was restored as a major tourism attraction.

The 2001 Census indicated a population of 174,120 for the parish of St James, and 55% (or 95,940 persons) is located in Montego Bay and its immediate environs (referred to collectively as the Montego Bay Special Area). The population of the GMBA was estimated at 98,000 in 1995 with an annual growth rate of 2.5%. About 80,000 workers are estimated to commute and work within the GMBA on a daily basis, and population numbers rise with the introduction of cruise ship and stop-over visitors. Unemployment rates in the GMBA is estimated at 17% with 65% of current economic activity consisting of family type businesses.

Potential impacts and mitigation measures have been identified for several aspects related to the physical, biological and social environments, in both the construction and operation phases.

Based on the issues identified by NEPA in their letter of May 6, special emphasis was given to drainage, sewage, and coastal works.

Erosion mitigation with respect to proximity of the development site to coastal/marine environment and reefs is the major consideration for coastal works. Consideration must be given to drainage of the site through percolation, overland flow, and existing natural drainage channels paying particular attention to the cumulative impact of increased storm water runoff from the site. The drainage plan which has been approved by the NWA will be implemented, and should prevent flooding on the site. Drainage to the property

from the southern watershed area should be improved with the implementation of the NCHiP drainage plan for this area and maintenance of drains.

The drainage plan for the property is designed to prevent flooding on the property. This is an aspect of "internal" drainage, (internal to the property boundaries). However, what is likely to impact the project is "external" drainage from the watershed area south of the road, beyond the property boundaries, based on recent rainfall events which resulted in the flooding of the Ritz Carlton Hotel, immediately to the west of the Palmyra property.

The back reef area is quite shallow, with numerous protruding patch reefs. These are very close to the water's surface and may be hazardous to water sports activities. The area must be properly marked before these activities are offered.

A report on the proposed beach improvement works by Smith Warner International (May 2005, Appendix 1) identifies three main areas of potential impact:

1. Sediment transport

2. Wave processes

3. Water quality and circulation

Palmyra Resort and Spa will not be releasing treated or untreated sewage effluent to the coastal waters. No negative impacts are expected from sewage generation. The Palmyra will be connected to the new sewage treatment plant constructed by Rose Hall Utility Ltd. and approved and

licenced by NEPA. The facility includes storage ponds, and re-use for irrigation. Due to the elevation of the site and the capacity of the ponds, flooding is not anticipated.

The project will have direct access to the main north coast artery from Montego Bay to Ocho Rios. Traffic management will require dialogue with the National Works Agency (NWA) and the project managers of NCHIP Segment 2, to facilitate safe intersection and merging of traffic in the vicinity of the project.

Discussions have already been held with the NWA regarding entrance / exit and the provision of two traffic signals.

Consideration of Alternatives

The land purchased by Palmyra Properties Ltd. For development of the Palmyra Resort and Spa was earmarked for hotel condominium development as part of the mandate of the agreement between the Government of Jamaica and Rose Hall Ltd.

Discussions with the developers indicate that no other alternatives in design were considered.

However, based on a letter from NEPA (Appendix V) three issues were highlighted as being of key concern. These were:

1) The number of habitable rooms per acre

2) The setback

3) The height of the buildings

The setback as recommended by the oceanographic engineers and the Town and Country Planning Authority has been incorporated in the design. The design now stands at 30 m, and the original setback of 15 m is no longer being considered.

The number of habitable rooms per acre has been reviewed in the context of the entire master plan and this has been shared with NEPA at a presentation to the Technical Review Committee meeting of April 26, 2005.

The density of the Palmyra Resort and Spa within its legal boundary is 100 habitable rooms per acre, the overall density of the northern estate neighborhood is 41 habitable rooms/acre, while the overall master plan residential density is 11habitable rooms / acre. (Cosmo Whyte Architect Ltd., 2005) (Table 1.2.1)

Based on the information received from Cosmo Whyte Architect Ltd. (2005), the Palmyra is to be built in 3 phases, in 5 blocks, ranging in height from 12 to 16 floors. The blocks are spaced on the site so as to afford views between the towers, from the public road.

The Palmyra is conceived as a major visual focal point around which the visual sequence of the Rose Hall urban experience is to be referenced.

The EIA Report also includes Environment Quality Objectives (EQO's) which seeks to guide the developer in said management techniques.

CHAPTER 1: INTRODUCTION

1.1 PURPOSE

This document presents the findings of the Environmental Impact Assessment (EIA) conducted for development of the proposed **Palmyra Resort and Spa**. The Palmyra Resort and Spa will be built at Rose Hall, St. James on the north coast of Jamaica (Figure 1.1).

The EIA report will form part of the documentary evidence in support of a permit application for to the National Environment and Planning Agency **(NEPA)**, which is the environmental regulatory authority of the Government of Jamaica.

1.2 BACKGROUND

Rose Hall Developments Ltd has been engaged in phased development of the coastal and landward component of the historic Rose Hall Estate since the 1960s, in keeping with an agreement with the Government of Jamaica.

This development is guided by a Conceptual Master Plan (Figure 1.2), and has included sale of land to other developers, as well as specific development by Rose Hall including Spring Farm (housing) Estate, Holiday Inn Hotel, restoration of the Rose Hall Great House, The Palms (condominium), Wyndham Hotel and the Wyndham Golf Course, Rose Hall Beach Club, The Highlands (housing) Estate, Ritz Carlton Rose Hall Hotel, the eighteen hole White Witch international golf course, and most recently

(2004) the construction of the Iberostar Rose Hall Resort and Spa.

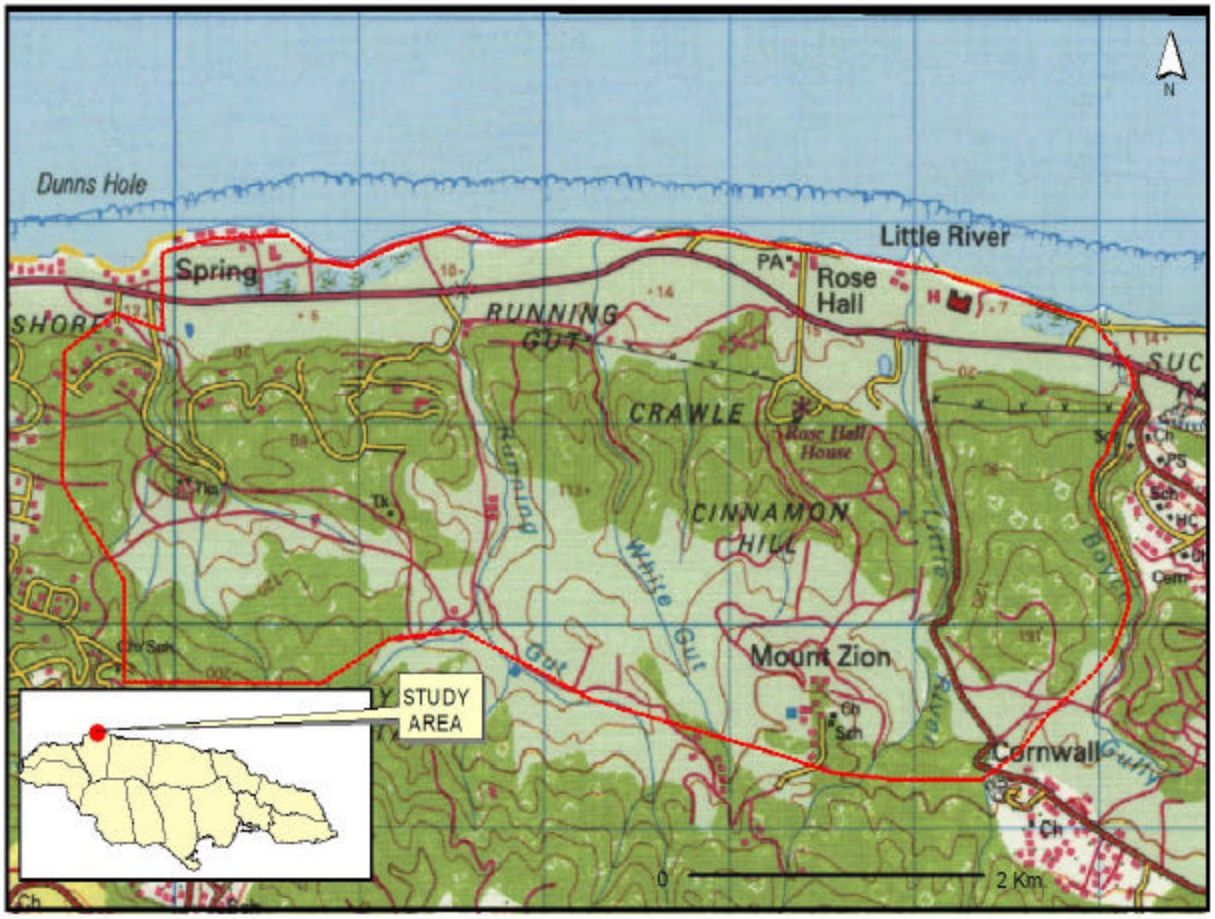


Figure 1.1 Location of project area.

1.2.1 The Master Plan

The Master Plan covers an area of 418.4 hectares (1034 acres) and includes the following resort, residential, commercial, infrastructural and forest reserve components as shown in Figure 1.2.1 and detailed in Table 1.2.1.

Resort:

Holiday Inn Sun spree hotel, Ritz Carlton Hotel, Wyndham Rose Hall Hotel, Sea Castles hotel, Iberostar Hotel, White Witch International Golf Course, Cinnamon Hill Golf Course, and other proposed hotel sites including the proposed Palmyra Spa and Apartment Hotel.

Residential:

Exclusive residential compounds (some completed, some under construction and some planned), apartments and town houses and residential communities.

Figure 1.2.1: Conceptual master Plan

Attachment 1

Table 1.2.1: ROSE HALL MASTER PLAN LAND USE

Source: Cosmo Whyte Architect Ltd., 2005

SECTION	ZONE	USE	SIZE PARCEL Hectares (Acres)	PERCENTAGE	DENSITY HABITABLE ROOMS/ACRE	YIELD (Habitable ROOMS)
A, B, C	COMMERCIAL/ RESIDENTIAL	Shopping Hotels Apartments Villas Recreational Club	27.5 (68.00)	6.5%	RANGE 100 habitable rooms/acre 50 habitable rooms/acre 30 habitable rooms/ acre Footprint-33.5-40%	2800
E	RESIDENTIAL	Apartments	11.1 (27.42)	3%	30 rooms/acre	822
W	COMMERCIAL	White Witch Golf Course	78.2 (193.23)	18.6%		
F	COMMERCIAL	National Conference Centre	14.1 (34.84)	3.3%		
I,K,J,H,G,L,M,N,O, P,Q,R,S,T,U,V	RESIDENTIAL	Villa Developments	128.5 (317.53)	3.3%		
Three Palms	COMMERCIAL	Three Palms Beach Golf Course	40.5 (100.07)	9.6%		
Great House	COMMERCIAL	Attraction	5.5 (13.59)	1%		
		SUB TOTAL	**305.4 (754.66)**		**Overall Master Plan Density 11 habitable rooms/acre**	**8385**
	FOREST (not included in any zones))	Nature Park	113.0 (279.22)	27%		
		TOTAL	**418.4 (1033.88)**			

Attachment 2

ROSE HALL MASTER PLAN - LAND USE
SECTION A, B, C-NORTHERN ESTATE

SECTION	ZONE	USE	SIZE HECTARES (ACRES)	% OF MASTER PLAN	YIELD	PROPOSED DENSITY	COMMENTS YIELD
(A) LOTS 16-18	RESIDENTIAL	Apartments Hotel The Palmyra Resort & Spa	6.56 ha (16.46)		629 units 1624 habitable rooms	100 habitable rooms/acre	629 Apt. units yielding 1624 habitable rooms Footprints 37% of Plot Area Ratio 1.96
(B) LOT 15	RESIDENTIAL RECREATIONAL	Recreational Beach & Apartments	(4.50 acres)		136 habitable rooms	30 habitable rooms/acre Footprints-33 1/3%	Beach clubs-1storey building Apartment units- 2 storey buildings
(C) LOTS 5-14	RESIDENTIAL	Townhouses Apartments	4.31 ha (10.67)		540 habitable rooms	50 habitable rooms/acre	Town house and apartment units 2&3 storey buildings (low rise)
(C) LOTS 3 & 4	HOTEL	Hotel	6.19 ha (15.32)		500 rooms	30 rooms/acre	500 room hotel 14,11 & 4 storey buildings
(C) LOT 1 LOT 2	COMMERICAL COMMERICAL		0.59 ha (1.48 acres) 2.03 ha (5.03 acres)				77, 000 sq. ft. of floor space
NET AREA			21.63 ha (53.46)				
GROSS AREA	A, B, C		27.49 ha (67.95 acres)	6.5%			
			TOTAL		2800 **habitable** rooms		**Neighbourhood density** **41 habitable rooms/ acre**

Commercial:

Shopping Mall, Recreational Beach Club National Conference Centre and community facilities including schools, post office and shops).

Infrastructure:

Rose Hall Developments Ltd. has applied for and received an Environmental Permit and user License to construct and operate a central sewage system for the entire area. The North Coast Highway currently under construction is expected to facilitate travel to the area.

Forest Reserve:

A Nature Park is planned for 13 ha (279.2 acres).

A Strategic Environmental Assessment of the Master Plan was conducted in 2004 (Environmental Solutions Ltd., 2004 a), to guide the development and ensure sound environmental management practices were implemented.

1.3 Description of the Project

The Palmyra Resort and Spa, will be developed on 16 hectares (39.52 acres) of land, currently labelled as Parcels A1 and A2 on the Master Plan at Rose Hall or Lots 16-18.

The property is situated between the Ritz Carlton Hotel (to the west) and the Palms to the east).

1.3.1 Project Components

The developers have produced a conceptual design for the site which includes a multi-building design to operate as hotel condominiums. The major components of the development, as shown in Figure 1.3, include the following:

- ✓ Three eleven floor buildings
- ✓ Two 16-floor buildings
- ✓ 500 units (1- and 2- bedrooms; 3 bedroom penthouse in each building)
- ✓ Spa
- ✓ Restaurant and Bars
- ✓ Resort Infrastructure
- ✓ Beach enhancement

The project comprises a total of 35 buildings, with 5 buildings containing condominium and hotel units, 4 buildings housing a health spa, a check in building, club facilities and a restaurant on the beach, 1 gate house and 25 three bedroom villas.

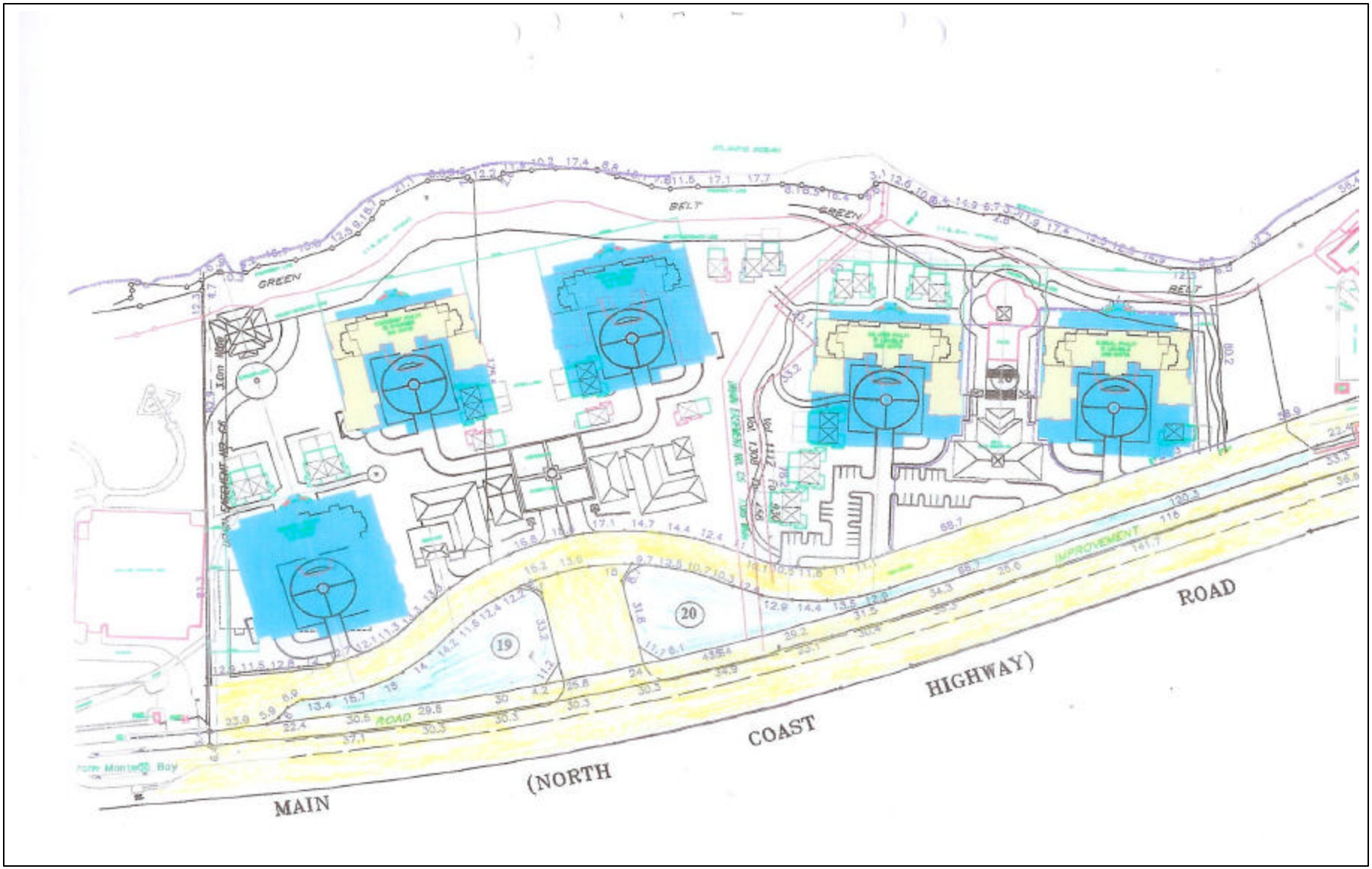


Figure 1.3: Palmyra Resort Conceptual Layout

1.3.2 Phasing of the Project

The projected number of units in the overall project is 629 and the total number of rooms is 1616. The Palmyra is to be buil3 in three phases, in five blocks, ranging in height from 13 t 16 floors. The blocks will be spaced on the site so s to afford views between the towers, from the public road. The unit and room count per phase is as follows:

Phase I

Phase I includes 2 condominium hotel buildings, 11 villas, the health spa and the gate house building. The number of units is 211 and the total number of rooms is 556.

Phase II

Phase II includes 2 condominium hotel buildings, 10 villas, the check in building and the clubhouse facility. The number of units is 306 and the total number of rooms is 780.

Phase III

Phase III includes 1 condominium hotel building, 4 villas, and the restaurant on the beach. The number of units is 112 and the total number of rooms is 280.

It is anticipated that the development will be linked to the central sewage treatment facility that has been designed, and approved for installation, to serve the resort facilities

in the Rose Hall area. Water will be supplied by N.W.C. and by Rose Hall Developments Ltd.

1.3.3 Drainage

A comprehensive drainage plan has been prepared for the Palmyra Resort & Spa. This plan has been submitted to and approved by the National Works Agency (NWA). The Drainage Layout General Arrangement Plan (C-01-2307) and the Sanitary Sewer Schematic Layout (P-1) are enclosed in the back pocket of this report.

This drainage plan will handle the drainage on the property ("internal" drainage). Drainage from the watershed area south of the development is not the responsibility of the developer ("external" drainage). However, the Northern Coastal Highway Improvement Project will be significantly increasing the capacity of the drains under their project. This improved capacity may be designed to accommodate a 25 year event.

An engineering report on surface water drainage has been prepared by N. O. White & Associates Ltd. (May 2005) on behalf of Palmyra Resort and Spa. These issues have all been considered and details are given in Appendix VIII.

1.3.4 Sewage Treatment

Rose Hall Utility Co. Ltd. applied for and received a licence to construct and operate a sewage treatment facility in Rose Hall. A licence for this facility was granted by NEPA in 2004.

A preliminary engineering report was prepared, and used as the basis for the submission of the application. The engineering report described the three major components of the total system: Wastewater Collection, Treatment and Irrigation Distribution Systems. The preliminary engineering report is given in Appendix IV.

The irrigation system will utilize effluent discharge from the plant. Nursery Lake is a man-made reservoir located 5,500 feet south of the highway at an elevation of 455 feet. It has a storage capacity of 33 million gallons. Stable Lake, also to be constructed at 3,000 feet south of the highway and 165 feet above seal level will have a storage capacity of 25 million gallons.

Palmyra Resort & Spa will be connected to the sewage treatment facility and will not be discharging treated or untreated sewage effluent to the coastal waters.

1.4 TERMS OF REFERENCE

The EIA documents the existing environmental conditions at the proposed site and its environs including physical, biological and socio-economic aspects. The TORs are based on the generic guidelines for **Recreational and Leisure Facilities** as established by the National Environment and Planning Agency, and are given below.

However, in a letter from NEPA (May 6, 2005), NEPA requested that the scope of the EIA be confined to the following areas:

5. Drainage related impacts.
6. Impacts associated with the disposal of sewage – considering the effects of item 1.
7. Impacts associated with the development of shoreline modification works.
8. Construction, solid and human waste related impacts.

NEPA GENERIC TERMS OF REFERENCE

In reality, significant environmental issues may be site specific and it is expected that these be incorporated accordingly. Sites of special consideration are:

Coastal Areas: Issues such as Coastline stability, coral reef, mangrove and wetland, seagrass impacts, unique coastal environments, nutrient loading in coastal waters and impact on coastal commercial fishing should be examined.

Upland Areas: Issues such as slope stability, available public transportation, access to basic amenities such as potable water and electricity, impact of drainage from the site on pre existing drainage patterns etc. should be examined.

Distinct Terrestrial Forest Types: Issues relating to the specific growth form of the vegetation, the carrying capacity, the successional stage of the forest and the projected level of disturbance which the forest can withstand.

Sites located within and adjacent to areas listed as protected or having protected species: The main issue(s) of concern are determined by the statutes of the convention in question and what the convention speaks to. The impact of the development on the specific sensitivities of the protected area should be highlighted. Mitigation of impacts should assess if the post mitigation status would be acceptable in the protected area context. Alternative sites should be rigorously evaluated.

An issue of priority for golf courses is the contamination of sediment and adjacent water bodies via fertilizers and colour sprays/dyes to maintain the green. Special consideration of the type of fertilizer and the frequency of use is needed. Also as far as is possible full irrigation (using recycled water) of the course should be implemented to reduce the use of sprays and dyes.

Theme parks are generally designed to blend with their environment. However there are special issues which need

to be reviewed; the biology of species to be introduced (for landscaping or as attractions), the need for a paved area and the impacts on loss of habitat, change in the immediate temperature of the environs and change in drainage pattern and percolation.

The Environmental Impact Assessment should:

1) Provide a complete description of the existing site proposed for development. Detail the elements of the development, highlighting areas to be reserved for construction and the areas which are to be preserved in their existing state.
2) Identify the major environmental issues of concern through the presentation of baseline data which should include social and cultural considerations. Assess public perception of the proposed development.
3) Outline the Legislation and Regulations relevant to the project.
4) Predict the likely impacts of the development on the described environment, including direct, indirect and cumulative impacts, and indicate their relative importance to the design of the development's facilities.
5) Identify mitigation action to be taken to minimise adverse impacts and quantify associated costs.
6) Design a Monitoring Plan which should ensure that the mitigation plan is adhered to.
7) Describe the alternatives to the project that could be considered at that site

To ensure that a thorough Environmental Impact Assessment is carried out, it is expected that the following tasks be undertaken:

Task #1. Description of the Project

Provide a comprehensive description of the project, noting areas to be reserved for construction and landscaping, areas to be preserved in their existing state as well as activities and features which will introduce risks or generate impact (negative and positive) on the environment. This should involve the use of maps, site plans, aerial photographs and other graphic aids and images, as appropriate, and include information on location, general layout and size, as well as pre-construction, construction, and post construction plans. For projects to be done on a phased basis it is expected that all phases be clearly defined, the relevant time schedules provided and phased maps, diagrams and appropriate visual aids be included.

Task #2. Description of the Environment

This task involves the generation of baseline data which is used to describe the study area as follows:

i) physical environment
ii) biological environment
iii) socio-economic and cultural constraints.

It is expected that methodologies employed to obtain baseline and other data be clearly detailed.

Baseline data should include:

(A) Physical

i) a detailed description of the existing **geology** and **hydrology.** Special emphasis should be placed on storm water run-off, drainage patterns, effect on groundwater and availability of potable water. Any slope stability issues that could arise should be thoroughly explored.

ii) **Water quality** of any existing wells, rivers, ponds, streams or coastal waters in the vicinity of the development. Quality Indicators should include but not necessarily be limited to nitrates, phosphates, faecal coliform, and suspended solids. The potential for pollution and/or contamination of sediment due to the lavish use of fertilisers in golf courses should be evaluated.

iii) Climatic conditions and air quality in the area of influence including particulate emissions from stationary or mobile sources, NO_x, SO_x, wind speed and direction, precipitation, relative humidity and ambient temperatures,

iv) Noise levels of undeveloped site and the ambient noise in the area of influence.

v) Obvious sources of pollution existing and extent of contamination.

vi) Availability of solid waste management facilities.

(B) Biological

Present a detailed description of the flora and fauna (terrestrial and aquatic) of the area, with special emphasis on rare, endemic, protected or endangered species. Migratory species should also be considered. There may be

the need to incorporate micro-organisms to obtain an accurate baseline assessment. Generally, species dependence, niche specificity, community structure and diversity ought to be considered.

(C) Socio-economic & Cultural

Present and projected population; present and proposed land use; planned development activities, issues relating to squatting and relocation, community structure, employment, distribution of income, goods and services; recreation; public health and safety; cultural peculiarities, aspirations and attitudes should be explored. The historical importance of the area should also be examined. While this analysis is being conducted, it is expected that an assessment of public perception of the proposed development be conducted. This assessment may vary with community structure and may take multiple forms such as public meetings or questionnaires.

Task #3 - Legislative and Regulatory Considerations

Outline the pertinent regulations and standards governing environmental quality, safety and health, protection of sensitive areas, protection of endangered species, siting and land use control at the national and local levels. The examination of the legislation should include at minimum, The investigation of Palmyra' proposed main beach marine environment was done by snorkeling. Eight (8) transect stations were selected in the back reef area of the coastal region (within the projected area of the groyne to be constructed). These transects were selected pertaining to the man made groyne proposed to be constructed to protect

the crest to the new beach. Underwater photographs were taken along these line transects.

Legislation such as the NRCA Act, the Wildlife Protection Act, the Town and Country Planning Act, legislation and policies from the Forestry Department, Building Codes and Standards, Development Orders and Plans and the appropriate international convention/protocol/treaty where applicable.

Task #4 - Identification of Potential Impacts

Identify the major environmental and public health issues of concern and indicate their relative importance to the design of the subdivision. Identify potential impacts as they relate to, (but are not restricted by) the following:

- change in drainage pattern
- flooding potential
- landscape impacts of excavation and construction
- loss of natural features, habitats and species by construction and operation
- pollution of potable, coastal, surface and ground water
- Air pollution
- capacity and design parameters of proposed sewage treatment facility.
- socio-economic and cultural impacts.
- risk assessment
- noise

Distinguish between significant positive and negative impacts, direct and indirect, long term and immediate impacts. Identify avoidable as well as irreversible impacts. Characterize the extent and quality of the available data, explaining significant information deficiencies and any uncertainties associated with the predictions of impacts. A major environmental issue is determined after examining the impact (positive and negative) on the environment and having the negative impact significantly outweigh the positive. It is also determined by the number and magnitude of mitigation strategies which need to be employed to reduce the risk(s) introduced to the environment. Project activities and impacts should be represented in matrix form with separate matrices for pre and post mitigation scenarios.

Task #5 Mitigation

Prepare guidelines for avoiding, as far as possible, any adverse impacts due to proposed usage of the site and utilising of existing environmental attributes for optimum development. Quantify and assign financial and economic values to mitigation methods.

Task #6 - Monitoring

Design a plan to monitor implementation of mitigatory or compensatory measures and project impacts during construction and operation of the facility. An Environmental Management Plan for the long term operations of the site should also be prepared.

An outline monitoring programme should be included in the EIA, and a detailed version submitted to NEPA for approval

after the granting of the permit and prior to the commencement of the development. At the minimum the monitoring programme and report should include:

- Introduction outlining the need for a monitoring programme and the relevant specific provisions of the permit license(s) granted.
- The activity being monitored and the parameters chosen to effectively carry out the exercise.
- The methodology to be employed and the frequency of monitoring.
- The sites being monitored. These may in instances, be pre-determined by the local authority and should incorporate a control site where no impact from the development is expected.
- Frequency of reporting to NEPA

The Monitoring report should also include, at minimum:

- Raw data collected. Tables and graphs are to be used where appropriate
- Discussion of results with respect to the development in progress, highlighting any parameter(s) which exceeds the expected standard(s).
- Recommendations
- Appendices of data and photographs if necessary.

Task #7 - Project Alternatives

Examine alternatives to the project including the no-action alternative. This examination of project alternatives should incorporate the use history of the overall area in which the site is located and previous uses of the site itself. Refer to NEPA guidelines for EIA preparation.

All Findings must be presented in the **EIA report** and must reflect the headings in the body of the TORs, as well as references. Eight hard copies and an electronic copy of the report should be submitted. The report should include an appendix with items such as maps, site plans, the study team, photographs, and other relevant information.

1.5 REPORT

The environmental assessment report will be concise and limited to significant environmental issues. The main text will focus on findings, conclusions and recommended actions supported by summaries of the data collected. The environmental assessment report will be organized according to the outline below.

- Executive Summary
- Policy, Legal and Administrative Framework
- Description of Proposed Project
- Description of the Environment
- Significant Environmental Impacts
- Analysis of Project Alternatives
- Impact Mitigation Management Plan
- Environmental Monitoring Plan

1.6 THE CONSULTANTS

In keeping with the requirements of a well-executed Environmental Impact Assessment, a multi-disciplinary core team was assembled to carry out the work. The main team members were:

Eleanor Jones, M.A. – Environment and Development Specialist, Principal Consultant and Team Leader

George Campbell, M.Sc. – Socio-economist, Principal Consultant

Margaret Jones Williams, Ph.D. – Ecologist, EIA Specialist and Deputy Team Leader.

Aedan Earle, M.Phil. - Environmental Geologist and GIS Specialist.

Sharonmae Shirley, M. Phil. – Environmental Chemist and Occupational Health Specialist.

Andrea Lanigan, M.Phil. (pending) - Marine Ecologist.

Tyrone Rose, – Laboratory Technologist/Technical Assistant

CHAPTER 2: POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

2.1 PERMITTING

Under the Natural Resources Conservation Authority Act (1991), the Natural Resources Conservation Authority (NRCA, now administered under the National Environment and Planning Agency, NEPA) is authorized to issue, suspend and revoke permits and licences. The Permit and Licence System was established in 1997 to ensure compliance with Sections 9 & 12 of the NRCA Act, which gives the NRCA the right to issue permits for new developments and request EIA studies where necessary.

Prescribed categories of projects requiring a permit have been listed by the NRCA/NEPA and these include Development Projects. A Project Information Form (PIF) and a Permit Application (PA) must be completed and submitted to NRCA/NEPA with the requisite application fee. NRCA/NEPA will then determine if an EIA is required and request submission of the Terms of Reference for conducting the EIA. An EIA is usually required for resort developments.

ESL was contracted by Palmyra Properties Ltd. to conduct the EIA for submission to NEPA. A Permit Application and Project Information Form were submitted to NEPA on March 31, 2005. This document constitutes the report of the EIA.

2.2 NATIONAL LEGISLATIVE AND REGULATORY CONSIDERATIONS - NATURAL ENVIRONMENT

2.2.1 Natural Resources Conservation Act (1991)

The Natural Resources Conservation Act was passed in the Jamaican Parliament in 1991 and provided the basis for the establishment of the Natural Resources Conservation Authority (NRCA) with primary responsibility for ensuring sustainable development in Jamaica through the protection and management of Jamaica's natural resources and control of pollution. Sections 9 and 10 of the NRCA Act stipulate that an Environmental Impact Assessment (EIA) is required for new projects and existing projects undergoing expansion.

The NRCA Act is the foremost piece of environment legislation in Jamaica, and is the basis on which NEPA issues environmental permits for developments.

2.2.2 Wildlife Protection Act (1945)

The Wildlife Protection Act of 1945 prohibits removal, sale or possession of protected animals, use of dynamite, poisons or other noxious material to kill or injure fish, prohibits discharge of trade effluent or industrial waste into harbours, lagoons, estuaries and streams, and Authorizes the establishment of Game Sanctuaries and Reserves. Protected under the Wildlife Protection Act are six species of sea turtle, one land mammal, one butterfly, three reptiles and several species of birds including rare and endangered species and game birds.

This Act should ensure that no dynamite, poisons or other noxious material are used to kill or injure fish, in the marine environment adjacent to the property and that no discharge of trade effluent or industrial waste occurs into the sea. No rare threatened or endangered species have been reported from the site.

2.2.3 The Endangered Species (Protection, Conservation and Regulation Of Trade) Act (1999)

This Act deals with restriction on trade in endangered species, regulation of trade in species specified in the schedule, suspension and revocation of permits or certificates, offences and penalties, and enforcement. Many species of reptile, amphibian and birds that are endemic to Jamaica but not previously listed under national protective legislation, or under international legislation, are listed in the Appendices of this Act.

Endangered species in Jamaica which are often involved in international trade include sea turtles, yellow snakes and two species of Amazon parrots. Sea turtles, although not reported from the Palmyra site, have been reported from other beaches in the Rose Hall area, and the yellow snake and parrots are often involved in international through the tourism industry. The Palmyra management should be aware of the potential for trade.

2.2.4 The Natural Resources (Prescribed Areas) (Prohibition of Categories of Enterprise, Construction and Development) Order (1996)

The island of Jamaica and the Territorial Sea of Jamaica has been declared as a Prescribed Area. No person can undertake any enterprise, construction or development of a

prescribed description of category except under and in accordance with a permit. The Natural Resources Conservation (Permits and Licenses) Regulations (1996) gives effect to the provisions of the Prescribed Areas Order.

The relevant application forms for an environmental permit have been submitted to NEPA for this project.

2.2.5 Water Resources Act (1995)

The Water Resources Act of 1995 established the Water Resources Authority (WRA). This Authority is authorized to regulate, allocate, conserve and manage the water resources of the island. The Authority is also responsible for water quality control and is required under Section 4 of the Act to provide upon request to any department or agency of Government, technical assistance for any projects, programmes or activities relating to development, conservation and the use of water resources.

It is the responsibility of the WRA as outlined in Section 16 to prepare, for the approval of the Minister, a draft National Water Resources Master Plan for Jamaica. Areas to be covered in this Draft Master Plan of 1990 included objectives for the development, conservation and use of water resources in Jamaica with consideration being given to the protection and encouragement of economic activity, and the protection of the environment and the enhancement of environmental values.

Section 25 advises that the proposed user will still have to obtain planning permission, if this is a requirement, under the Town and Country Planning Act. In addition, Section 21

of the Act stipulates that if the water to be used will result in the discharge of effluents, an application for a license to discharge effluents will have to be made to the Natural Resources Conservation Authority or any other relevant body as indicated by the Minister.

With regard to underground water, Section 37 states that it is unlawful to allow this water to go to waste. However, if the underground water "interferes or threatens to interfere with the execution or operation of any underground works", it will not be unlawful to allow the water to go to waste in order to carry out the required works provided that there is no other reasonable method of disposing of the water. The Authority also has the power to determine the safe yield of aquifers. (Section 38).

There are no wells to be tapped on the Palmyra site but wells do exist on other areas of the Rose Hall Development.

2.2.6 The Beach Control Authority (Licensing) Regulations (1956)

The Beach Control Authority (Licensing) Regulations (1956) stipulates that a license is required for the modification of any beach/coastline and sets out requirements for the posting of public notices.

Application forms will be submitted to NEPA for foreshore modification required in respect of creation of beaches, swim area and marine structures.

2.2.7 Country Fires Act (1942)

Section 4 of the Country Fires Act of 1942 prohibits the setting of fire to trash without prior notice being given to the

nearest police station and the occupiers of all adjoining lands. In addition, a space of at least fifteen feet in width must be cleared around all trash to be burnt and all inflammable material removed from the area. Section 6 of the Act empowers the Minister to prohibit, as may be necessary, the setting of fire to trash without a permit.

Offences against this Act include:

- Setting fire to trash between the hours of 6.00 p.m. and 6.00 a.m. (Section 5a);
- Leaving open-air fires unattended before they have been completely extinguished (Section 5b);
- Setting fires without a permit and contrary to the provisions outlined in Section 6 (Section 8);
- Negligent use or management of a fire which could result in damage to property (Section 13a);
- Smoking a pipe, cigar or cigarette on the grounds of a plantation which could result in damage to property (Section 13b).

Fires should not be used to clear vegetation.

2.2.8 Quarries Control Act (1983)

The Quarries Control Act of 1983 established the Quarries Advisory Committee, which advises the Minister on general policy relating to quarries as well as on applications for licenses. The Act provides for the establishment of quarry zones, and controls licensing and operations of all quarries. The Minister may on the recommendation of the Quarries Advisory Committee declare as a specified area any area, in which quarry zones are to be established and establish quarry zones within any such specified area.

Section 5 of the Act states that a licence is required for establishing or operating a quarry though this requirement may be waived by the Minister if the mineral to be extracted is less than 100 cubic metres. Application procedures are outlined in Section 8. The prescribed form is to be filed with the Minister along with the prescribed fee and relevant particulars. The applicant is also required to place a notice in a prominent place at the proposed site for a period of at least 21 days starting from the date on which it was filed.

No quarry zones are proposed for the project areas, but developers' guidelines should stipulate requirements for the use of material from licensed quarries and ensure the use of certified contractors.

2.2.9 The Pesticides (Amendment) Act (1996)

The Pesticides (Amendment) Act of 1996 amended sections of the principal act, which came into effect in 1975 and established the Pesticides Control Authority. This Act gives the Authority the responsibility of controlling the importation, manufacture, packaging, sale, use and disposal of pesticides. Section 11 states that the Authority is required to keep a register or record of all relevant information such as registered pesticides, restricted pesticides, pest control operators and persons licensed to import or manufacture pesticides. Under Section 16 of the Act, the Authority may also, with the approval of the Minister, make regulations which relate to areas such as:

- Aerial application of pesticides;
- Supervision required for the use of pesticides, the prescribed protective clothing to be worn and other precautionary measures;

- The permissible levels of pesticides to be used;
- The periods during which particular pesticides may or may not be used on certain agricultural crops;
- The disposal of pesticides and packages.

Pesticides may be required in landscaping and routine maintenance. Use of pesticides sold be according to national legislation and approved by the Pesticide Control Authority.

2.2.10 Air Quality Standards

The Federal Clean Air Acts which came into force in the United States in 1990 established air quality standards for six pollutants: ozone (O_3), carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), respirable particulate matter (PM10) and lead (Pb). An allowable level for each of these pollutants has been set by the United States Environmental Protection Agency (US EPA) whose objective is to protect the public from exposure to dangerous levels.

National standards, known as the National Ambient Air Quality Standards (NAAQS), were established and they were categorized into two groups. In one group, there are the primary standards, designed to protect human health and in the other, there are the secondary standards designed to protect the environment and limit property damage.

2.2.11 Noise Standards

To date, Jamaica has no National legislation for noise, but World Bank guidelines are often used for benchmarking purposes. The NRCA is currently preparing a draft document for national Noise Standards.

During the construction and operation phases, noise standards as stipulated by NEPA should be adhered to.

2.2.12 Water Quality - NRCA Act (1990)

The NRCA has primary responsibility for control of pollution in Jamaica's environment, including pollution of water. National Standards exist for industrial and sewage discharge into rivers and streams. WHO Standards for drinking water are used and these are regulated by the National Water Commission. There are no national standards for ambient water quality of riverine systems.

2.2.13 The Beach Control Authority (Licensing) Regulations (1956)

The Beach Control Regulations require a permit for any works on the beach, coastline or foreshore. Application must be made to the Applications Secretariat at the National Environment and Planning Agency (NEPA). Requirements include a Notice of Application to be posted on the landward and seaward sides of the property and said Notice should be served on adjoining neighbours.

Foreshore modification including dredging, beach creation, and construction of groynes have been proposed for the Palmyra development. A Beach Control Authority License will have to be applied for, in order to implement these works.

2.3 NATIONAL LEGISLATIVE AND REGULATORY CONSIDERATIONS – HUMAN, CULTURAL AND SOCIAL ENVIRONMENT

2.3.1 Town and Country Planning Act (1958)

Section 5 of the Town and Country Planning Act authorizes the Town and Country Planning Authority to prepare, after consultation with any local authority, the provisional development orders required for any land in the urban or rural areas, so as to control the development of land in the prescribed area. In this manner, the Authority will be able to coordinate the development of roads and public services and conserve and develop the resources in the area.

Any person may, under Section 6 of the Act, object to any development order on the grounds that it is:

- impractical and unnecessary;
- against the interests of the economic welfare of the locality.

However, if the Minister is satisfied that the implementation of the provisional development order is likely to be in the public interest, he may, under Section 7 (2) of the Act, confirm it with or without modification by publishing a notice in the Gazette. Section 8 of the Act also gives the Minister the authority to amend a confirmed development order.

Section 10 of the Act states that a development order must include:

- clearly defined details of the area to be developed;
- regulations regarding the development of the land in the area specified;

formal granting of permission for the development of land in the area.

If the provisions of section 9A of the Natural Resources Conservation Authority (NRCA) Act apply to the development, the application can only be approved by the Planning Authority after the NRCA has granted a permit for the development. (Section 11 (1A). The Authority may impose a "tree preservation order" under Section 25 of the Act if it considers it important to make provision for the preservation of trees and woodlands in the area of the development. This order may:

- prohibit the cutting down, topping, lopping or wilful destruction of trees;
- secure the replanting of any Sector of the woodland area in which trees were felled during the forestry operations permitted under the order.

The Minister can, under Section 26 of the Act, make regulations to restrict and regulate the display of advertisements in any area to be developed if he considers this to be in the interest of public safety. Section 28 of the Act empowers the local authority to require the owner or occupier of land in the development area to take the steps necessary to ensure its proper maintenance.

Specifications as laid out by the Town and Country Planning Authority must be adhered to.

2.3.2 Land Development and Utilization Act (1966)

Under Section 3 of the of the Land Development and Utilization Act (1966), the Land Development and Utilization Commission is authorized to designate as agricultural land, any land which because of its "situation, character and other relevant circumstances" should be brought into use for agriculture. However, this order is not applicable to land, which has been approved under the Town and Country Planning Act for development purposes other than that of agriculture. Among the duties of the Commission outlined in Section 14 of the Act is its responsibility to ensure that agricultural land is "as far as possible, properly developed and utilized".

This land has been approved for development purposes.

2.3.3 The National Solid Waste Management Authority Act (2001)

The National Solid Waste Management Authority Act (2001) is “an act to provide for the regulation and management of solid waste; to establish a body to be called the National Solid Waste Management Authority and for matters connected therewith or incidental thereto”.

The Solid Waste Management Authority (SWMA) is to take all steps as necessary for the effective management of solid waste in Jamaica in order to safeguard public health, ensure that waste is collected, sorted, transported, recycled, reused or disposed of, in an environmentally sound manner and to promote safety standards in relation to such waste.

The NSWMA also has responsibility for the promotion of public awareness of the importance of efficient solid waste

management, to advise the Minister on matters of general policy and to perform other functions pertaining to solid waste management.

Disposal of solid waste including construction spoil must be done in accordance with the regulations of the NSWMA and at an approved dumpsite.

2.3.4 The Public Health Act (1976)

The Public Health (Air, Soil and Water Pollution) Regulations 1976, aim at controlling, reducing, removing or preventing air, soil and water pollution in all possible forms.

Under the regulations:

(i) No individual or corporation is allowed to emit, deposit, issue or discharge into the environment from any source.

(ii) Whoever is responsible for the accidental presence in the environment of a contaminant must advise the Environmental Control Division of the Ministry of Health and Environmental Control, without delay.

(iii) Any person or organization that conducts activities which release air contaminants such as dust and other particulates is required to institute measures to reduce or eliminate the presence of such contaminants.

(iv) No industrial waste should be discharged into any water body which will result in the deterioration of the quality of the water.

Regulations of 1998

The owner or occupier of any commercial or industrial premises shall:

- ❖ Ensure that all garbage not being garbage to be collected by a contractor is disposed of at least twice in every seven days by incineration or burial or by any other approved means
- ❖ Garbage is stored in an approved manner

These regulations are applicable to the developer and the management during both the construction and operation phases of the Palmyra Resort.

2.3.5 Tourism Product Development Co. Ltd.

TPDCo requires the following list of documents for JTB licensing:

Completed application form with required documentation submitted to Manager, Licence Processing Department, TPDCo.

Public Liability Insurance

List of Directors

Certificate of Incorporation

Valid Food Handler's Permit

Valid Health Certificate

Tax Registration Number (TRN) Business Enterprise Number

Approval from local planning authority

Letter of approval from Fire Department re safety of building

Proper security arrangements (certified personnel)

Beach Licence (where applicable)

Work Permit (where applicable)

TPDCo recommendation

Also, all Government Statutory requirements must be met and adhered to.

2.4 INTERNATIONAL LEGISLATIVE AND REGULATORY CONSIDERATIONS

2.4.1 Cartagena Convention (Convention for the Protection And Development of the Marine Environment of the Wider Caribbean Region) (1983)

Adopted in March 1983 in Cartagena, Colombia, the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region, also known as the Cartagena Convention, is the only legally binding environmental treaty for the Wider Caribbean. The Convention came into force in October 1996 as a legal instrument for the implementation of the Caribbean Action Plan and represents a commitment by the participating governments to protect, develop and manage their common waters individually and jointly.

Ratified by twenty countries, the Cartagena Convention is a framework agreement, which sets out the political and legal

foundations for actions to be developed. The operational Protocols, which direct these actions, are designed to address special issues and to initiate concrete actions. The Convention is currently supported by three Protocols. These are:

The Protocol Concerning Co-operation in Combating Oil Spills in the Wider Caribbean Region (The Oil Spills Protocol), which was adopted and entered into force at the same time as the Cartagena Convention;

The Protocol Concerning Specially Protected Areas and Wildlife in the Wider Caribbean Region (The SPAW Protocol), which was adopted in two stages, the text in January, 1990 and its Annexes in June, 1991. The Protocol entered into force in 2000.

The Protocol Concerning Pollution from Land-based Sources and Activities in the Wider Caribbean Region (LBS Protocol), which was adopted in October, 1999.

Pollutions issues in the context of the Cartagena Convention will be relevant to this project.

2.4.2 Biodiversity Convention

The objectives of the Convention on Biological Diversity are "the conservation of biological diversity, sustainable use of its components and the fair equitable sharing of the benefits arising out of the utilization of genetic resources". This is the first global, comprehensive agreement which has as its focus all aspects of biological diversity: genetic resources, species and ecosystems. The Convention acknowledges that the "conservation of biological diversity is a common concern of

humankind and an integral part of the development process". In order to achieve its goals, the signatories are required to:

- Develop plans for protecting habitat and species.
- Provide funds and technology to help developing countries provide protection.
- Ensure commercial access to biological resources for development.
- Share revenues fairly among source countries and developers.
- Establish safe regulations and liability for risks associated with biotechnology development.

Jamaica's Green Paper Number 3/01, entitled Towards a National Strategy and Action Plan on Biological Diversity in Jamaica, speaks to Jamaica's continuing commitment to its obligations as a signatory to the Convention.

The developer should be aware of the essence of the Biodiversity Convention, particularly in the context of the conservation of biological diversity, particularly of the marine environment.

CHAPTER 3: METHODOLOGY AND APPROACH

3.1 General Approach

A multi-disciplinary team of experienced scientists and environmental professionals was assembled to carry out the required resource assessment, generation of baseline data, determination of potential impacts and recommendation of mitigation measures. An iterative approach among the environmental team members and other project professionals was adopted.

The team utilized the Charette-style approach to data gathering, analysis, and presentation whereby team members conducted the reconnaissance investigations together to determine the critical elements for analysis and the issues to be highlighted for the design and planning process. Team meetings were held to discuss the progress of investigations and analyses and facilitate integration of data toward an understanding of the systems at work in both the natural and built environment.

Baseline data for the study area was collected using a combination of:

- Site Reconnaissance
- Aerial Survey
- Analysis of Maps and Plans
- Review of Reports and background documents
- Field Studies and Laboratory Analyses

- Charette Style Consultations
- Public Consultations

3.2 Physical Environment

Information was gathered on the existing physical environment, particularly as related to geology, topography, soils, drainage, water quality, air quality and noise.

3.2.1 Geology, Topography, Soils

Information on the climate, geology, topography, soils, was obtained by compiling data from existing reports, and source agencies. Aerial photos, satellite imagery and other published maps were also examined.

Field work was carried out to augment and verify existing information relating to geology and soils and to obtain first hand knowledge of the topography.

3.2.2 Hydrology and Drainage

Surface and ground water characteristics and flows were assessed using field investigation as well as maps, aerial photographs and data from previous reports.

3.2.3 Air Quality

Air contains particulates in the form of dust. A portion of that dust with particle size less than 10 microns can be retained in the lungs. During construction and excavation activities the concentration of fugitive dust increases significantly.

The objective of the air quality monitoring exercise was to determine the normal concentration of respirable particulates in the project area prior to construction works. Air quality

measurements were taken at four sites in the project area. The sites are listed in Table 3.2.3 and Figure 3.2.3.

The air quality assessment involved the measurement of ambient levels of respirable particulates, PM10 (<10µm). Particulates were measured using a combination of Air Lite area sampler/ Sensidyne (BDX 530) personal vacuum pumps (suction 30 and 3 1/min respectively), attached to pre-weighed Millipore filters. The pumps were placed at the approximate respiratory height of pedestrians for a twenty four (24) hour period at the four sites, April 18-19, 2005. The pumps were then returned to the ESL laboratory where the filters were stabilised and weighed to determine a Time Weighted Average (TWA) value for the particulates.

Table 3.2.3: Air Quality Sampling Stations – Palmyra Developments

Site #	**Location**
Pa1	Southwest of property
Pa2	Northwest of property
Pa3	Northeast of property
Pa4	Southeast of property

Figure 3.2.3: Air Quality Sampling Stations

3.2.4 Noise

Noise readings, wind direction and any unusual local noise sources were recorded. Measurements were taken using Quest Electronics sound level meters, which conform to ANSI S1.4 - 1983, TYPE 2 and IEC 651 - 1979, TYPE 2 standards. The meter was calibrated before and after each set of reading. Perimeter stations were selected.

3.2.5 Water Quality

The overall objective of the water-quality sampling programme is to document baseline water quality conditions in the project area. The water quality sampling programme is intended to be indicative. The degree of compliance of all pollution indicator parameters with the NEPA ambient water quality guidelines is documented. The data is used to establish "action levels" for determination of whether the proposed development may have an adverse effect on surface/subsurface water systems.

Four sampling stations were selected in the coastal zone based on their location relative to the discharge points of surface and possibly subsurface drainage systems, as well as their current or potential impairment. The station locations are listed in Table 3.2.5 and shown at Figure 3.2.5.

One water quality sampling exercise was conducted on April 18, 2005.

Table 3.2.5: Water Quality Sampling Stations – Palmyra Developments

Site #	Location
P1	Control station off reef
P2	Seaward Eastern boundary
P3	Seaward Western boundary
P4	Middle of coastal zone

Samples were collected at a depth of 0.5 m, sample collection was facilitated by use of a boat. All samples were collected in pre-cleaned 2 litre polyethylene sample bottles. Bacterial samples are collected at the water surface in sterilized 100 ml glass bottles.

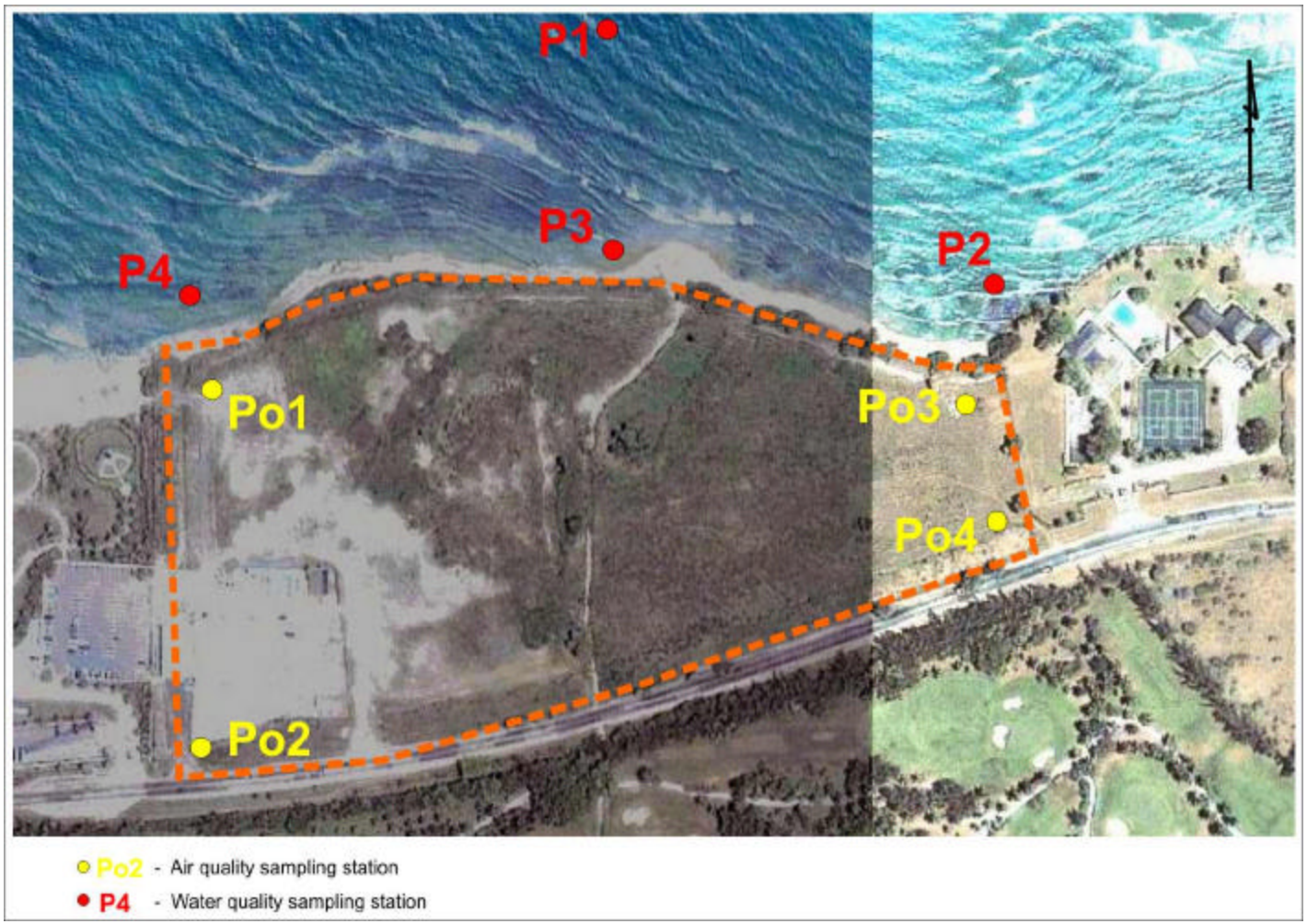
The following parameters were analysed on all of the water samples:

◊ pH
◊ Salinity
◊ Temperature
◊ Dissolved Oxygen
◊ Total Suspended Solids
◊ Nitrate
◊ Phosphate
◊ BOD_5
◊ Total and Faecal Coliform

Salinity, temperature, and dissolved oxygen were measured *in situ* at all sampling stations using a YSI Model 57 Salinity/Conductivity/Temperature (SCT) meter and YSI Model 33 oxygen meter respectively. Measurements were taken at the surface (0.5m depth) of the water column.

Environmental Solutions Limited Laboratory performed or supervised the analysis of all parameters. Laboratory analyses are performed using certified methodology, primarily from the text 'Standard Methods for Examining Water and Wastewater' and HACH.

Figure 3.2.5: Water Quality Sampling Stations



The quality assurance programme at the ESL laboratory is based on the quality system established in the ISO 17025 standard. This involves the collection of duplicate samples for every four samples collected in the field. Duplicate samples are taken through the entire analytical chain.

3.3 Biological Environment

The status of the flora and fauna of the study area was determined by a review of literature relevant to the area and field investigations for both the terrestrial and marine environments.

3.3.1 Flora

The vegetative communities were identified using the method of Grossman *et al* (1991) and classified into community types. Identification was carried out of dominant tree species. The vegetation was identified and described for the property.

3.3.2 Fauna

Information on fauna was gathered from existing literature on reported species as well as observations in the field. Observations were made particularly to assess the presence of birds in the terrestrial and coastal environments. Information was obtained from locals in the area about the presence of any significant specie.

3.3.3 Marine Environment

The marine environment for the coastal strip from the Ritz Carlton to the Wyndham was investigated by SCUBA diving and snorkelling along the coastline, in the offshore lagoon, in the back reef area and in the fore reef zone. This was done

for the Strategic Environmental Assessment in April 2004. A qualitative assessment of area was conducted to provide a species list and an abundance (DAFOR) rating for each species.

The DAFOR is a subjective rating which provides an indication of whether an organism is Dominant, Abundant, Frequent, Occasional or Rare in the environment. Quantitative data on coral cover and size were collected along 10 m long transects. Data on macroalgal cover and coral recruit densities were collected using 0.25 cm^2 quadrats.

In addition to the assessment of the reef structure, a recent survey was conducted to determine any significant changes in the marine environment since April 2004, and to specifically analyse the sites proposed for establishment of benthic structures. These include the site for the groynes and breakwaters as determined by Smith Warner (2005) (Appendix 1). Smith Warner conducted a general marine survey in March 2005 and determined the sites for the structures including boardwalk, groyne, breakwaters and gazebos.

The investigation of Palmyra's proposed main beach marine environment was done by snorkelling. Eight (8) transect stations were selected in the back reef area of the coastal region (within the projected area of the groyne to be constructed). These transects were selected based on the proposed structures to be constructed. Underwater photographs were taken along these line transects.

Underwater photographs were taken at each of the eight selected stations. Line transects were selected (as shown in Figure 3.3.3) based on the proposed beach development with regards to the planned dredging activities and construction of man-made groynes (breakwaters). A snorkeling survey was conducted and the pictures taken along these transects. Each transect had three points, one at either end of the line transect and the third in the middle o these two points. Each point has an approximate distance of 1metre (+/- 0.1metre) between where photographs were taken along each transect.

The stations are listed below and also identified on Figure 3.3.3.

	Stations	**Location**
1.	Submerged Breakwater	East of beach shoreline (33.0).
2.	Timber Jetty	West of beach shoreline (33.0).
3.	Emergent Breakwater "A"	69.0 northwest, (at sea).
4.	Submerged Breakwater "B"	37.0 northwards, (at sea).
5.	Breakwater "C"	32.0 northwards, (at sea).
6.	Emergent Breakwater "C"	36.0 northeast, (at sea)

7.	Area to be Dredged	Middle of beach (1.0m & 1.9m elevation).
8.	Crest of new beach (a & b)	Along 2 point on present beach (west and east).

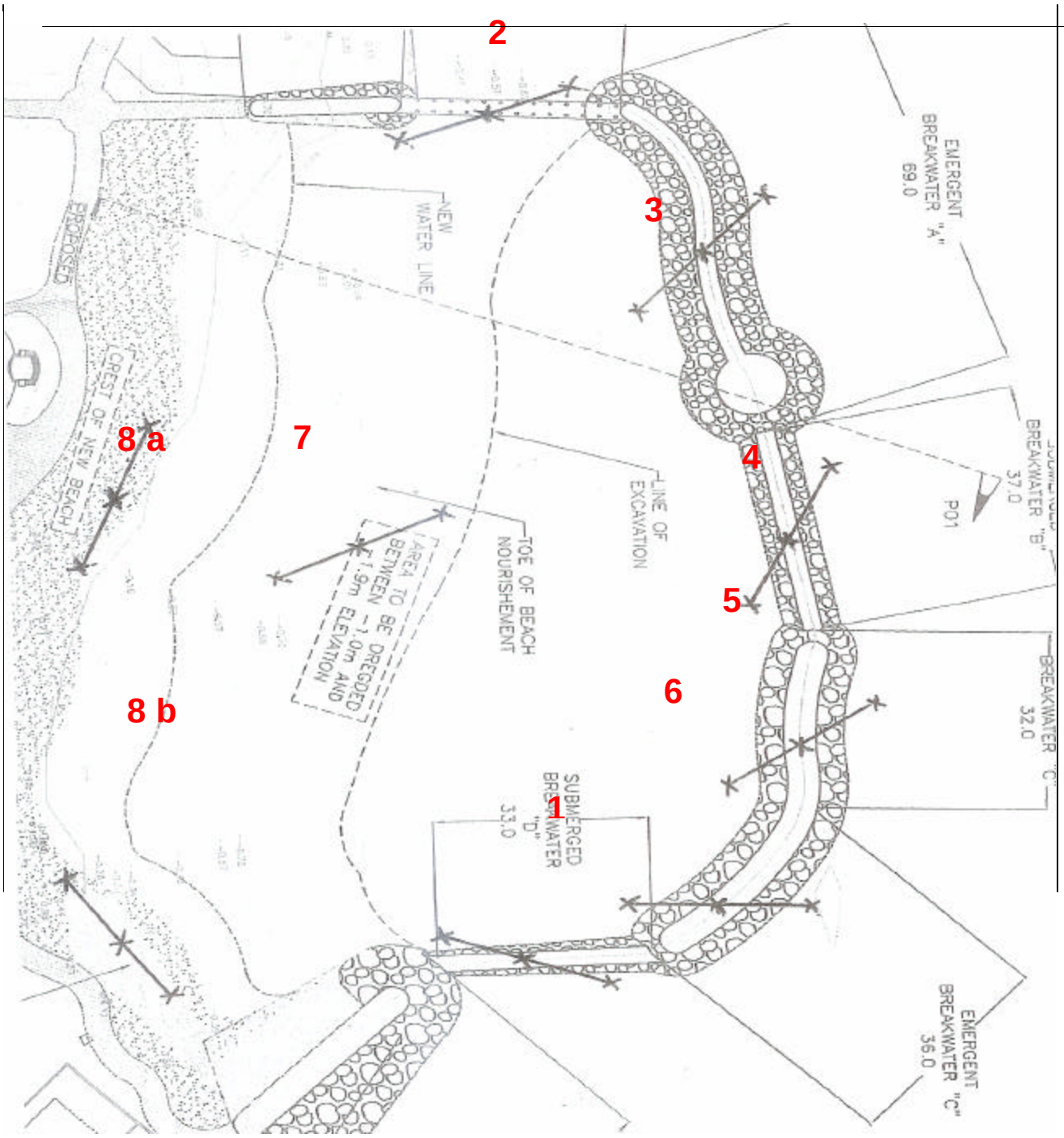


Figure 3.3.3 - Map of Proposed Main Beach at Palmyra Development site, showing where groins (breakwater) that are planned to be constructed in the sea.

3.4 Socio-economic Environment

Rapid field appraisal techniques in conjunction with desk research were employed to investigations of the socio economic considerations within the project area, *viz*:

- population and settlement characteristics
- land uses and livelihoods
- developments underway
- water supply and other utilities
- waste management practices
- recreational activities

CHAPTER 4: DESCRIPTION OF EXISTING ENVIRONMENT

4.1 Physical Environment

4.1.1 Climate

The climate of the study area is subtropical and typical of the island of Jamaica where the climatic conditions are largely determined by the north east trade winds and localised orographic features. Rainfall is the dominant climatic parameter that in turn influences variations in temperature, humidity and evaporation. The major synoptic scale weather systems affecting the island are upper level troughs, cold fronts and tropical systems. Upper level troughs occur throughout the year but occur more frequently during the winter months.

Cold fronts typically affect the island between December to April and result from low pressure systems that form over the south-eastern USA. These cold fronts frequently become stationary over the north coast of Jamaica producing intense rainfall that can last for several days. Tropical systems including tropical waves, storm and hurricanes develop between June and November each year in the north Atlantis tropical cyclone basin. These systems traverse the Caribbean basin from east to west bringing with them high velocity winds, intense rainfall and storm surge.

The mean annual rainfall for the island is 168 cm with two rainy seasons between May and June and the second

between October and November during which over 40 % of rainfall occurs. Rainfall data collected at the Sangster International Airport (SIA) located about 4 miles to the west of the property between 1951 and 1980 is shown in Figure 4.1.1. The annual mean rainfall is 105 cm with a maxima in May and October and a minimum in March.

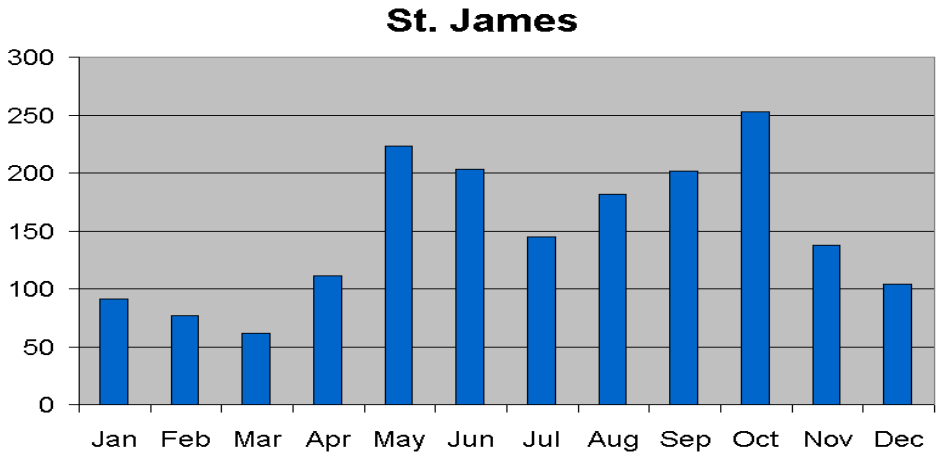


Figure 4.1.1.a.: The annual mean rainfall

Intense rainfall of relatively short duration is also characteristic of this region occurring as sudden downpours. Maximum 24 hour rainfall estimated at the SIA is presented in Table 4.1.1 for return periods of between 2 and 100 years.

Table 4.1.1 : Estimated Maximum 24 – Hour Rainfall (mm)

RETURN PERIOD	T2	T5	T10	T25	T50	T100
RAINFALL (mm)	84	147	188	239	279	316

The average annual temperature for Jamaica is 27^{o}C. Data from the SIA indicate that annual temperature for the project area is 27.4^{o}C with a maximum of 28.9^{o}C in August and a low of 25.9^{o} C in February

The wind direction at the SIA is predominantly from the east with recorded wind measurements presented in Figure 4.1. The data indicates that winds from the east occur about 45% of time and 29% of the time from the north eastern sector typically between 7 to 21 knots. Mean wind speeds are generally higher in the daytime with a peak of about 15 knots at 2pm. and a low of 3 knots at midnight. During the night-time there is s strong tendency for wind speeds to come from the south-eastern sector at between 3 and 7 knots.

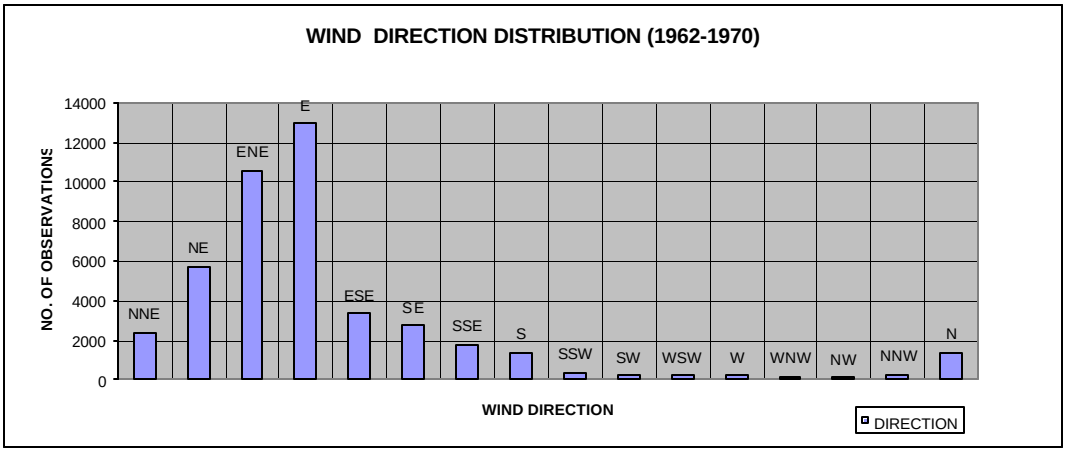


Figure 4.1.1 b. Wind data supplied by the SIA meteorological station.

Long term climate change is likely to cause a gradual rising of sea levels. The United Nations Environment Program (UNEP) has suggested that sea level rise of 2.8 mm/year or 2.2 inches over 20 years can be expected. This in turn will cause a corresponding increase in ground water levels.

4.1.2 Topography & Drainage

The proposed site is located on a flat coastal strip extending from the limestone foothills in the south to the coastline. Figure 4.1.2 a. The property for the proposed project lies north of the east-west oriented main road. The land surface is relatively flat with a gentle slope of about 1:40 towards the sea as shown in the topographic survey Map 1 (back pocket). At the coastline the ground surface is in the order of 5 meters above mean sea level forming a terrace that slopes steeply down to the shoreline. Towards the south the maximum elevation is in the order of 8 meters. An artificial berm with a maximum height about 10.5 meters high runs along the southern boundary of the property. Segments of an old coastal road is located along the northern edge of the coastal terrace. There is little relief with a man-made spoil heap forming the only other feature of significant height, in the order of 11 meters high.

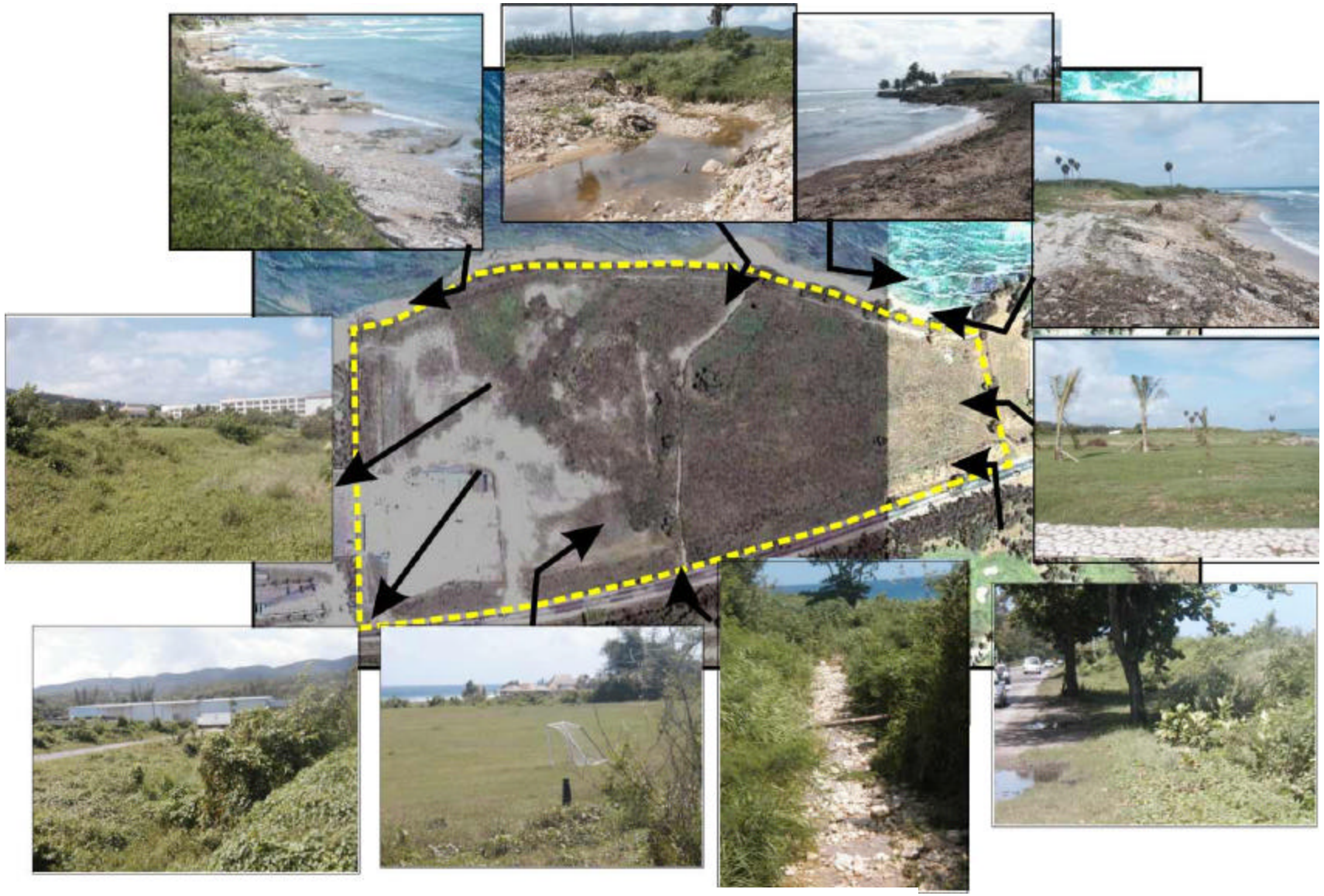


Plate 4.1.2: Topography of site

Figure 4.1.2 a: Palmyra Site

The shoreline consists of two distinct bay segments separated by a headland. A wide bay occupies the eastern two thirds of the shoreline. A smaller segment at the western end is part of bay which extends to the west of the property line. The shoreline of the eastern segment is characterized by a cobble beach with a relatively flat foreshore. The shoreline of the western segment is covered by exposed flat ironshore outcrops of raised reef terraces. A small pocket, sandy beach is found within the eastern segment.

The surface drainage features of the site already presented in Section 1.3.3 are shown in a reduced format in Figure

4.1.2b. There are two main drainage channels passing through the site.

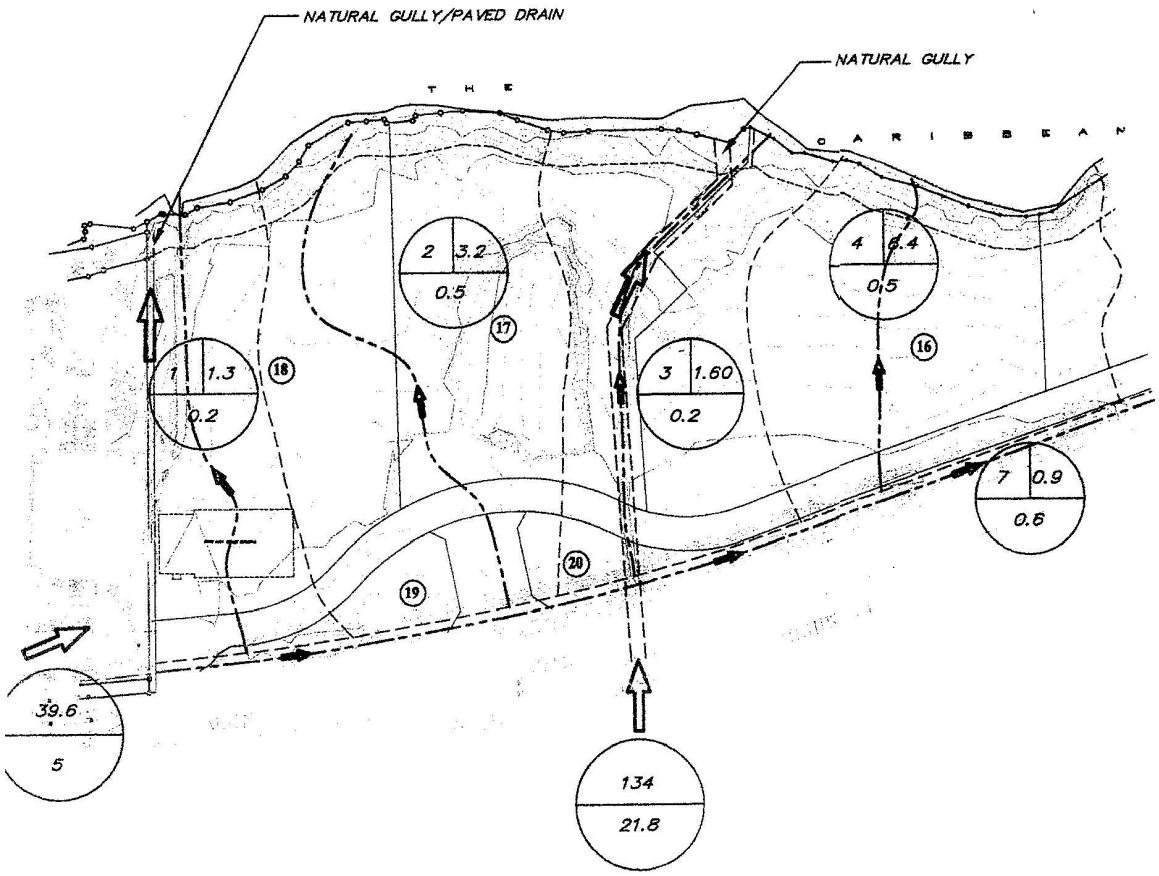


Figure 4.1.2 b: Drainage Features of the Palmyra Site (Source: Palmyra Resort and Spa)

Both are temporary streams that carry significant volumes of runoff after heavy rainfall. The White Gut is located on the western boundary of the property and consists of a rectangular concrete channel. This channel drains an area of 39.6 hectares south of the main road and 25 year return period discharge has been estimated at 5 M^3/sec. A large

natural drainage channel passes through the center of the site and drains an estimated area of 134 hectares. The channel bed is flat and covered with boulders. Storm water discharge for a 25 return period event was estimated at 21.8 M^3/sec. The berm along the southern boundary of the site prevents overland flow of storm water runoff from moving northwards over the site.

4.1.3 Geology & Groundwater

The site is covered with soil and there are no rock outcrops. Geotechnical evaluations carried out by Qore Inc. (Appendix V), included the drilling of 18 boreholes for sample collection, subsurface soil and rock evaluation. Soils observed on the surface were classified as tan and brown silty clays with various sized limestone fragments. These soils are residual soils formed by the in situ weathering of the underlying limestone rocks. The thickness of the soil varied between 8 to 21 feet with a sharp transition between the soil and the limestone bedrock.

The limestone underlying the soil belongs to the Coastal Group of limestones that consists of a series of rubbly, bioclastic calcarious rocks and marls that are the remnants of raised reef terraces along the north coast. The rock was classified as a marl and disturbed samples described as white, silty fine to coarse sands and silty gravels with minor amounts of clay.

Groundwater levels measured by Qore Inc. were 5 to 8 meters below the ground surface. It is expected that

fluctuations in ground water levels will occur due to weather conditions and sea level changes.

4.1.4 Natural Hazards

The project site is exposed to the natural hazards associated with flooding, hurricanes, and earthquakes. Flooding from stormwater runoff and ponding due to high intensity and long duration rainfall can be a major problem along the north coast road and adjacent properties. Hurricane related hazards consist of high velocity winds, flooding from intense rainfall, and coastal flooding and erosion from storm surge. Earthquakes hazards include the effects of ground shaking and to a lesser extent coastal flooding from tsunami.

High velocity wind generated by hurricanes can exceed 160 miles per hour. High buildings located along the coastline with no wind barriers could therefore be exposed to the full impact of hurricane winds according to the track of the hurricane with respect to the island.

The elevated sea levels and high energy waves produced by hurricane storm surge can cause extensive coastal inundation and erosion. A storm surge analysis for this segment of the north coast shoreline was carried out by Smith Warner International, (Appendix I). The report indicates that storm surge inundation levels can potentially reach 4 meters. This includes a sea level rise of 2 meters and wave run-up of 2 meters.

The main effect from earthquakes on land is the impact of ground shaking on structures. The impact on buildings in turn depends on the nature of the soils at the site and the design of the building. In general high rise buildings are more vulnerable to ground shaking than low rise buildings. The potential for earthquake related ground shaking throughout Jamaica was studied by Shephard, 1997. Figure 4.1.4 shows the range of peak horizontal ground acceleration that can be expected across Jamaica. Montego Bay and the project site is shown to be in the range 170n-220 gals.

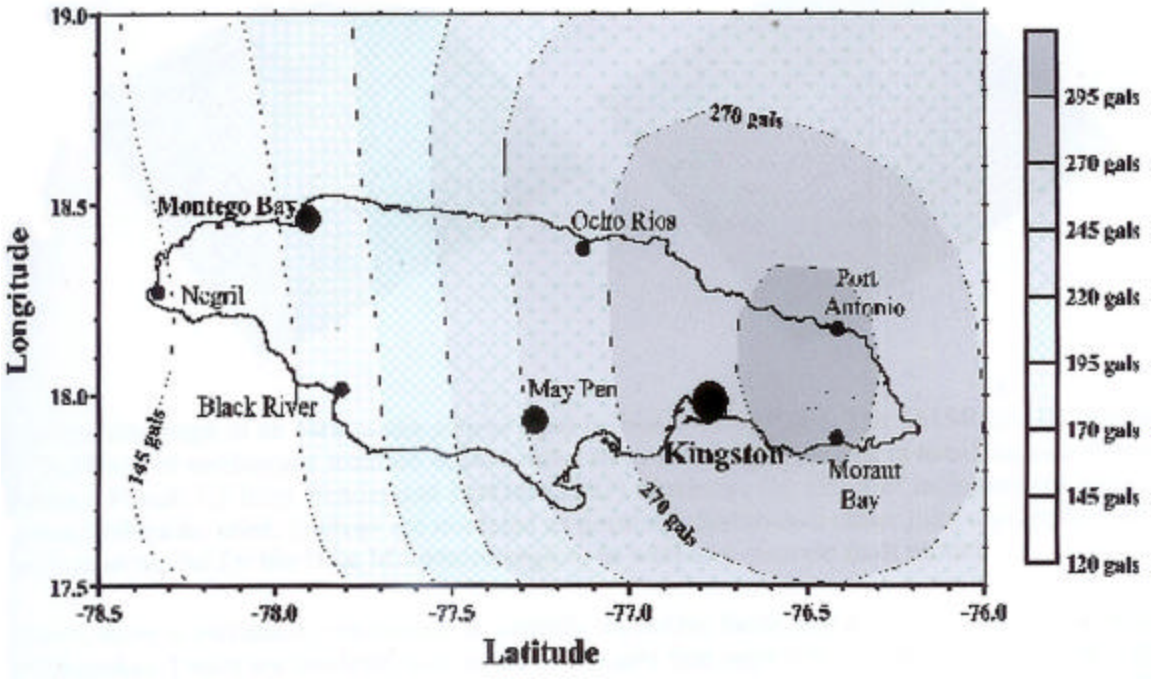


Figure 4.1.4: Expected Peak Horizontal Ground Acceleration (Source: Shephard, *et al*, 1997)

The potential for earthquake induced tsunami is high along this section of the Jamaican north coast. Both earthquake

initiated submarine landslides offshore the north coast as well as sea floor displacement by fault movement can generate damaging tsunami along the Jamaican north coast. The unstable steep submarine slopes offshore the project site could potentially generate tsunami if they failed as a result of a high magnitude earthquake event. A tectonically active area just south of eastern Cuba has the capacity to produce sea floor displacements that could generate tsunami that could possibly affect the north coast of Jamaica. The effects of tsunami generated by either of these potential sources would be similar to the effect of hurricane storm surge, although the possible height of the tsunami has not been determined.

4.1.5 Coastal Water Quality

The results of the baseline sampling exercise for the SEA conducted in April 2004, showed that the water at all the stations sampled was well oxygenated with low bacterial levels. Phosphate levels were variable. High phosphate levels were recorded at the mouth of the Boyce Gully and Little River, significantly exceeding the National Environment and Planning Agency's (NEPA) interim ambient marine water quality standard. Lower levels were measured at the other three stations. Nitrate, biochemical oxygen demand and total suspended solids were high at all stations sampled.

These readings indicate high nutrient loading and high levels of sedimentation, possibly due to terrestrial run-off which carries fertilisers from agricultural practices and golf courses, as well as loose soil.

Table 4.1.5 a: Water Quality Data from the SEA (Environmental Solutions Ltd., 2004)

PARAMETERS	**NEPA Ambient Interim Water Standards**	STATIONS				
		White Gut River WQ1	**Little River Reef front WQ2**	**Little River Mouth WQ 4**	**Boyle Gully Reef front WQ3**	**Boyle Gully Channel WQ5**
pH	6.5-8.5	7.9	7.9	7.9	7.9	7.9
Dissolved Oxygen (mg/L)	>4	6.7	6.5	6.4	6.4	6.7
Salinity (ppt)	-	35.5	35.4	35.4	35.4	35.4
Temperature (^{0}C)	-	27.9	27.7	28.2	27.7	27.9
BOD (mg/L)	2	30	30	24	19	18
TSS (mg/L)	10	75	51	14.7	48	45
Nitrate (as nitrogen) (mg/L)	0.001 – 0.081	2.0	2.3	2.4	1.1	2.0
Phosphate (mg/L)	0.001 -0.055	0.01	0.01	1.43	0.01	1.43
Total Coliform (MPN/100ml)	<500	<3	<3	<3	<3	<3
Feacal Coliform (MPN/100ml)	<100	<3	<3	<3	<3	<3
Oil & Grease (mg/L)	10	2.4	10.3	<2.0	4.13	9.0

Current water quality data was collected at the Palmyra site. This data is given in Table 4.1.5 b.

Table 4.1.5 b: Current Water Quality Data at the Palmyra Site, April 20, 2005

PARAMETERS	SAMPLES				
	Control Station P 1	East of Coast P 2	West of Coast P 3	Middle of Coast P 4	NEPA Ambient Marine Standards
pH	8.4	8.3	8.3	8.0	8.0-8.44
Salinity (ppt)	35.9	35.8	35.7	35.7	ambient
Dissolved Oxygen (mg/L)	8.8	9.8	8.5	8.6	4.5-6.8
BOD (mg/L)	2.0	4.0	2.0	1.0	0.57-1.16
Nitrate (mg/L)	0.00	0.00	0.00	0.02	0.001-0.081
TSS (mg/L)	29.3	17.3	27.0	33.0	-
Phosphate (mg/L)	0.03	0.11	0.03	0.04	0.001-0.055
Oil & Grease (mg/L)	5.00	2.12	1.87	2.87	-
Total Coliform (MPN/100ml)	15.0	15.0	75.0	1100.0	48-256
Faecal Coliform MPN/100ml)	4.0	<3.0	3.0	4.0	<2-13

The primary objective of the water quality sampling exercise is to determine the baseline water quality conditions of the surface water systems in the project area. The data obtained for this investigation were compared with the results for the water quality assessment for the Rosehall Development SEA, May 2004.

Four sampling stations were selected in the coastal waters off the proposed project site. The sites were selected based on their location relative to existing/proposed discharge points and their current or potential impairment.

The following discussion is based on data generated from a single sampling exercise. The extent to which conclusive inferences are drawn is therefore limited data. The data is however sufficient to provide an indication of the water quality in the project are.

The water quality data generated for the present study as well as the historical data are discussed in the following sections.

◊ **Salinity and Conductivity**

The pH and salinity measurements recorded for both stations are typical for tropical coastal waters.

◊ **Biochemical Oxygen Demand (BOD_5) & Dissolved Oxygen (DO)**

BOD levels in excess of 2.0 mg/l indicates elevated organic loading, which is a cause for concern. The biochemical oxygen demand for all sites is just above the required NEPA standard. This suggests a slightly elevated demand for oxygen. Dissolved oxygen readings are at saturation levels hence there is no oxygen deficiency at this time.

Oil and Grease

The oil and grease level recorded for each station was lower than the NEPA the trade effluent standard of 10 mg/l. NEPA does not currently have a standard for ambient marine waters for oil and grease. The level measured at Station P1 (5.0 mg/l) is somewhat elevated.

◊ **Total and Faecal Coliform**

Faecal coliform bacteria counts are used as indicators of the presence of pathogenic organisms. The generally accepted limit for faecal coliforms in human contact waters is 100 MPN/100 ml. faecal bacterial levels at all four sites are well within the NEPA guideline and are not a cause for concern at this time.

The Total Coliform level at the site in the middle of the beach area (P4) was elevated (1100). This station should be watched for any further increases as a non point source may be influencing the coliform levels at this site.

◊ **Nutrients (Nitrate & Phosphate)**

The nitrate and phosphate concentrations recorded for the sampling stations were generally low. Station P2 at the eastern section of the coast was the only site with phosphate levels slightly above the standard. This site should be carefully monitored to see if this trend continues.

◊ **Total Suspended Solids (TSS)**

The coastal waters were turbid at all four sampling stations. The suspended solids data indicate high suspended solids loading in the surface waters. There is no ambient suspended solids standard, using the NEPA Trade Effluent Standard (30 mg/l) for comparison. The results show that suspended solids at most stations were above or close to this standard. Elevated suspended solids are likely a result of high wave action and/or run-off from on land.

◊ **Summary**

The results generated for the present study indicate that the water quality in the project area is not showing any signs of stress. Bacterial and nutrient levels are generally low and the water is well oxygenated. TSS is the only parameter of concern.

The historical data collected in early 2004 showed some similarity with the present data. The waters were well oxygenated with low bacterial levels. Phosphate levels were low and suspended solids were high. Nitrates and BOD levels were however elevated.

4.1.6 Air Quality

The ambient air quality data generated for the present study are presented in Table 4.1.6 below.

Table 4.1.6: Ambient Respirable Air Quality Data for the Palmyra Development Site, April 20, 2005.

LOCATION	Results extrapolated to 8 hrs/ $\mu g/m^3$	NEPA 24 Hr Guide Line $\mu g/m^3$
Western End of Property	139.6	150
Western End at the Coast	150.4	
Eastern End of Property	151.3	
Eastern End of Coast	196.9	

Respirable particulates are defined as those particles with diameter less than or equal to 10 microns. These particles are inhaled into the respiratory system and have the potential to cause upper respiratory tract ailments.

Respirable particulates levels are at or above the recommended ambient air quality PM10 guidelines established by NEPA. The sampling stations are generally quite windy as indicated by the wind data. The stations are also subject to a significant amount of fugitive dust from the roadway, vacant lot and coastal zone in their immediate vicinity.

Construction activities will likely increase the ambient PM 10 levels and as such mitigation measures should be implemented to manage this impact.

4.1.7 Noise

The noise measurements recorded for the present study are presented in Table4.1.7 below.

Table 4.1.7: Noise measurements conducted at the Palmyra Project Site, April20, 2005

LOCATION	Results Noise dBA	Miles /hour	Comments	NEPA Guideline
Western End of Property, P 1	83.3	8.3	Next to the main road, heavy vehicular traffic.	75.0
Western End at the Coast P 2	86.5	15.3	Strong prevailing winds at the coastline and rough seas.	
Eastern End of Property P 3	69.4	7.0	Next to the main road heavy and regular vehicular traffic.	
Eastern End of Coast P 4	78.7	15.2	Strong prevailing winds at the coastline and rough seas.	

The noise levels recorded at three of the stations monitored are currently above the NEPA guideline for perimeter noise. This noise would be from ambient sources including vehicular traffic on the main road, high velocity winds and ocean waves. Only one station has noise levels within the standard.

The current data indicate that noise levels during construction, if kept within the perimeter limits, should not present a significant impact to the neighbouring hotels during construction, as the ambient levels are already high, from existing sources.

4.1.8 Coastal & Marine Aspects

Storm surge analyses have been conducted for the Rose Hall Palmyra Development, by Smith Warner International Ltd. (SWIL), to ascertain water levels resulting from storm events. Storm surge resulting form a hurricane is an increase in ocean level due to a combination of:

Direct wind-driven water (wind setup),

Potential energy due to wave breaking (wave setup), and

Uplift induced by atmospheric pressure drop (inverse barometric pressure rise).

The method for computing storm surge involves a determination of deep water wave conditions, including wave height and period, as well as inverse barometric rise, followed by the computation of the resulting nearshore conditions.

In this case, deep water conditions were determined from the NOAA database of tropical storm and hurricane tracks. Nearshore water levels were predicted using engineering tools sBEACH and SWAN to determine 1D and 2D representations of water levels respectively. Analyses were conducted for the existing site conditions and for a layout with the proposed coastal structures.

Aspects that were covered in the analysis included:

- ✓ Deep Water Storm Waves

- ✓ Water Levels using sBeach (one dimensional linear model)
- ✓ Water Levels using SWAN

The full report from SWIL is given in Appendix I.

A hindcast model was used to determine deep water wave conditions from four separate directions reaching the site. These wave conditions were used as input to the models sBEACH and SWAN, which were used to transform deep water waves to nearshore wave conditions and water levels at the site. The wave conditions which resulted in the largest water levels on site were presented.

Based on the SWIL report (Appendix I), the Mines and Geology Division (MGD) recorded a maximum storm surge height of 2.5m and a maximum inland surge distance of 138 metres during the passage of Hurricane Allen.

The storm surge from the simulations conducted (taking into consideration wave run-up) suggests inundation reaching as high as 4.2 metres above MSL and a set-back of 30 metres. The inundation level is higher than that recorded by MGD, however, the inland distance is substantially lower than 138m measured by the MGD during Allen in 1981.

As previously mentioned, the setback distance is governed by site topography, it is therefore recommended that the storm surge levels that were computed in this analysis be used and a new setback distance of 30 metres, which is based on existing site topography, be adopted.

A report by Smith Warner International May 2005, on the required beach improvement works for the Palmyra Resort & Spa was commissioned as a separate study and is included in Appendix 1. This report will also be used as the basis for submission of a beach licence for the proposed foreshore modification works.

The main findings of the Smith Warner report (May 2005, Appendix 1) indicated the following:

> Significant effects on currents where found to be localized, in that, major reduction current speeds only occurred within the lagoon created by the coastal structures. However, this reduction of current speed did not adversely affect circulation and flushing, which was confirmed by the particle tracking process. If necessary, circulation and flushing could be improved by lowering the crest of the submerged breakwaters or the removal of the eastern submerged breakwater during the final engineering phase.

> The storm surge from these simulations (taking into consideration wave run-up) suggests inundation reaching as high as 4.2 metres above MSL which translate into a set-back of 30 metres.

The findings suggest that the eastern sector (Region 1) is predominantly an area of accretion, while the western sector (Regions 2 and 3) are areas of erosion.

The area considered during the benthic assessment is relatively healthy, although apparently under some stress from nutrients and sediments. There is substantial coral growth in the area, particularly in the shallow western regions, and along the eastern section approaching the rock outcrop/patch reef (approximately 80m offshore).

Giving consideration to the species present and relative health of the seagrass and corals in the area it is recommended that any construction or dredging activities be limited to the immediate nearshore area, within 50m of the shoreline. Every effort should be made to protect the patch reef on the western region of this sector, and during the construction of the proposed structures it is imperative that sediment barriers be maintained, and turbidity monitoring carried out to ensure the protection of the remaining seagrass beds and the corals. Heavy equipment should not be allowed to traverse the areas adjacent to the rock outcrop/patch reef.

4.2 BIOLOGICAL ENVIRONMENT

4.2.1 Terrestrial flora

The undeveloped areas of the Rose Hall property to the south of the main road are mainly ruinate pastureland interspersed with areas of disturbed dry limestone forest. Two large triangular areas on the White Witch Golf Course constitute the dry limestone forest remaining on the property. The margins of the dry limestone forest generally show signs of disturbance, with mainly shrubs occupying the dense undergrowth.

The site was cleared several years ago during the construction of the Ritz Carlton Hotel and can now be classified as secondary modified vegetative communities (Grossman *et al*, 1992). A berm was created from construction spoil during the Ritz Carlton construction and this is now covered with grass.

Plate 4.2.1 a: Open Grassland

Plate 4.2.1 b: Grassy berm resulting from excavated spoil from the Ritz Carlton Construction

Plate 4.2.1 c: Sea grapes behind the beach

The site proposed for the Palmyra Resort and Spa is dominated by open grassland with a few isolated trees, a bank of coastal vegetation and five (5) palm trees. The palm trees are rumoured to mark the burial site of some of the husbands of the legendary Annie Palmer, White Witch of Rose Hall, and these trees are to be kept for historical and cultural reasons. There are no significant vegetative issues to be considered on this site.

Plate 4.2.1 d: "Annie Palmer Trees" believed to be the grave site of Annie Palmer and three of her husbands

4.2.2 Terrestrial fauna

4.2.2.1 Birds

A field survey and literature research was conducted as part of the Strategic Environmental Assessment (Environmental solutions Ltd., 2004 a) to identify existing avifauna on the site. Historical information was also used from previous studies on the Rose Hall property.

Although the forested areas of the Rose hall lands support diverse avifauna populations, the grassy lands on the Palmyra do not support a significant bird population due to the absence of large feeding trees.

4.2.3 Marine Ecosystem

The marine area extending from the Wyndham Rose Hall Hotel to the Half Moon Hotel is quite uniform in its physical and biological characteristics. A fringing reef extends throughout the area, and is part of the north coast fringing reef system. It may be divided into two distinct areas – the back reef zone and the fore reef zone. These areas are not separated by an emergent reef crest; the back reef area slopes gently into the fore reef zone. The back reef zone is within 100 m of the shore, and is quite shallow.

4.2.3.1 Lagoon Area

All photographs have been scanned, labelled, described and then compiled based on the locations of each transect presented above. Tables and graphs are produced to look at the Abundance Rating of marine species observed and photographed.

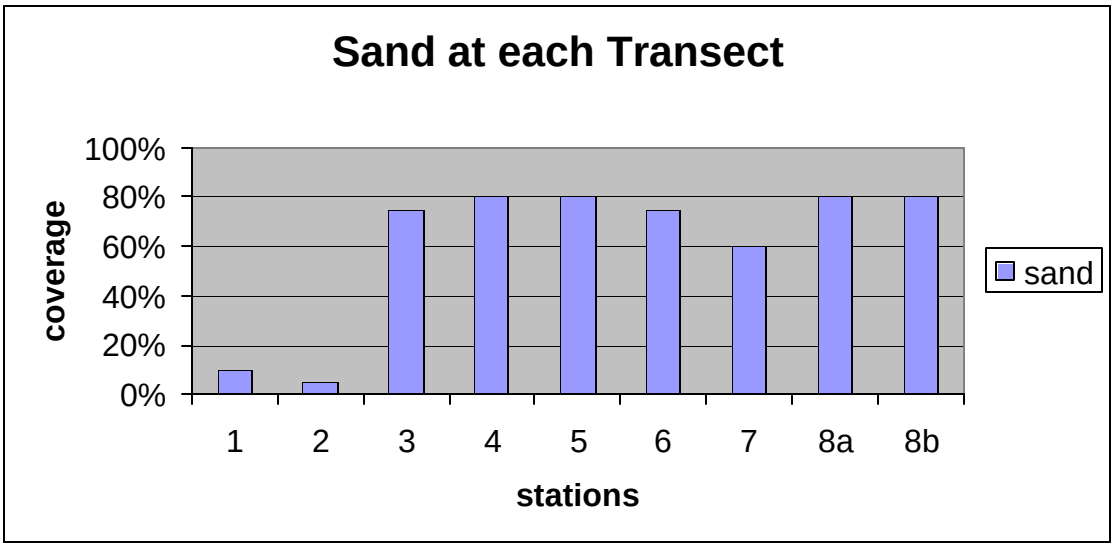
Table 4.2.3.1: Abundance of Species Observed

Transect Station Number	Abundance of species observed and material covering sea floor			
	(a) Sand %	(b) Seagrasses %	(c) Rock/ Coral Head %	(d) Algae %
1	10	0	80	10
2	5	0	90	6
3	75	5	10	10
4	80	5	5	10
5	80	5	5	10
6	75	0	10	15
7	60	30	0	10
8a	80	10	10	0
8b	80	10	10	0

(a) Sand

The sand on the main beach is coarse and of medium to large grain across the beach. A significant quantity of small stones is also present as a part of the coastline. The sand grain size in the middle of the beach bay area and along the line transects done at sea are much finer with a noticeable amount of sediment settling along the seafloor. This is coming mainly run off from storm water washing down soil and other loose fine limestone sediment.

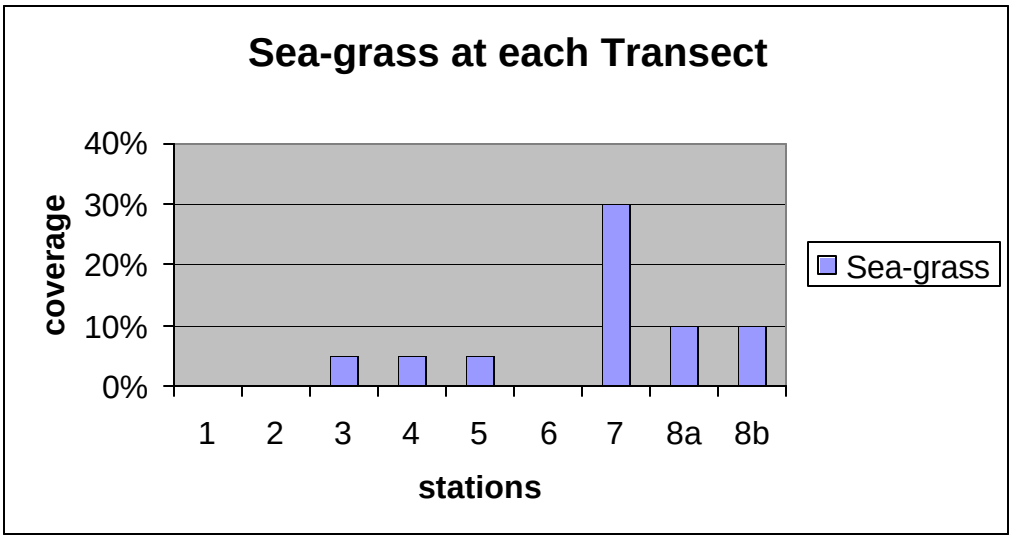
Figure 4.2.3.1 a: Sand at Each Transect



(b) Sea-grasses

Sea-grass (*Thalassia testudium)* beds are present in patches mainly along the inshore marine areas just off the beach crest. They are most abundant between 0.8m to 2m depth of water, and wash up in a significant amount along the shoreline dead/decaying.

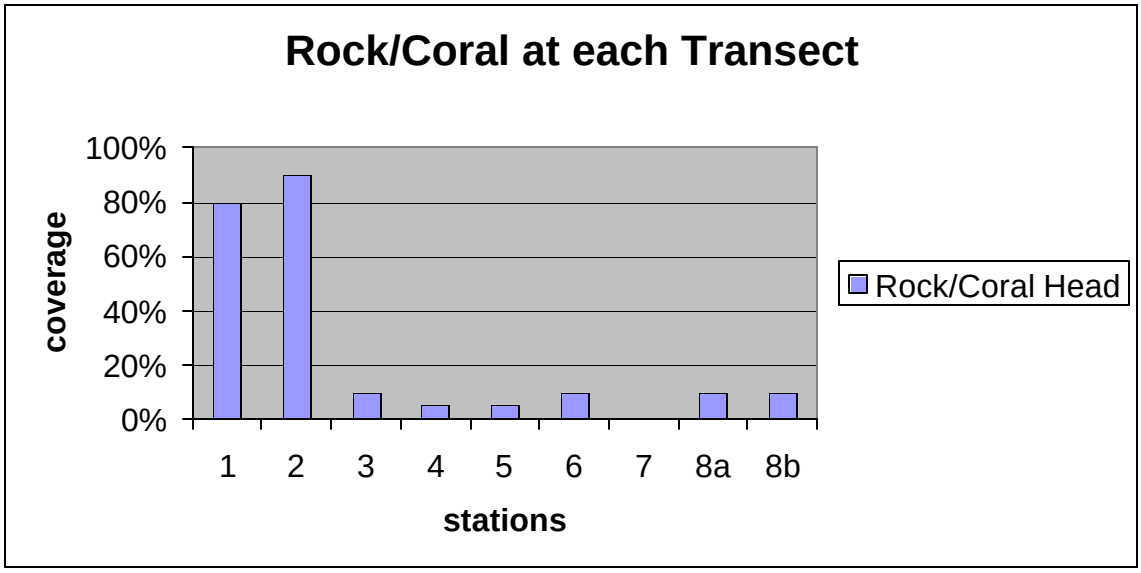
Figure 4.2.3.1 b: Seagrass at each Transect



(c) Rock/Coral Heads

Just off the cliff at the present main office building and to the western end of the property, the seafloor is almost covered with large boulders and dead coral. Further towards the north breakwaters are a few dispersed coral heads *(Monstastrea annularis, Porite astereoides and gorgonian coral –Pterogorgia guadalupensis),* which is observed to be in scattered in rubble.

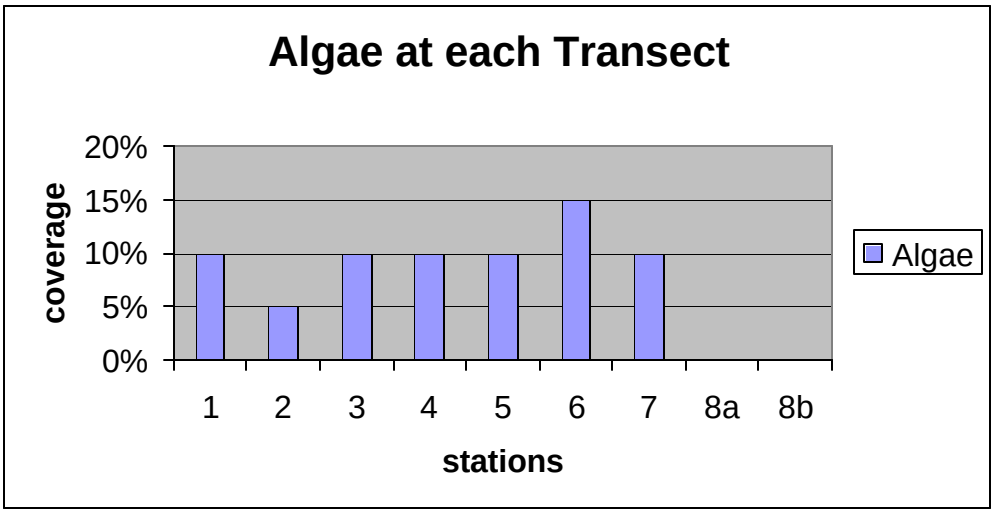
Figure 4.2.3.1 c: Rock/Coral at each Transect



(d) Algae

Algae cover is noticeable at the inshore stations, but this coverage dispersed and represents no more than approximately 10% at any one station. The dominant species observed is the fleshy brown algae and filamentous turf algae. Most commonly seen are *(Sargassu and Dictyota).* Green calcareous algae *(Halimeda, Penicillus and Udotea)* are seen in smaller quantities.

Figure 4.2.3.1.d: Algae at each Transect



(e) Other

Small Reef Fishes and several Sea Urchins are other marine organisms also observed in area that was surveyed. These specimens were observed dispersed across the sea floor whilst snorkelling and their total numbers were not considered significant compared to above four (4) group. However, their importance and significance in creating an ecological balance cannot be overshadowed. Several Reef Fishes (*Parrotfish, Damselfish Doctorfish and Wrasses, approximate average length of 15-30cm)* were seen occasionally at the stations at sea amongst isolated coral heads and a few sea urchins (*Diademia sp. and Tripneustes sp.*) were seen dispersed in the sea-grass bed patches.

A freak storm had occurred in the Montego Bay area a few days before the survey was done. A huge volume of fine sediment was deposited into the beach bay area, transported by the runoff water, resulting in the inshore

waters being murky for up to 200m - 500m out to sea. The proposed swimming area for the main beach was heavily impacted.

Areas identified with high rock/coral head cover on the seafloor pavement should be considered in the planned dredging activities to construct the groynes and the crest of the proposed main beach area.

4.2.3.2 Back reef zone

The back reef is characterized by shallow (1.5 to 4 m), flat or gently sloping pavement covered by a thin layer of sand. Closer to shore the pavement is covered by a deeper layer of sand which merges with the beach. The sand in the back reef zone is white and of fine to medium grain, and covers approximately 50% of the substrate. The sand appears to contain fine limestone sediments carried by run-off water from further inland.

This zone is dominated by fleshy brown algae and filamentous turf algae. Macroalgal cover is approximately 30%. *Sargassum, Turbinaria* and *Dictyota* are the most commonly seen. Calcareous green algae such as *Halimeda, Penicillus* and *Udotea* also occur in smaller quantities, as well as the red alga *Jania.* Crustose coralline algae is infrequently seen, mainly because of sedimentation throughout the area. Fleshy macroalgae were relatively tall,

with heights of 15 to 25 cm. Calcareous macroalgae were generally less than 10 cm in height.

Patch reefs and isolated coral heads characterize the coral of this area. Live hard coral cover is generally low, at less than 5%. The most commonly occurring scleractinians are *Siderastrea radians*, *Montastraea annularis* and *Porites astreoides.* Isolated small heads of *Montastraea cavernosa*, *Siderastrea siderea* and *Diploria strigosa* are also present. Coral rubble is scattered throughout the area, and sediment- or algal-covered standing dead colonies are frequently seen. The gorgonian coral *Pterogorgia guadalupensis* is common in this zone, as well as *Eunicea mammosa* and *Pseudopterogorgia sp.*

The fish community is mainly composed of small reef fish, and is dominated by parrotfish, doctorfish, damselfish and wrasses. Fish are generally not very numerous in this zone. A large proportion of the community is composed of juveniles, with the remaining mature fish being small, at an average length of =20 cm.

Small patches of sparsely growing seagrass (*Thalassia testudinum*) were occasionally seen in the back reef area, as well as a few urchins (*Diadema sp*. and *Tripneustes sp*.). Encrusting sponges were seen occasionally on dead coral heads, and numerous mounds of sand created by *Arenicola sp.* were distributed throughout the deeper sand patches.

4.2.3.3 Fore reef zone

The fore reef zone is made up of well-developed spur and groove formations, oriented with their long axes parallel to the prevailing currents. This zone occurs at depths of 5 to 12 m, with the tops of the spurs at depths = 2 m. Large sand channels separate the spurs, the sand being coarse, and made up of disintegrating *Halimeda* fragments.

Macroalgal cover on the fore reef is relatively low, at approximately 30%. Crustose coralline algae occur in patches covering dead coral substrate, with an overall cover of 10%. Turf algae are common on exposed hard substrate. The macroalgal community is mainly composed of brown algae such as *Dictyota, Sargassum, Stypopodium, Lobophora* and *Turbinaria*, and green algae such as *Halimeda, Ventricaria* and *Caulerpa*. Calcareous macroalgae were generally short, with heights of 3 to 8 cm. Fleshy macroalgae were taller, with an average height of 15 cm.

Live coral cover is approximately 20% on the fore reef, with colonies of approximately 20 to 40 cm diameter. A few colonies were seen which measured more than 1 m in diameter. *Montastraea annularis, Porites astreoides, Millepora sp., Agaricia agaricites* and *Siderastrea sp.* are the most commonly seen. Coral recruits (colonies < 2 cm in diameter) were occasionally seen. Old coral rubble occurs throughout the site, indicating that this area suffered severe damage from storms. At site 2, (Wyndham Hotel), a large stand of *Acropora cervicornis* was found. The majority of the

stand appeared to have died a long time ago, but small areas were still healthy.

Fish were numerous at the fore reef sites, and were mainly scarids (parrotfish), acanthurids (doctorfish), pomacentrids (damselfish) and labrids (wrasses). Mixed schools of grunts and snappers were occasionally seen. The parrotfish present were juveniles as well as initial and terminal phases. The mature fish were not very large, most being less than 20 cm long. Other commercially important fish were present in small numbers, such as hogfish, spanish hogfish, bar jacks, graysbys and goatfish. The area shows signs of over-fishing due to the relatively small numbers of fish seen, and the predominance of juvenile and small mature fish. A few fishermen were seen in the area, as well as the occasional fish pot.

Numerous *Diadema* were present on the reef, with densities of 4 m^2. The presence of these herbivorous echinoderms aids in the suppression of macroalgal growth, providing clear hard substrate on which coral larvae may settle. These urchins are important in this area due to the relatively low numbers of herbivorous fish present.

Mounds belonging to the lugworm *Arenicola sp.* were frequently seen throughout the sandy grooves. A few species of sponge were also seen, particularly the encrusting form of the brown variable sponge. Gorgonians are fairly common in this zone, with four species occurring

frequently. The corky sea fingers and the grooved-blade sea whip were seen most regularly.

4.2.3.4 Reef at Palmyra

The reef areas at Wyndham Rose Hall and Ritz Carlton were studied during the Strategic Environmental Assessment of Rose Hall Developments Master Plan in April 2004 (environmental Solutions Ltd., 2004a). This study included two sites at Wyndham Rose Hall which forms the eastern boundary of the Palmyra property. At the first site a depth of 4.5 m was recorded, and is part of the back reef zone. Approximately 30% of the substrate is covered in sand. Live scleractinian coral cover ranges from 5 to 10%, and gorgonian cover is approximately 5%. Macroalgae covers the remaining 55 to 60% of the substrate. The area is mainly flat pavement with scattered shallow depressions. The coral heads are generally isolated rather than occurring in an organized structure. The majority of the coral heads seen are long dead, probably due to storms or anthropogenic effects such as over-fishing and nutrient pollution.

At the second site, in the fore reef zone, the depth ranged from 6 to 9 m, and is made up of well-developed spurs and grooves. The tops of the spurs rise to depths of 1.5 m. Live hard coral cover increases to approximately 20%, and sand cover decreases to approximately 20%. Crustose coralline algae occupy 10% of the substrate, while macroalgae covers 25 to 30%. The remaining 20 to 25% is covered by

gorgonians, sponges and other benthic cnidarians. *Diadema* are common at this site.

At Ritz Carlon, which forms the western boundary of the Palmyra property there is a back reef site which slopes gently from 1.5 to 4.5 m depths. Sand cover is high, at 40 to 50%, and is interspersed with sparsely growing seagrass blades. Macroalgal cover averages 30% cover at this site, and turf algae is abundant. A number of gorgonians occur here, but live hard coral cover is low. The dominant scleractinian at this site is the small *Siderastrea radians*.

A section of the reef at the Palmyra property was studied, in the fore reef zone. This area is approximately 7.5 m deep. This site displays the spur and groove formation, with the long axes oriented in a south-west to north-east direction. The sand channels or grooves are particularly wide in this area, and coral rubble was quite abundant.

Plate 4.2.3.5: Eastern Beach at Palmyra

4.2.3.5 Turtles

Turtle nesting is known to occur from other beaches in Rose Hall, particularly Wyndham and Iberostar. However, no turtle nesting has been reported from this beach at Palmyra. The beach profile is narrow and steep and pebbly to the east, with concrete slabs from the sea wall of the old north coast road to the west. The beach profile is not likely to encourage sea turtle nesting.

Sea turtles are protected by both national and international legislation.

4.3 SOCIO ECONOMIC ENVIRONMENT

4.3.1 The Site

The site for the Palmyra Resort and Spa development site is currently occupied only by the Sales and marketing Office for Palmyra Properties Ltd. This building will be used within the development as a Club House.

The land is owned by Rose Hall Developments Ltd. The socioeconomic characteristics of the site therefore lie in the regional setting and characteristics of the surrounding communities.

4.3.2 Regional Setting

The Palmyra Resort and Spa site sits between the Wyndham Rose Hall and the Ritz Carlton. A long stretch of coastal flatlands lie to the west of Rose Hall Beach Club extending to Sea Castles condominium and Success Beach, the eastern boundary of the Rose Hall Master Plan site. On the landward side across the main road and to the east lies the sprawling community of Lilliput and Barrett Hall further east. Barrett town lies inland from Success, and could be considered part of the sphere of influence of the project.

The project is located within the larger regional setting of Rose Hall Developments and the Greater Montego Bay Area. Rose Hall Developments has been described above in Chapter 1, and it is important to reiterate that the development sits amidst significant tourism development

extending from Montego Bay through Falmouth and ultimately Ocho Rios. As indicated in Section 1.2 of this report conversion of the estate lands to urban/resort/residential uses has been occurring since the late 1960s when the Rose Hall Great House was restored as a major tourism attraction.

The estate forms part of the Greater Montego Bay Area (GMBA) for which a development plan to the year 2014 was drafted and eventually promulgated by the Grater Montego Bay Redevelopment Co. (GMRC) in 1997. The GMBA is the residential and economic core of St. James and covers an area of 52,168 acres extending over a radius of 19 kilometers from Montego Bay to include 38 residential districts in 42 planning areas. The 2001 Census of Jamaica refers to the Montego Bay **"Special Area",** which essentially incorporates the GMBA. The area has been zoned for **mixed resort commercial /residential use.**

Tourism is posited as the growth industry and economic mainstay of the GMBA. Key development plans within GMBA relate to construction and expansion of the hotel, resort and attraction infrastructure, expansion of the Donald Sangster International Airport (SIA), now operated by MBJ Airports Ltd, expansion of shipping and the Freeport, and business expansion within the Freezone.

The economy of Montego Bay and the GMBA has changed over the last fifty years from being a trading post serving the western end of the island as a largely agricultural town to being a tourism resort economy. The area has about fifty percent of Jamaica's tourism accommodation and accounts for about 35% of the national tourism earnings. Currently

the GMBA has about 4,200 tourist rooms with a mix of hotels, guest houses, cottages and apartments. About 50% of available rooms are found in hotels with 200 or more rooms that represent about 13% of all accommodation types. The economy of the GMBA represents about 6% of national GDP.

Figures provided by the Jamaica Tourist Board, indicate that Montego Bay accounts for 30.9% of visitor arrivals to Jamaica, and that the four main hotel properties lying within the Project area account for 37.4% of visitors to Montego Bay.

The Project, must therefore be regarded as significantly positioned, in relation to Montego Bay's tourism product.

4.3.3 Population

The 2001 Census indicated a population of 174,120 for the parish of St James, and 55% (or 95,940 persons) is located in Montego Bay and its immediate environs (referred to collectively as the Montego Bay Special Area). The population of the GMBA was estimated at 98,000 in 1995 with an annual growth rate of 2.5%. About 80,000 workers are estimated to commute and work within the GMBA on a daily basis, and population numbers rise with the introduction of cruise ship and stop-over visitors. Unemployment rates in the GMBA is estimated at 17% with 65% of current economic activity consisting of family type businesses.

In the Montego Bay Special Area, persons between the ages of 0-39 years account for 73% of the population, and those in the 15-39 age cohort account for 40%. STATIN data and community based interviews, confirm that this age

distribution is also representative of that found in the communities within the project area. The Project will therefore be located within and impact, a predominately young population.

The Dependency Ratio, is a STATIN indicator of the degree of dependency on the 15-64 age group by the rest of the population. This ratio for the Montego Bay Special Area is 61.23, which means that for every 100 persons within these communities, 61 are assumed dependent on the rest. It is very likely that the Dependency Ratio for the poorer communities neighbouring the Project area, have this same value.

Of additional consideration is the level of education within the project region. Educational attainment figures are at present available only for the parish (2001 census), but as Montego Bay is the major centre these data could be considered somewhat representative. The Census reports educational attainment for the population 15 and over as 25% Primary, 56% Secondary, 3% University and 9% Other Tertiary.

The hospitality sector currently absorbs skills across the educational spectrum. However entry requirements for employment in the type of upper scale properties found within the Project area are increasing. Typically, candidates applying for entry level supervisory and managerial positions to these hotels, can offer tertiary, including post graduate qualifications. Similarly, it appears that the demand for most domestic staff, could, if required, be met by applicants having completed some secondary education. Educational levels in the surrounding communities could not be

ascertained, but observation seems to indicate lower levels of achievement and therefore marginal skill offerings.

Employment possibilities within the project area, and in associated developments is a vexed issue as some persons seem to feel "outside" the resort developments. The implications for community relations suggest the need for involvement of the relevant government agencies and tourism interests in facilitating opportunities for improved synergies.

One such initiative could be some form of collaboration between such stakeholders as, the Montego Bay Chamber of Commerce, The Urban Development Corporation, The Jamaica Tourist Board and Rose Hall Development Ltd. to plan and initiate community tourism projects, that can link, innate, community based entrepreneurial skills, to the Project. Currently the Rose Hall Development Ltd, has a school feeding program, which supports several schools in the neighbouring communities to the value of about J$900,000 annually. Other individual properties within the Project area also have out reach programs. A coordinated approach, which places greater focus on creating income earning potential, may be what is required into the future. The objective would be to begin bridging the major socio-economic gap, separating the Project from its poorer neighbours.

4.3.4 Settlements

Settlement within the project area is dominated by Lilliput, a major settlement which has spread over the years on the hills south of the main road.

Communities	Population	% of Total
Lilliput	4,865	58.32
Barrett Town	1,441	17.27
Barrett Hall	1,100	13.19
Spot Valley	531	6.36
Cornwall	405	4.85
TOTAL	**8342**	**100**

Table 4.3.4: Population of Surrounding Communities

4.3.4.1 Lilliput

Lilliput is a low and low middle income, residential squatter community. The community is served by some basic schools, but has neither a public health clinic, or police post. Social infrastructure includes a community playing field and churches. The size and proximity of this settlement to the project requires planning for effective community relations.

Population & Demography

The population of Lilliput in 2001 was 4,865 or about 30% of the Montego Bay Special Area (STATIN). The population has exploded over the last 10 years, increasing from approximately 1,087 in 1991 to its present figure, or by some 347%. This explosion is probably attributable to two main factors. Firstly the overall net migration into St. James over the period, which it can be reasoned has been focused on the Montego Bay Special Area. Secondly, diminishing

coastal residential land space and increasing land values, have acted as engines of growth for this “100% squatters community”. Increased tourism activity, better transportation and the eastward economic expansion of Montego Bay, have created both real and perceived employment opportunities, to which internal migration has responded. The population is evenly split with respect to gender (50% each).

The largest segment of the population is in the age group 0-39 years accounting for over 77% of the population. The population is therefore significantly young, this ratio being higher than that for the Montego Bay Special Area (73%). Assuming that the population exhibits the same characteristics as the Montego Bay Special Area, the dependency ratio is likely to exceed 61%, meaning that 6.1 persons out of every 10 are dependent on the remaining population. The official ratio of female headed households is not available, but based on limited interviews, it is reported to be as low as 30% of all households. If correct this either points to atypical stability in family relationships, or a high proportion of adult male households.

Land Use and Livelihood

The main land use is residential. Small scale trading activities are carried out mainly in food, retail, and household services. In common with squatter communities elsewhere, main occupations seem to be based on hustling occupations, and domestic and artisan skills supplying services both within and outside of the community. Livelihoods are mainly derived from construction labour,

domestic services to tourism, and craft. Under- employment or outright unemployment is evident. There is no visual evidence of a serious tourism product being offered or developed within the community.

Water Supply

Water supply is partially metered and is sourced from the Martha Brae water supply system. It is tapped from the 24 inch NWC main on the coast road, which brings water from the Martha Brae treatment plant. Residents interviewed reported that water supply is good.

Public Health & Safety

Absorption pits (30%) and pit latrines (70%) are the main sanitary conveniences used. Given the limestone bedrock, sewage disposal is important not only to health of the community but also coastal water quality. The direct consequences for the hospitality sector and fisheries are stark. Garbage disposal & collection is undertaken by Western Parks and Markets (WPM). However, littering is much in evidence, throughout the community. The likely consequence of this is that solid waste, during rain events, is being carried into the sea. Investigations of water quality and coastal conditions described above (Sections 4.1 and 4.2) suggest a direct link between these practices and water quality and aesthetic observations in the coastal waters.

Transportation & Traffic

The main mode of public transportation for community members is by route taxis. The project will therefore impact the community, in that it can be expected to add to the growing traffic congestion on the main road into Montego Bay. Lilliput itself, has three entrances off of the main road into the community.

Developments Underway

The Urban Development Corporation (UDC) primary school is currently under construction at the coastal road entrance close to Wyndham Rose Hall. The other major development is the Iberostar Rose Hall Resort and Spa, a three phase, three hundred room facility, which is currently under construction beside the Rose Hall Beach Club. No other major development plans are associated with the community.

4.3.4.2 Long Bay Fishing Beach

This small fishing beach is located at Long Bay in Greenwood, and is marked by a couple of vending stalls that have traditionally sold conch shells. It is not a licensed beach, but the few fishermen using it, claim to be licensed. The beach provides a livelihood for about 12 fishermen, and berths 6 boats, all of which were on the beach at the time of the survey. Unlike Success Beach and Grange Pen, there are no structures on the beach. The fishers estimate that only 5 business places and a small number of residents provide regular patronage. The stalls that sell conch shells

and curios are not connected to the beach. The shells are imported from Savanna-La-Mar.

It is evident, and the fishermen confirm, that the beach has been in decline for many years. About 70l pounds of fish per fisherman is landed per week. This is less than a quarter it is claimed, of what would have been landed in the 1980's.

Long Bay is of interest, because it marks the point, east of the Rose Hall Development area at which the fishers do not associate the fall off in fish catch with the construction of the Ritz Carlton. Instead they blame over fishing the area, and the use of half-inch seine nets, and spear guns, by irresponsible fishers as the main reasons.

The fishermen regard the tourism development project positively and take pride in the evident growth and importance of Montego Bay as a tourist destination. They are uncertain as to the potential impacts on Long Bay of the Project, but this is not a threatening issue to them.

Unlike the other beaches, because of the absence of dwellings, and the close proximity to supporting community infrastructure, the issues of waste management and sewage disposal on the beach, is minimal. However a nearby failed marina at the western end of the bay, shows evidence of being used as a community dump. The fishing beach poses no threat to the Project, but could benefit from any increased community employment that the Project provides.

4.3.5 Infrastructure

4.3.5.1 Water Supply

Potable water is supplied to the GMBA from the Great River and Queen of Spain's Valley water treatment plants with a

combined output capacity of 32 million gallons per day supplying current demand of an estimated 24 million gallons per day. It is expected that water supply will be adequate to meet the demand of approximately 1.2 million litres per day required for the hotel operation.

Basins	Currently Supplying	Projected Demand 2015	Reliable Yield
Great River	21.96	32.91	381.20
Martha Brae	1.17	3.34	89.0
Totals	**23.13**	**36.25**	**470.20**

Table 4.4: Water Resources Available to St. James (Millions of Cubic Meters per Year (MCM/Year)

4.3.5.2 Sewage

Sewage from the Palmyra Resort and Spa development will be treated through the new sewage treatment plant established by the Rose Hall Utility Company. The treated effluent from the wastewater treatment facility will be pumped into an irrigation distribution system for beneficial reuse and sale to customers as irrigation water. It is estimated that the daily average flow from the existing hotels, resorts, and commercial establishments would be 350,000 gallons per day with a potential future flow of 1,000,000 gallons per day.

The wastewater treatment facility is an extended aeration system which has benefits of ease of operation and maintenance, more capable handling of spikes in flow and

contents and less generation of solids. The company would build operate and maintain a wastewater collection force-main which would extend along the eight mile stretch of coastal highway. Details of the collection system, irrigation system and wastewater treatment system are given in Appendix IV.

4.3.5.3 Solid Waste Disposal

The Retirement Waste Disposal site which is the official solid waste disposal site for Montego Bay is currently being upgraded to function as a landfill site. The site receives about 80 tonnes of solid waste per day and serves the parishes of St. James and Hanover. Palmyra Resort and Spa will need be serviced by Western Parks and Markets and the official municipal system.

4.3.5.4 Electricity and Telecommunications

The Jamaica Public Service Company supplies electricity to the GMBA, and recent improvements at the Bogue plant have greatly enhanced power supply to the GMBA. It is anticipated that power supply will be adequate to meet the needs of the development. Energy efficient operations should be integrated into the development plans for all major energy users of the resort.

The telecommunications services are provided to the GMBA by all the service providers in Jamaica, and data transfer services are provided by the Montego Bay Digiport facility. Conferencing facilities will require efficient telecommunications.

4.3.5.5 Transportation

Montego Bay is the major transportation node for western Jamaica. Ground transportation for commuting non-resident population, local residents and tourists is largely by privately owned taxis and mini buses. Larger minibuses and tour buses transport passengers out of the city. The North Coast Highway Improvement Project (NCHIP) includes as Segment II upgrading of the link between Montego Bay and Ocho Rios. This improvement includes development links that bypass the towns of Falmouth, Duncans and Rio Bueno, and will function as an improved transportation corridor.

NCHIP is scheduled to begin work in the area by the end of 2004, and therefore consultation with the Project Managers is crucial to enable effective synergy between construction requirements of the many developments within the area. The design of the main entrance to the project, must provide a smooth interchange between the project and the main bound traffic

Recent road improvements within the GMBA has improved traffic flow and eased traffic congestion, and NCHIP is expected to further improve traffic movement after completion of road works.

The Donald Sangster International Airport serves as the hub of the national airline, Air Jamaica, and is the larger of two international airports serving the island, transporting most of the Jamaica's tourists to the island. The airport was recently privatized under a development agreement and an expansion and development plan is underway. Development plans are underway for the Montego Bay Freeport, which is a major transhipment container port, with cruise berths. The

Freeport is associated with the Montego Bay Freezone, which is also expected to increase business enterprise. Road traffic east of Montego Bay associated with these operations is therefore expected to increase.

4.3.6 Archaeological & Cultural Heritage

The Rose Hall Estate and environs have a rich archaeological and cultural heritage which has been somewhat tapped as part of the tourism product. However, there is considerable potential yet to be developed and one such opportunity for the project is the Greenwood Great House, already an attraction, but which is in close proximity to the project through Barrett Hall. This Barrett Browning Great House at Greenwood is likely to become an important attraction for the project, given its ease of access.

Mount Zion, southwest of the project in the Rose Hall Development area, was a free village. Its imposing Church and graveyard were established in the year of emancipation. The church bell is inscribed with the text preached on Emancipation Day.

Other estate related, archaeological & cultural heritage elements exist and add to the general attractiveness of the area for tourism. Such elements should be surveyed and preserved and with the help of both the Project and the National Heritage Trust, be made available to deepen the potential for inclusion of the surrounding communities in the benefits of the Project.

CHAPTER 5: POTENTIAL IMPACTS AND MITIGATION MEASURES

5.1 Potential Impacts

This section identifies the potential impacts, and suggested mitigation measures, as related to the proposed Palmyra Resort and Spa development. Findings of the assessment are presented according to site preparation, construction and operation phases. The impacts have been analysed in the context of significant positive or negative, direct or indirect, long term or short term. The impacts are presented in Tables 5.1 and 5.2.

The following main issues have been identified.

5.1.1 Land Use Management

The site is currently undeveloped with not much vegetation to be cleared.

5.1.2 Drainage and run-off

Erosion mitigation with respect to proximity of the development site to coastal/marine environment and reefs is the major consideration. Consideration must be given to drainage of the site through percolation, overland flow, and existing natural drainage channels paying particular attention to the cumulative impact of increased storm water runoff from the site. The drainage plan which has been approved by the NWA will be implemented, and should prevent flooding on the site. Drainage to the property from the

southern watershed area should be improved with the implementation of the NCHiP drainage plan for this area and maintenance of drains.

The drainage plan for the property is designed to prevent flooding on the property. This is an aspect of "internal" drainage, (internal to the property boundaries). However, what is likely to impact the project is "external" drainage from the watershed area south of the road, beyond the property boundaries, based on recent rainfall events which resulted in the flooding of the Ritz Carlton Hotel, immediately to the west of the Palmyra property.

The main mitigation measures that will be expected to prevent flooding on the Palmyra property from "external" drainage will be:

1. The improved road works under the Northern Coastal Highway Improvement Project (NCHiP) will see the installation of two main drains of increased capacity, to accommodate flow from events with a 25 year return period.
2. Maintenance of these drains, and the natural drainage systems leading into them, is required, as these channels should be kept clear and free of debris.
3. Rose Hall Developments Ltd. is willing to continue dialogue with the Task Force created to address relevant issues in the Montego Bay area, including flooding, and to be involved as appropriate with any efforts to improve watershed management in that area.

Rose Hall Developments Ltd. has already proven their commitment by agreeing to provide rain gauges for the Meteorological Service to use in the area.

5.1.3 Terrestrial ecology

No major impacts are expected on the terrestrial ecology. The palm trees on the property are to be retained, for heritage value.

5.1.4 Marine ecology

Sea Turtle nesting has been reported from the beaches in the Rose Hall area no reports have been received of turtles nesting on this beach, therefore no mitigation measures have been recommended.

5.1.5 Coastal and marine environment

The back reef area is quite shallow, with numerous protruding patch reefs. These are very close to the water's surface and may be hazardous to water sports activities. The area must be properly marked before these activities are offered.

A report on the proposed beach improvement works by Smith Warner International (May 2005, Appendix 1) identifies three main areas of potential impact:

4. Sediment transport
5. Wave processes
6. Water quality and circulation

Sediment Transport

Impacts on sediment transport are expected to be negligible during the construction phases of this project, however, they will become more noticeable in the post construction phase. Since the net sediment transport is to the west, the eastern end of the permeable structure will reduce the sediment transport rates. The reduction in transport rates will be caused by accretion of sand on the eastern side of the structure. However, in the long-term perspective, sand will no longer be deposited at the structure but will be transported past the structure; therefore, the initial transport rate to the west will likely be restored.

Wave Processes

In the past, waves during storm surges have had serious negative impacts on the beach and adjacent properties. The construction of the coastal protective structures will reduce the intensity of these waves on the shoreline, and will therefore have an overall positive impact on the beach stability.

Water Quality and Circulation

The main impacts on coastal water quality will arise during construction as a result of sedimentation. While, the impacts on water circulation are expected to be negligible during the construction phase of the project. The potential sources of contamination have been identified as:

• Silt from rocks being placed in the works; and

• Fuel and lubricants from construction equipment.

The potential for short-term degradation of nearshore water quality exists if there is heavy rainfall and sedimentation during rock placement. These impacts are expected to be relatively limited in extent, and should only persist for short times during the construction phase. Measures that should be employed to mitigate these impacts include:

• Scheduling the construction work for during the dry season;

• Specifying and selecting rock material with a minimum of fine material. Armour stones for the revetment and breakwaters should be washed properly before being placed in the nearshore water;

The construction schedule should be optimized to minimize the residence time of material stockpiled on site;

• Fueling and servicing of construction equipment should be carried out away from the shore and river banks, and special bounded areas should be provided for these activities; and

• A silt barrier should be installed and maintained during the nourishment and construction exercises.

The hydrodynamic modeling conducted implies that there should be no adverse impact on water quality and circulation caused by the development after construction.

5.1.6 Community Relations

Exclusion from employment opportunities on projects that have already taken place within the Project area is a complaint that fuels tension between community residents and project development within the Greater rose Hall area. The perception is that very few jobs are directed towards these communities, either during hotel construction or post construction. While complaining that the tourism sector does not absorb sufficient workers from the communities, these communities still acknowledge the sector as being their most important source of employment. Therefore, domestic services, construction and hustling occupations are very important.

The project can be expected to bring employment and income benefits, to the nearby communities, and in exchange benefit from construction labour skills, and existing or trainable domestic occupational skills.

The project may aggravate the social pressures on the community, to the extent that new low skill employment generation, perceived and real, will likely increase the residential squatting demand unless affordable staff housing is provided. The relevant government agencies, or the private real estate development sector, with incentives if necessary, should be mobilized to do this.

5.1.7 Traffic patterns, entrance and exits and connection to the North Coast Highway

The project will have direct access to the main north coast artery from Montego Bay to Ocho Rios. Traffic management will require dialogue with the National Works Agency (NWA) and the project managers of NCHIP Segment 2, to facilitate safe intersection and merging of traffic in the vicinity of the project.

Discussions have already been held with the NWA regarding entrance / exit and the provision of two traffic signals.

5.1.8 Physical carrying capacity of proposed infrastructure and services

Total water management, including potable supply, sewage disposal and storm water drainage, energy, and internal pathways are the major considerations. Carrying capacity appears to be adequate given the proposed Rose Hall Utility Co sewage treatment facility and the Montego Bay water supply infrastructure. Drainage infrastructure will be designed to take account of the projected stormwater flows.

5.1.9 Social Amenities

Social amenities within the project setting are very limited. The Resort will provide its own amenities and the surrounding communities have limited facilities. There will be limited impact of the project on the surrounding areas' utilities or social amenities.

5.1.10 Solid Waste Management

Solid waste must be disposed of properly particularly when vegetation is cleared. The resort will be part of the wasteshed of Western Parks and Markets and Retirement is the official waste disposal (landfill) site. Construction spoil and site clearance material will need to be carefully bundled for collection and disposal at the approved site.

During the operational phase the project should seek to employ waste reduction initiatives, e.g. composting of organics, recycling/reuse, minimise packaging etc., so as to reduce the volume of waste to be collected and transported to the landfill. Cost savings can be realised and coastal water quality must be protected from solid waste disposal.

5.1.11 Sewage Treatment

Sewage treatment will be handled by the Rose Hall Utility Company's sewage treatment plant. An application for the construction and operation of a sewage treatment plant was submitted and approved by NEPA, in 2004. A licence was granted for the treatment of sewage to the Rose Hall Utility Co. Palmyra Resort & Spa will not be discharging treated or untreated sewage effluent into the coastal waters. There are no anticipated negative impacts from sewage discharge.

The specifications for this licenced sewage treatment facility is given in Appendix IV. Treated effluent will be stored at Nursery Lake (capacity 33 million gallons) for reuse in the irrigation system.

The Rose Hall Utility Company sewage treatment facility includes an irrigation component. During periods of heavy rainfall when irrigation is not required, the storage facilities including Nursery Lake will be utilized. The golf courses to the south of the property will allow for more percolation of water than the paved developed areas on the north side of the main road.

Table 5.1: Natural Environment – Potential Impacts, Cumulative Impacts and Mitigation Measures

Environmental Aspect	Potential Impacts	Mitigation Measures
Hydrology and Drainage	***Site Preparation & Construction*** Paving of open green space will reduce percolation and may increase surface run off following rainfall events. This is a permanent irreversible impact which could be potentially negative. NEPA has specifically raised drainage as an issue for consideration. The Ritz Carlton to the west of Palmyra has suffered from flooding during heavy rainfall events, with an incident as recent as April 2005. The cause of the flooding was attributed to inadequate drainage capacity and blocking of drains by solid waste and debris.	1. Storm water drains will be designed to prevent ponding and flooding of the property as well as sheet flow across the site. 2. All existing drainage lines, and specifically the dry gully, must be kept open with no obstructions built within these lines. Culverts and drains should be designed to channel surface run-off into existing drainage lines. **These mitigation measures are the responsibility of the developer.** ***Operation Phase*** ***Internal Drainage*** During the operation phase the mitigation measures incorporated in the engineering design should prevent problems of ponding, and facilitate surface run-off.

Table 5.1: Natural Environment – Potential Impacts, Cumulative Impacts and Mitigation Measures

Environmental Aspect	Potential Impacts	Mitigation Measures
	Operation Phase Flooding at the Ritz Carlton resulted in closure of the facility for a 3 month period.	Scheduled inspections and maintenance of drainage channels is critical. These mitigation measures are the responsibility of the developer. ***External Drainage*** The existing drains under the main road are inadequate. The Northern Coastal Highway Improvement Project will result in an increase in capacity of the drains and this should help to alleviate the type of flooding experienced in May 2005. **These mitigation measures are the responsibility of the NCHIP and NWA.** Rose Hall Developments Ltd. and Palmyra Resort & Spa are willing to engage in discussions with relevant government agencies in an effort to address the issues of poor watershed management which affects drainage systems external to the site, but that have the potential to directly impact the site. This would include liaison as appropriate with the

Table 5.1: Natural Environment – Potential Impacts, Cumulative Impacts and Mitigation Measures

Environmental Aspect	Potential Impacts	Mitigation Measures
		established Task Force. Rose Hall Developments Ltd. has already been a part of this initiative through a commitment to provide rain gauges for the Meteorological Services Department, to install in the area.

Table 5.1: Natural Environment – Potential Impacts, Cumulative Impacts and Mitigation Measures

Environmental Aspect	Potential Impacts	Mitigation Measures
Hazard Vulnerability	***Site Preparation and Construction*** Impacts during site preparation or construction relate to the effect of flood events and stormwater run-off on the project site and surrounding areas. Flooding is a major natural hazard to be considered and the major impact is derived from the effect of heavy runoff. Tropical storm or hurricane force winds will induce flying debris and particles from stored materials and partially finished buildings. With respect to man-made/technological hazards, accidents can occur as a result of construction activities directly on-site and as a result of activities off-site, such as transportation of equipment and materials.	1. Site preparation and construction schedules should take account of the traditional rainy season between May and October, and of the hurricane season from June to November, during which tropical systems sometimes bring flood rains and hurricane winds. Extraordinary tropical systems have also caused problems of supersaturated soils, so that schedules should factor this eventuality. 2. Buildings should adhere to hurricane and earthquake resilient design standards. 3. A safety management plan including traffic handling and equipment management procedures should be developed as part of the construction scheduling. **These mitigation measures are the responsibility**

Table 5.1: Natural Environment – Potential Impacts, Cumulative Impacts and Mitigation Measures

Environmental Aspect	Potential Impacts	Mitigation Measures
	Health and safety aspects must be considered with respect to workers during both the Construction and the Operation Phases. ***Operation Phase*** During the operation phase the mitigation measures incorporated in the engineering design should prevent flooding or ponding on the site and surroundings. Hurricane force winds can affect utility lines.	**of the developer.**

Table 5.1: Natural Environment – Potential Impacts, Cumulative Impacts and Mitigation Measures

Environmental Aspect	Potential Impacts	Mitigation Measures
Air Quality	***Site Preparation and Construction Phase*** Movement of trucks and heavy-duty equipment to and from the project area, as well as construction work and stockpiling of earth material, will contribute to dust emissions. Construction activities will also result in the removal of vegetation that will expose and loosen soil which can become airborne with medium to strong winds. The transport of aggregate for road and drainage culvert construction will also contribute to the fugitive dust levels. Construction vehicles will emit air contaminants such as nitrogen and sulphur oxides as well as particulates.	1. Watering of un-vegetated areas and stripped road surfaces along which construction vehicles and trucks travel will control dust emissions by up to 70%. A full-time watering truck should be maintained on site for watering road surfaces as needed to minimize fugitive dust emissions. Over-saturated conditions, which would cause outgoing trucks to track mud onto public streets, should be avoided. Watering would not be necessary on days when rainfall exceeds 2.5 mm (0.01 inch). 2. Stock piling of earth materials for construction should be carried out within temporarily constructed enclosures to limit fugitive dust. Vehicles transporting earth materials should be covered *en route*. Mixing equipment should be sealed properly and vibrating equipment should be equipped with dust removing devices. Stockpiles of fines should be

Table 5.1: Natural Environment – Potential Impacts, Cumulative Impacts and Mitigation Measures

Environmental Aspect	Potential Impacts	Mitigation Measures
	Operation Phase No major air quality impacts are predicted during the operational phase.	covered on windy days. 3. A monitoring program for dust is recommended to assess the effectiveness of control measures in meeting ambient air quality standards. 4. Provide dust masks to operators in order to protect them from dust impacts. **The above mitigation measures are the ultimate responsibility of the developer, working with contractors and subcontractors.**
Noise	***Site Preparation and Construction Phase*** The noise level is expected to increase during site preparation and construction with the use of heavy machinery and earth moving equipment. Construction noise impacts are not expected to be a severe nuisance to	***Site Preparation and Construction Phase*** 1. Although not expected to create a significant negative impact, noise impacting on nearby resort facilities can be minimised by scheduling construction activities to the hours between 7 am and 6 pm. Construction machinery and vehicles should be

Table 5.1: Natural Environment – Potential Impacts, Cumulative Impacts and Mitigation Measures

Environmental Aspect	Potential Impacts	Mitigation Measures
	guests at the Ritz Carlton Hotel next door as the buildings closest to the Palmyra property are utility buildings such as the kitchen and the open expanse of a parking lot.	serviced at regular intervals in order to keep noise to a minimum. 2. Perimeter noise monitoring is recommended during the construction phase. ***Operation Phase*** 3. The perimeter wall near the main road can significantly reduce roadside noise. Vegetative barriers have been shown to reduce noise by 1-3 dB, and may also be considered by the developer, if required, to minimize external noises to the guests. **Responsibility of the developer as determined.**

Table 5.1: Natural Environment – Potential Impacts, Cumulative Impacts and Mitigation Measures

Environmental Aspect	Potential Impacts	Mitigation Measures
Coastal Water Quality	***Construction Phase*** Major construction phase impacts are anticipated on coastal water quality as a result of the proposed oceanographic works, which will include dredging, beach creation, construction of groynes and construction of gazebos. ***Operation Phase*** The most important indirect impacts relate to increased nutrient loading in the coastal environment from the potential use of fertilisers on the grounds. Runoff from parking areas may also transport oil and grease to Oyster Bay.	1. Provision of portable chemical toilets at all work sites, with appropriate sanitary arrangements for disposal of the contents. 2. Oil and grease which may be generated from construction equipment should not be allowed to run overland, where it may eventually be washed into the sea. All oil and grease should be properly stored and disposed of, off site, to prevent washdown in terrestrial run-off during rainfall events. 3. Booms and sediment traps should be used in the near shore to prevent sedimentation impacts on the coral reef. **The above mitigation measures are the ultimate responsibility of the developer, working with contractors and subcontractors.** 4. Turbidity monitoring should be carried out during

Table 5.1: Natural Environment – Potential Impacts, Cumulative Impacts and Mitigation Measures

Environmental Aspect	Potential Impacts	Mitigation Measures
		the construction phase. 5. Durng the operation phase the approved sewage treatment and disposal system should prevent disposal of untreated sewage effluent to the coatal waters. 6. The services of a reliable, certified contractor must be engaged for the timely and efficient removal of solid waste to an approved site. Collection bins must be adequate in number and appropriately spaced throughout the site. **These mitigation measures are the responsibility of the management entity for the development.**

Table 5.1: Natural Environment – Potential Impacts, Cumulative Impacts and Mitigation Measures

Environmental Aspect	Potential Impacts	Mitigation Measures
Vegetation	***Site Preparation and Construction Phase*** Vegetation will have to be cleared. However, the existing vegetation is mostly gassland with a few mature trees. Loss of vegetation will also increase surface run-off and sheet flow after heavy rainfall events.	1. Landscaping will improve vegetative cover and add to airshed purification functions. 2. Selection of plants for landscaping should consider the following: habitat suitability, feeding trees, trees of national interest, flowering trees and shrubs. 3. Vegetation planted for landscaping buffers and for aesthetic appeal should be maintained, and a maintenance programme should be established and implemented. 4. The palm trees on the property are to be retained and should be 'red-flagged' for contractors to take note. **Responsibility of the developer and any contractors or subcontractors.**

Table 5.1: Natural Environment – Potential Impacts, Cumulative Impacts and Mitigation Measures

Environmental Aspect	Potential Impacts	Mitigation Measures
Coral Reefs	**Construction Phase** During the construction phase there is the potential for increased turbidity during foreshore modification work. **Operation Phase** During the operation of the property the potential damage to the coral reef exists from anchor damage and snorkel/scuba driving damage.	1. All efforts should be made to ensure that the reef is protected from the effects of sedimentation, resulting from high turbidity. 2. Booms and/or sediment traps must be deployed to contain sediments and prevent their passage to the reef. 3. Mitigation measures as recommended by Smith Warner 2005 (Appendix 1) should be implemented. **Operation Phase** 1. Recreational boats should not be anchored on the reef structure. Anchoring should be restricted to mooring buoys or jetties. 2. Sensitisation should be done for guests and training for relevant staff to advise of the risks of damage to the reef structure from holding, standing on or breaking off sections of coral.

Table 5.2: Social Environment – Potential Impacts, Cumulative Impacts and Mitigation Measures

ENVIRONMENTAL ASPECT	POTENTIAL IMPACTS	MITIGATION MEASURES
Traffic, Transportation and Access Roads	**Site Preparation and Construction Phase** Site preparation and construction activities will see an increase in the movement of heavy vehicles and construction equipment.	1. Scheduling of construction work allow for the movement of material and heavy equipment and should seek to minimize disruption to traffic flow along the main north coast artery and. 2. Properly trained flag persons and roadside signs should be used where movement of heavy machinery and construction equipment leaves or enters the main road. 3. Arrangements for parking and

ENVIRONMENTAL ASPECT	POTENTIAL IMPACTS	MITIGATION MEASURES
	Operation Phase Disruption to traffic is not anticipated during the operation phase. Exit ramps from the main road to access the property are required.	storage of material should be made onsite as is feasible for efficient operations. 4. Discussions have been held with the National Works Agency regarding the provision of entrance / exit lanes and two sets of traffic signals. **The mitigation measures are the responsibility of the developer and the contractors in consultation with the National Works Agency.**
Business Enterprises	**Construction and Operational Phases** No business enterprises will be disrupted.	

ENVIRONMENTAL ASPECT	POTENTIAL IMPACTS	MITIGATION MEASURES
Employment	**Site Preparation, Construction and Operational Phases** Employment opportunities will be created during the site preparation and construction phases. Large numbers of both skilled and unskilled labour will be required for the duration of the construction activities. Additionally, economic opportunities will involve the sourcing of construction material and linkages created with local and regional suppliers and industries.	1. Both skilled and casual labour will find employment and this is expected to be a positive impact for surrounding communities. 2. Workers should be briefed on traffic management, solid and liquid waste disposal, dust management, parking, idling of equipment and oil spill control 3. The "politicization" of employment opportunities often poses some challenge to contractors, and the need for security and relevant dialogue have to be factored into construction planning 4. HEART and other skills training institutions can be consulted as a source for required skills.

ENVIRONMENTAL ASPECT	POTENTIAL IMPACTS	MITIGATION MEASURES
		The mitigation measures are the responsibility of the developer or contractor.
Solid Waste Management	**Site Preparation and Construction Phase** Solid waste generated from the site preparation and construction activities will include construction debris, vegetation, and solid waste generated at the construction camp.	1. Construction sites generate considerable waste and provision must be made for suitable separation and storage of waste in designated and labelled areas throughout the site and the site camp. 2. Collection of waste by certified contractors and disposal at an approved site, as recommended and approved by the National Solid Waste Management Authority. The recommended site is Retirement in St. James. 3. Any hazardous waste should be

ENVIRONMENTAL ASPECT	POTENTIAL IMPACTS	MITIGATION MEASURES
		separated and stored in areas clearly designated and labelled, for future entombing and disposal as directed by NSWMA. 4. Workers training should include instructions on how to dispose of food and drink containers emphasizing the need to protect the coastal environment. 5. Construction camps and work areas must be adequately equipped with portable chemical toilets. 6. Portable chemicals must be provided, maintained and removed by a certified contractor. 7. Consideration should be given

ENVIRONMENTAL ASPECT	POTENTIAL IMPACTS	MITIGATION MEASURES
		to the establishment of an integrated Solid Waste Management Plan. **The mitigation measures are the responsibility of the developer.**

ENVIRONMENTAL ASPECT	POTENTIAL IMPACTS	MITIGATION MEASURES
Proposed Developments	Many developments are proposed under the Rose Hall Developments Master Plan. These include a Conference Centre and other resort facilities. Other developments along the north coast that are also proposed include the Oyster Bay Resort Development at Florida/Bush Cay, and the Harmony Cove Resort Development, in Trelawny, as well as the Bahia Hotel at Pear Tree Bottom and the Royal Georgian Resort, Spa and Golf Course in St. Ann.	***1.*** Cumulative impacts related to traffic management may occur if construction schedules overlap. The mitigation measures as described under traffic management would need to be applied by other developers. ***The mitigation measures are the responsibility of the developer***
Public Health and Safety	**Site Preparation and Construction Phase** Site preparation and construction will involve transportation and storage of significant volumes of construction material, and proper disposal of construction spoil and any hazardous waste.	1. To minimize risk to the public the construction activities, which will directly affect the movement of traffic and pedestrians, should be properly scheduled and standard construction techniques for sign posting and flagging should be adhered to.

ENVIRONMENTAL ASPECT	POTENTIAL IMPACTS	MITIGATION MEASURES
		2. Dust control by wetting is essential. 3. Unnecessary idling of construction related vehicles should be discouraged 4. Proper sign posting of speed limits and entrances and exits. 5. Discussions should be held with the relevant authorities regarding facilities for fire protection and health and safety. ***These mitigation measures are the responsibility of the developer.***

ENVIRONMENTAL ASPECT	POTENTIAL IMPACTS	MITIGATION MEASURES
Sewage Treatment	**Operation Phase** Sewage will be generated during the Operation Phase.	1. Raw sewage must not be pumped into the sea. 2. Sewage will be treated at the Rose Hall Sewage Treatment Facility which is operated by the Rose Hall Utility Co. and licenced by NEPA. ***The mitigation measures are the responsibility of the developer.***
Utilities	***Construction and Operation Phase*** 1. Increased demand on water supply	1. Discussions should be held with the National Water Commission regarding the supply of potable water, with peak period demands discussed. ***The mitigation measures are the***

ENVIRONMENTAL ASPECT	POTENTIAL IMPACTS	MITIGATION MEASURES
		responsibility of the developer in consultation with the National Water Commission.

5.2 POSITIVE IMPACTS

The aim of Palmyra Properties Ltd. Is to develop the Palmyra Resort and Spa with luxury hotel condominium accommodation, and supporting recreational and resort infrastructure. Several positive impacts are anticipated from the fulfilment of these objectives.

Physical Environment

The engineering of drains, kerbs and channels, should channel storm water run-off to reduce potential ponding and sheetwash. Sedimentation control devices should reduce the levels of siltation in nearby coastal waters.

The proposed sewage treatment plant to be built and operated by Rose Hall Utility company will constitute a major facility in the area and it is expected that wastewater management throughout that section of the north coast will be greatly enhanced, thus reducing the potential pollution to the coastal waters. It is expected that nutrient loading and the effects of eutrophication in coastal waters will be minimized.

The construction of the coastal protective structures is expected to reduce the intensity of waves on the shoreline,

which have had negative impacts on the beach and adjacent properties.

Biological Environment

Engineering for stormwater run-off can have beneficial impacts on the coral reefs through the reduction of siltation.

Socioeconomic Environment

The Palmyra Resort and Spa development will make a significant contribution to the tourism product in Jamaica in terms of investment opportunity for condominium style accommodation, recreational facilities and support services. The Palmyra development will be another aspect in the fulfilment of the mandate of Rose Hall Developments Ltd.

The evidence of squatting/informal settlements in the surrounding areas is a major cause for concern with respect to environmental integrity of some of Jamaica's major natural and built assets. Controlled and well-designed development with the attendant infrastructure to facilitate positive environmental impact is a positive impact of this proposed development.

During design, site preparation and construction, employment will be generated for several categories of workers including engineers, casual labourers, skilled and

unskilled workers, as well as suppliers of goods and services. During the operation phase supplies of goods and services will be required.

6.0 CUMULATIVE IMPACTS

In addition to the potential negative impacts identified previously, and site specific positive impacts, cumulative impacts are of importance not just in the context of the Rose Hall Developments Master Plan but also for the north coast of Jamaica.

Other developments proposed for the future within Rose Hall include resort facilities, a conference centre and luxury homes. Developments proposed for the north coast area include the following:

Proposed Development	**Number of Rooms**
The Royal Georgian Golf Course, Resort and Spa at Llandovery in St. Ann	≅800
Bahia Principe Hotel at Pear Tree Bottom, in St. Ann	1,900
Harmony Cove Resort at Harmony Cove in Trelawny	2,895 rooms 476 luxury homes
Trelawny Stadium for World Cup Cricket 2007 at Greenfield in Trelawny	N/A
Oyster Bay Hotel at Florida/Bush Cay Peninsula in Trelawny	<- 1,700
Iberostar Hotel at Rose Hall in St. James currently under construction	900
Northern Costal Highway Improvement Project currently underway in St. Ann, Trelawny and St. James	N/A
Riu Mammee Bay	≅ 400
Ocean Point, Duncans	2,200

The construction of a major resort such as Palmyra within the Rose Hall area is in fulfilment of the given mandate for Rose Hall Developments Ltd. Within the context of the Rose Hall Developments Master Plan and the entire north coast area, the cumulative impacts will relate to both the construction and operation phases.

6.1 Construction Phase Cumulative Impacts

The construction phase is expected to last at least 24 months. The construction schedule for Palmyra may overlap with the construction schedules of other proposed developments, which will give rise to cumulative impacts during the construction phase. These cumulative impacts include the following:

- ✓ Sourcing of earth materials to facilitate construction will increase the existing demand at licensed quarries
- ✓ Transport of earth materials along the same main road, and from the same quarries will increase traffic congestion and wear and tear on road surfaces
- ✓ Increase in vehicular traffic to support construction work will include suppliers, contractors and construction vehicles

- ✓ Disruption to traffic flow for daily commuters and tourists will occur in the vicinity of work sites and may include the use of detours
- ✓ Increase in levels of fugitive dust and respirable particulates will occur during construction due to the removal of vegetation, storage and transport of earth materials, and construction works
- ✓ Increase in opportunistic retail providers along the route and in close vicinity to construction sites, usually occurs by major work sites
- ✓ Increase in generation of solid waste including construction waste and vegetative matter
- ✓ Increase in the disposal of solid waste to the Haddon and Retirement dumps

6.2 Operational Phase Impacts

After construction of some, or all of these proposed developments, the operation of the facilities will also have cumulative impacts, which will include the following:

- ✓ Increase in the number of major facilities on the northern side of the north coast road, in a relatively short space of time, will alter the existing built environmental profile
- ✓ The reduction in the existing view of the Caribbean Sea from the road is termed a reduction in the 'windows to the sea'. This will result in an alteration of the existing aesthetic appeal of motoring on the north coast road.

- ✓ Increase in the amount of paved surfaces which will reduce the existing rate of percolation into the soil and increase the amount of surface run-off to the coastal zone. Surface run-off can carry residues from pesticides and fertilizers, sediment, and solid waste to coastal waters.
- ✓ The movement of the ocean currents from east to west along the north coast of Jamaica, and the distinct long-shore drift that exists along the Rose Hall coastline, will be affected by the construction of groynes, breakwaters, island features and other oceanographic features proposed for some of the facilities. The reduction in the westward movement of sediment which is needed to replenishes beaches can affect downstream recreational sites.

6.3 Mitigation Measures

Implementation of site specific mitigation measures as recommended in the individual and independent Environmental Impact Assessments, including this one, should minimize the negative impacts and reduce the cumulative effects described, particularly during the construction phase. Some of the cumulative impacts during the operation phase will not be able to be mitigated.

7.0 ENVIRONMENTAL QUALITY OBJECTIVES

Environmental Quality Objectives (EQOs) have been identified for the proposed development, in keeping with several aspects highlighted in the SEA for the Master Plan. These EQO's highlight the following aspects:

Integrated Water Resource Management

The use of potable water, treatment of waste water and irrigation systems have been proposed for integration to encourage reuse and recycling, as detailed in the proposed sewage treatment facility (Appendix III and Section 6.0).

Stormwater Run-off Control

Stormwater run-off to the main road must be controlled so as to prevent flooding and deposition of sand and gravel on the roadway. Runoff also has the potential to carry large volumes of sediment and agricultural chemicals (particularly fertilizers) to the coastal waters. The use of grassy verges instead of paved sidewalks should allow for percolation, and so reduce runoff, ponding, and accelerated erosion.

Energy Efficiency

Energy efficiency is essential to sustainable development and to operating cost management. The integration of energy efficient systems should be part of all aspects of the development. Home owners should also be “encouraged” to install energy efficient equipment, including fluorescent bulbs, timers and household appliances.

Minimization of Pollution

Pollution of the coastal environment may be exacerbated by poor solid waste management practices, which can result in the wash down of material during rainfall events. Proper solid waste management practices are to be incorporated in the development including the provision and installation of trash receptacles, collection and removal of trash by a certified contractor for disposal at an approved site.

Appropriate and effective sewage treatment and disposal is essential to the quality of the coastal environment.

Sewage will be treated at the Rose Hall Sewage Treatment Plant.

Aesthetic Appeal

The Rose Hall Master Plan included the submergence of utility lines underground as a means of improving aesthetic appeal. This policy will apply to the Palmyra development.

Building design and architectural layout to date have taken account of the aesthetic value of the site and the north coast resort environment. No unacceptable intrusion is anticipated.

8.0 CONSIDERATION OF ALTERNATIVES

The land purchased by Palmyra Properties Ltd. For development of the Palmyra Resort and Spa was earmarked for hotel condominium development as part of the mandate of the agreement between the Government of Jamaica and Rose Hall Ltd.

Discussions with the developers indicate that no other alternatives in design were considered.

However, based on a letter from NEPA (Appendix V) three issues were highlighted as being of key concern. These were:

4) The number of habitable rooms per acre
5) The setback
6) The height of the buildings

The developer has considered these issues in the project plans.

8.1 Setback

The setback as recommended by the oceanographic engineers and the Town and Country Planning Authority has

been incorporated in the design. The design now stands at 30 m, and the original setback of 15 m is no longer being considered.

8.2 Number of Habitable Rooms per Acre

The number of habitable rooms per acre has been reviewed in the context of the entire master plan and this has been shared with NEPA at a presentation to the Technical Review Committee meeting of April 26, 2005.

The density of the Palmyra Resort and Spa within its legal boundary is 100 habitable rooms per acre, the overall density of the northern estate neighborhood is 41 habitable rooms/acre, while the overall master plan residential density is 11habitable rooms / acre. (Cosmo Whyte Architect Ltd., 2005) (Table 1.2.1)

The proposed Palmyra density is not without precedent in resort areas as the Montego Freeport resort area was to a similar density.

The Rose Hall Development Company has the environmental permit and user license to build a central sewerage plant to service the Palmyra and all the other major developments in the master plan. The plant is expected to be fully functional by July 2006.

8.3 Height of Buildings and Form

Based on the information received from Cosmo Whyte Architect Ltd. (2005), the Palmyra is to be built in 3 phases, in 5 blocks, ranging in height from 12 to 16 floors. The blocks are spaced on the site so as to afford views between the towers, from the public road.

The alternative, given the limited depth of the site, would be a medium rise horizontal slab forming a continuous edge and forming a visual barrier from the public domain.

The Palmyra is conceived as a major visual focal point around which the visual sequence of the Rose Hall urban experience is to be referenced.

Travelling from the west along the Rose Hall Boulevard, the Holiday Inn Hotel is low rise, the Half Moon Hotel and commercial centre are low rise, the Ritz Carlton is medium rise, the Palmyra Spa and Resort will be high rise; the resort residential and apartments and beach club, east of The Palmyra are low rise. The proposed hotel (west of the Wyndham Hotel) will be high-rise while the Wyndham Rose Hall Hotel is medium rise.

The Palmyra will clearly be a focal point with the proposed hotel (west of the Wyndham), its counterpoint at the easterly end of the coastal Resort strip.

The towers would not be blocking the view from any other development, as the Half Moon and White Witch Golf Courses are south of the site and the villas and exclusive

residential compounds are at a sufficiently high elevation in the Rose Hall foothills.

Table 8.3 gives an obstacle evaluation of the buildings proposed.

Table 8.3: Obstacle Evaluation

Building #	Name	Tower Height (m)	Base Elevation (m)	Top Evaluation (m)
1	Sabal Palm	53.5	5.35	58.85
2	Silver Palm	53.5	5.35	58.85
3	Royal Palm	59.7	5.35	65.05
4	Coconut Palm	59.7	5.35	65.05
5	Sentry Palm	53.5	5.35	58.85

The Jamaica Civil Aviation Authority (JCAA) was contacted regarding the building heights and the potential for obstruction of flight path of the Sangster International Airport. The JCAA has confirmed that their calculations show that the buildings fall well beneath the ANNEX 14 surfaces associated with Sangster International Airport and as such will not constitute any hazard to aircraft operating at that location. *(Dwight Dietrich, Procedure Specialist, JCAA).*

8.4 No Action

The site with no development would mean retention of the open grassland. However, such action may perpetuate degradation in terms of solid waste dumping and polluted runoff to the coastal zone. Management of the site is critical to environmental quality.

The economic value to be added to the site is part of the mandate for Rose Hall Estate lands. An environmentally

sound development that takes account of the physical, ecological and social quality objectives can be a positive contribution.

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APPENDICES