ENVIRONMENTAL IMPACT ASSESSMENT

Seawind Key Investments Ltd.
10a Chelsea Avenue
Kingston 5, Jamaica

Prepared by

Environmental Solutions Ltd.
20 West Kings House Road
Kingston 10, Jamaica

JANUARY 2007

ENVIRONMENTAL IMPACT ASSESSMENT

Seawind Key Resort Development

at

Montego Bay Freeport,
St. James,
Jamaica

Submitted to:

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Kingston 10, Jamaica

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EXECUTIVE SUMMARY

This document presents the environmental impact assessment report (EIA) for the proposed Seawind Key Resort Development at Montego Freeport, Montego Bay, St. James, Jamaica. The EIA was initiated with a public consultation held at Doctor's Cave Beach Club Conference Centre on 15 September 2006 when the project proposal and a preliminary scoping of the environmental issues were presented for public comment. The National Environment & Planning Agency (NEPA) approved the Terms of Reference for the EIA on 19 December 2006. Data collection and fieldwork was carried out between September and December 2006.

The Client also made or submitted presentations on the project to a number of agencies and institutional stakeholders. These were NEPA/NRCA, Jamaica National Heritage Trust, Environmental Health Unit, Mines & Geology Department, Montego Bay Marine Park, National Solid Waste Management Authority, Water Resources Authority, Office of Disaster Preparedness & Emergency Management, St. James Parish Council, National Water Commission.

PROJECT BRIEF:

Developer:	Seawind Key Investments Ltd. 10a Chelsea Avenue Kingston 5
Operator:	AMResorts ('Secrets - Preferred Hotels and Resorts')
Environmental Consultants:	Environmental Solutions Ltd. 20 West Kings House Road Kingston 10, Jamaica

Site Description:

- Location. The project site is located at the western end of Seawind peninsula. It occupies 24 acres (97,124 m^2) but the title shows 32 acres (125,452 m^2) – the difference reflecting the area lost to shoreline erosion caused by storm waves.
- Topography. Flat, low-lying (<2.7m asl) land at western end of promontory at Montego Freeport (see Figure 1). The land was created by infilling of a

Figure 1. Satellite image showing part of Montego Bay, Montego Freeport and location of Seawind Key site.

mangrove cay (originally one of the Bogue Islands) in the late 1960's using material dredged from the excavation of the ship basin.

- o Geology & Soils. Borehole data (NHL Eng. Ltd., October 2006) indicate gravelly sands (0 – 1.5m) overlying layer of fine peaty soil (1.5 – 3m) over calcareous gravels and sands + coral chips (3+ m). The site is underlain by coastal limestone characterised by low permeability. Any ground water would be brackish or saline.
- o Vegetation. The site has been subject to occasional clearing but at the time of the survey was covered by a diverse secondary pioneer herbaceous community comprised of >65 species of plants dominated by the grass, *Sporobolus indicus*. Common trees are Willow, Seagrape and Lead Tree. A stand of mixed mangroves lines the southern side of the property.
- o Fauna. The site is inhabited by a wide variety of small animals including insects, snails, amphibians, reptiles and mammals. These include the endemic butterfly (*Heterosmaitia bourkei*), an endemic frog (*Eleutherodactylus sp*.), and the endemic bird, the Red-billed Streamertail (*Trochilus polytmus*). Sea turtles (all 6 species found in Jamaica are either threatened or endangered) reportedly nest on the beach.
- o Marine habitats & protected area. The seaward edge of the property is fringed by a coral reef facing the northwest and which bears the brunt of the 'northers' – the shoreline is badly eroded. The reef is comprised of two crests between which is a shallow lagoon. Beyond the outer crest is the typical fore reef slope and buttress zone. Seagrass beds cover the susbstrate in the shallow waters. The southern side of the site, with its mangrove fringe, borders the Bogue Lagoon, a fish sanctuary. The whole Seawind peninsula lies within the boundaries of the Montego Bay Marine Park, which extends from Whitehouse to Unity Hall.

Hazard vulnerability:

The site is vulnerable to waves associated with 'northers' (cold fronts moving south from North America), hurricanes and storm surges, and earthquakes and tsunamis. The storm surge analysis carried out for this project (SWIL, 2007) determined that a total water level increase of 2.6m (8.5 ft) could be expected.

Land use zoning:

The project area is zoned for residential/resort use in the 1982 St. James Parish Development Order. The peninsula is occupied elsewhere by a 400-room hotel, five apartment complexes and the Montego Bay Yacht Club

Other proposed projects nearby:

Proposed residential subdivision next door, proposed Sunset Beach Resort & Spa expansion, proposed lot developments at eastern end of promontory, proposed expansion of cruise ship berthing, free zone expansion projects and proposed mega mart and shopping centre for Freeport.

Environmentally sensitive areas:

The project area is situated within the boundaries of the Montego Bay Marine Park and lies adjacent to the Bogue Lagoon Fish Sanctuary. Endangered species of sea turtles nest on the beach at Seawind.

Socio-economic & community context:

- Project is located in an area zoned for proposed type of development.
- The majority of survey respondents across all communities indicated acceptance of the project.
- Local work force likely to be available in Montego Bay.

- Project compatible with planned developments for the area.
- Project will induce increased demand on social infrastructure.
- No apparent archaeological or cultural heritage issues.
- No identified prescriptive rights issues.

Project description:

- See site plan at Figure 2.
- 700-room hotel (Secrets A & B, each with 260 junior suites + 90 luxury suites and sharing common lobby, administrative office and 'back-of-house'.
- 3 - 5 story room blocks.
- Maximum occupancy = 1,480 guests.
- Employment = ~1,000 persons.
- About 15,500 m^2 of eroded shoreline will be reclaimed. The existing groynes will be removed and new shore protection structures (eight groynes & several breakwaters) will be constructed to create three coves suitable for bathing.
- Estimated electricity consumption during resort operation = 3.5 MW. Supply to be provided by JPS and a 3.5 MW diesel-powered stand-by generator will also be installed. Various energy saving methods are to be implemented.
- Estimated water consumption during operation = 700 m^3/day. Supply to be provided by NWC.
- Estimated generation of sewage = 454 m^3/day, to be collected and pumped via the existing mains to the NWC Bogue Treatment Plant about 3km away.
- Project includes development and management of a public beach park at eastern end of property.
- Duration of construction works = 24 months

Figure 2. Seawind Key site plan.

- Project life cycle = ~30 years

Environmental permits & licences:

1. NRCA Permit for construction and operation of resort development.
2. BCA Licence for use of the foreshore and floor of the sea for commercial/recreational activities.
3. BCA Licence to undertake any foreshore modification work (dredging, beach nourishment, jetties, groynes construction, etc.).
4. NRCA Licence for discharge of air pollutants from stand-by generator (by April 2008).

Significant environmental issues:

Construction phase – negative impacts

- Loss of land use options

Loss of terrestrial habitat & biodiversity
Materials stockpiling & storage – coastal contamination

- Land surcharge – drainage modification
- On-site concrete batching plant operation - dust & toxic effluents
- Timber scaffolding & form support – forest depletion
- Construction solid waste & disposal
- Dusting – air quality degradation
- Sewage & litter – public health & contamination
- Impervious surfacing & paving – increased runoff
- Construction works water demand – supply shortage
- Coastal excavation and construction works – marine habitat loss
- Sourcing rock, beach fill & sand – indirect impacts
- Coastal works material stockpiling
- Fuel & chemicals storage & spillage
- Solid waste management
- Equipment & vehicle maintenance – soil contamination
- Replanting & landscaping

Employment/Income generation

Construction phase – positive impacts

Employment – socio-economic benefit
Replanting & landscaping – habitat recreation

- -

Operation phase – negative impacts

- Water demand – supply shortage
- Energy demand – fossil fuel combustion/emission of green house gases
- Sewage collection & disposal
- Solid waste management & disposal
- Sea turtle nesting impairment – endangered species

Misuse of reef resouces – poor SCUBA/snorkling pactices
Mosquito fogging
Induced housing demand – uncontrolled settlement/squatting

Operation phase - positive

Employment & staff training – socio-economic benefit
Landscape & grounds maintenance

- Public beach facility management

All of the identified negative impacts can be mitigated, if not avoided, except in the case of the last issue – squatting – which requires further and deliberate government intervention. Table 3 provides a summary of the environmental impacts.

The EIA report includes environmental specifications for the construction works and an outline plan for environmental monitoring of the construction phase. The latter cannot be finalised until the final details for construction are defined and NEPA's permit conditions are known.

PHR - 28 January 2007

Table 3. Seawind Key Resort - Summary of construction and operation phase impacts.

ENVIRONMENTAL IMPACT	IMPACT TYPE								MITIGATION		
	Positive		Negative								
	Significant	Not significant	Significant	Not significant	Short Term	Long Term	Irreversible	Cumulative	No Mitigation Required	Mitigation Required	Reference to Mitigation Section
CONSTRUCTION PHASE IMPACTS											
1. Loss of land use options			×			×	×		×		
2. Loss of terrestrial habitat & biodiversity			×		×			×		×	5.4.1.2
3. Soil erosion – marine turbidity				×	×					×	5.4.1.3
4. Loss of recreational amenity – pre-empted use				×	×					×	5.4.1.4
5. Piling & building foundations – noise & vibration				×	×					×	5.4.1.5
6. Earth materials sourcing - illegal quarrying				×	×					×	5.4.1.6
7. Materials transport – dusting & spillage				×	×					×	5.4.1.7
8. Materials stockpiling & storage – coastal contamin.			×		×					×	5.4.1.8
9. Construction works induced traffic - congestion				×	×					×	5.4.1.9
10. Land surcharge – drainage modification			×			×	×			×	5.4.1.10
11. Concrete batching plant operation – dust & effluents			×		×					×	5.4.1.11
12. Timber scaffolding & form support – forest depletion			×			×				×	5.4.1.12
13. Construction solid waste storage & disposal			×		×					×	5.4.1.13
14. Dusting – air quality degradation			×		×					×	5.4.1.14
15. Construction works noise – public health				×	×					×	5.4.1.15
16. Sewage & litter – public health & contamination			×		×					×	5.4.1.16
17. Impervious surfacing & paving – increased runoff			×			×				×	5.4.1.17
18. Installation / upgrading of utilities – soil erosion				×	×					×	5.4.1.18
19. Const. works water demand – supply depletion			×		×					×	5.4.1.19
20. Replanting & landscaping – habitat enhancement	×					×		×	×	×	5.4.1.20
21. Employment – socio-economic benefit	×				×				×		
22. Roadside vending – eyesore & litter				×	×					×	5.4.1. 22
23. Visual intrusion on seascape				×		×	×	×	×		

Table 3 (cont'd) Seawind Key Resort - Summary of construction and operation phase impacts.

ENVIRONMENTAL IMPACT	IMPACT TYPE								MITIGATION		
	Positive		Negative								
	Significant	Not significant	Significant	Not significant	Short Term	Long Term	Irreversible	Cumulative	No Mitigation Required	Mitigation Required	Reference to Mitigation Section
CONSTRUCTION PHASE IMPACTS (cont'd)											
24. Coastal excavation & construction works			×			×	×			×	5.4.2.1
25. Sourcing rock, beach fill & sand – coastal works			×		×					×	5.4.2.2
26. Material stockpiling – coastal works			×		×					×	5.4.2.3
27. Employment – income generation	×				×			×	×		
28. Fuel & chemicals storage - spillage			×		×					×	5.4.3.1
29. Solid waste management			×		×					×	5.4.3.2
30. Equipment / vehicle maintenance – soil contamin.			×		×					×	5.4.3.3
OPERATION PHASE IMPACTS											
31. Employment / staff training	×					×		×	×		
32. Water demand – resource depletion			×			×		×		×	5.4.4.2
33. Energy demand – fossil fuel combustion			×			×		×		×	5.4.4.3
34. Sewage collection & disposal			×			×		×		×	5.4.4.4
35. Solid waste management & disposal			×			×		×		×	5.4.4.5
36. Surface runoff & disposal – erosion & contamination				×		×				×	5.4.4.6
37. Vehicular traffic - congestion				×		×		×	×		
38. Night-time entertainment - noise				×		×				×	5.4.4.8
39. Sea turtle nesting – protected species			×			×		×		×	5.4.4.9
40. SCUBA & snorkeling / misuse of reef resources			×			×		×		×	5.4.4.10
41. Landscape & grounds maintenance	×					×		×		×	5.4.4.11
42. Mosquito fogging			×			×				×	5.4.4.12
43. Public beach facility management	×					×			×		
44. Induced housing demand & squatting			×			×		×		×	5.4.4.14

1. INTRODUCTION

1.1 PURPOSE

This document responds to the request made by the National Environment & Planning Agency (NEPA) in their letter received on 26 November 2006 for an environmental impact assessment (EIA) of the proposed Seawind Key resort development project to inform their review of the environmental permit application. The initial permit application documents were submitted on 9 October 2006 and further supplementary information was submitted on 20 October 2006.

The EIA seeks to identify in a structured and systematic manner the possible consequences, positive or negative, of the proposed project on the environment, to determine those which are deemed significant, and to present appropriate mitigation measures to avoid or reduce the adverse impacts of those that are negative to acceptable levels.

The approved Terms of Reference for the EIA are exhibited at Appendix 1.

1.2 BACKGROUND

The proposed 9.7 hectares (24 acres) development site is located on the southwestern tip of the peninsula at Montego Freeport, Montego Bay, Jamaica, as shown in Figure 1.1. The site is part of a 2,000 ha (5,000 ac) reclamation and development project initiated in 1966 that involved the filling of several mangrove cays, the Bogue Islands, using in part material excavated from the sea floor to create the free port zone, shipping port and cruise ship terminal (Figure 1.2). The project site has since then been subject to extensive shoreline erosion, particularly on its seaward side, caused by exposure to ‘northers’ and hurricane waves over the past three decades. It is estimated that the site has lost about 3 ha (8 ac) due to these factors. The site is flat with an elevation not exceeding 2.7 metres.

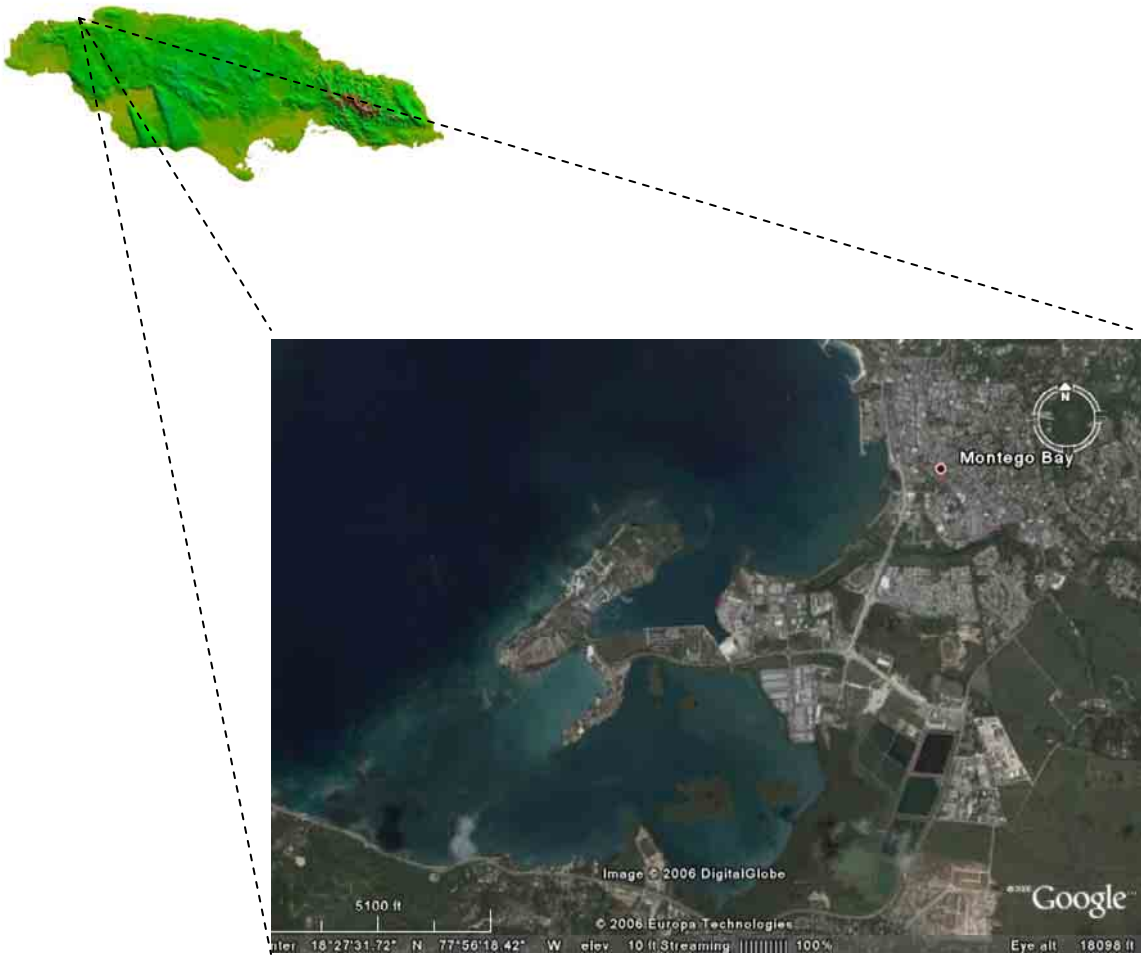


Figure 1.1 Satellite image of the Montego Freeport area.

Figure 1.2 Photograph of Montego Freeport - dredging & filling circa 1969. (Source: *Jamaica Architect*)

The peninsula is zoned for resort/residential development in the 1982 St. James Parish Development Order. Existing developments on the tip of the peninsula include one hotel, three apartment complexes, and a marina. There are pending residential developments proposed for the northeastern end.

The Freeport is located within the boundaries of the Montego Bay Marine Park established in 1992. Within that there is the Bogue Lagoon which is designated as a fish sanctuary under the Fishing Industry Act of 1976. The capture of fish within its waters is prohibited.

1.3 PROJECT OVERVIEW

The developer, Seawind Key Investments Ltd. of 10a Chelsea Avenue, Kingston 5, Jamaica, intends to build a 700-room hotel resort complex to be operated under the brand of AM Resorts ('Secrets - Preferred Hotels and Resorts'). The project managers are Fuerte Hoteles of Marbella, Spain. The project architects are Liev Rodriquez, Spain, and Clifton Yapp & Associates, Jamaica.

The development will occupy lands purchased from Montego Freeport Limited, a public company administered by the Urban Development Corporation, comprising the nine lots identified below at Table 1.1 and registered with the Office of Titles. The lots are situated on the southwestern tip of the peninsula.

Table 1.1 Seawind Key Resort - List of lot titles.

Lot #	Certificate of title
A12	Volume 1091, Folio 244
A13	Volume 1091, Folio 245
A14	Volume 1091, Folio 246
A15	Volume 1091, Folio 247
A16 – A18	Volume 1057, Folio 134
A76	Volume 1091, Folio 256
A85	Volume 1091, Folio 257

The development will comprise the construction of 3-, 4- and 5-storey room blocks, a central facility and reception lobby and the usual facilities associated with a large hotel including offices, restaurants and bars, entertainment areas, spas, kitchens & laundry, swimming pools and other back-of-house operations. The whole complex will be built in a single phase and construction works are anticipated to last for 24 months. The resort will cater primarily to US and European visitors.

A significant part of the construction works will be the reclamation of shoreline lost to wave erosion since the original filling of the cay and the marine engineering works designed to protect the new beaches. These are discussed in detail below at Section 4.2.

1.4 ENVIRONMENTAL IMPACT ASSESSMENT

1.4.1 Objective

The environmental impact assessment (EIA) seeks to identify, in a structured and systematic manner, the possible consequences, positive or negative, of the proposed resort development project on the site, the environment at Montego Freeport and other potentially affected areas. This allows, were possible, for appropriate mitigation measures to be identified and presented that will serve to avoid or ameliorate any adverse impacts to acceptable levels. Thus the EIA is a tool that assists in the overall decision-making process and helps to achieve a mode of development that is sustainable. The Terms of Reference for the EIA are shown at Appendix 1.

1.4.2 Study area

The area over which the project may exert some level of influence or that which may affect the project includes, for the purpose of this EIA, the actual project development site, the adjacent Montego Bay Marine Park and fringing coral reef and inshore waters, the city of Montego Bay and its communities, the communities providing significant numbers of project labour and resort employees, and the quarries from which the earth materials to be used on the project will be obtained. A map of the study area is shown at Figure 1.4.1.

1.4.3 Study team

The multidisciplinary skills required to conduct the EIA were assembled from expertise at and available to ESL. The core team was made up of the following persons:

- ◊ Peter Reeson, M.Sc. - Principal Consultant; Ecologist & EIA Specialist – Team Leader
- ◊ Eleanor Jones, M.A. – Geographer & Natural Hazards Specialist
- ◊ George Campbell, M.A. – Socioeconomist
- ◊ Sharonmae Shirley, M.Phil. - Environmental Chemist
- ◊ Andrew Ross, B.Sc. – Marine Biologist
- ◊ Theresa Rodriquez, B.Sc. – Geographer & GIS Specialist
- ◊ Phillip Rose, M.Sc. – Botanist
- ◊ Vaughan Turland - Ornithologist & Lepidopterist

1.4.4 Methodology

1.4.4.1 Initial stakeholder consultations

At the outset of the project, a public consultation was held at Doctor's Cave Beach Club in Montego Bay on 15 September 2006 at which the proposed project was presented. A summary of the main issues raised by the participants is provided as part of the Terms of Reference for the EIA exhibited at Appendix 1.

In addition to that, and following the advice of the Applications Secretariat, NEPA, the Client also made or submitted presentations to a number of agencies and institutional stakeholders. These were NEPA/NRCA, Jamaica National Heritage Trust, Environmental Health Unit, Mines & Geology Department, Montego Bay Marine Park, National Solid Waste Management Authority, Water Resources Authority, Office of Disaster Preparedness & Emergency Management, St. James Parish Council, National Water Commission. The recommendations received and/or notes of the meetings are available at the Client's offices.

1.4.4.2 Vegetation survey

Owing to the very disturbed and herb-dominated nature of the vegetation, the main field methodology employed was the Line Intercept / Transect method developed by H. L. Bauer in 1943. It entailed the use of a marked length of rope (or measuring tape) placed in a straight line through the vegetation. Any plant that was covered by the line or whose canopy covered the line was tallied. Also, the total decimal fraction of the line covered by each species was measured and calculated as a percentage of the total length of the line.

Two line-transects were used for this study. Both were laid perpendicular to the dirt road in the middle of the study area: the first heading running approximately 85 m due north-west (towards the windward shore) and the second running 70 m due south-east (towards the leeward shore). The percentage cover of each species was determined at 5 – 10 m increments along the line.

Figure 1.4.1 Map showing project study area.

In addition to the line intercepts, a series of walking traverses were conducted on both coasts and through sections of the vegetation to identify any species that may have been missed in the transects. For species that could not be identified in the field, a sample was collected for determination at the Herbarium of the University of the West Indies.

The information gathered by the line-transects and traverses was used to create a list of all the plant species occurring at the study site and to determine the level of dominance/importance of each plant species in the form of a DAFOR (**D**ominant, **A**bundant, **F**requent, **O**ccasional & **R**are) ranking. The species list is given at Table 2.6.1.

The field survey was carried out over one day on September 10, 2006.

1.4.4.3 Butterfly & bird survey

The purpose of the survey undertaken at the southwestern end of Seawind Key was to:

- Identify and list the birds (terrestrial & marine) and butterflies using the habitat during the period of the survey and to categorise them in terms of their relative abundance;
- Comment on the existing quality of the habitat for birds and butterflies, the implications and impact of habitat loss occasioned by site clearance in terms of local and regional significance; and
- Make recommendations regarding planting material that could be incorporated in the landscaping that would help to restore/enhance bird life and butterfly habitat.

The survey (see details in table below) was undertaken by two persons; an observer and a recorder and it was limited to birds and butterflies. It did not extend to a search for moths or caterpillars and larvae of moths and butterflies. It also did not give consideration to other fauna which may be present or which may visit the area for breeding purposes.

Date	Time of survey	Sunrise	Sunset
18 November 2006	1530 - 1730 hrs	0619 hrs (approx.)	1735 hrs (approx.)
19 November 2006	0630 - 1130 hrs		

The weather during the period of the survey was generally favourable for the observation of butterflies and birds. The sky was overcast (3/4 to 7/8 cloud cover) for most of the time but with sunny spells. There was no precipitation. Wind was negligible.

Method of butterfly survey:

Day 1	In conjunction with the bird survey, point counts of 5 minutes duration were taken at 6 points along a transect formed by the main track running from the site entrance to the south western end of the property. The area of observation was limited to a radius of approximately 75m from the observation point. Additional point counts were made in areas of potential interest
Day 2	• Slow walk – approx 1mph NE to SW along main track transect – stopping when a specimen was encountered. • Slow walk NE to SW through the bush on a transect approx 20m to the south of the main track and parallel to it – stopping when a specie was encountered. • Slow walk SW to NE through the bush on a transect approx 10m to the north of the main track and parallel to it – stopping when a specie was encountered.

Method of bird survey:

Day 1	Point counts of 5 minutes duration were taken at 6 points along a transect formed by the main track running from the site entrance to the south western end of the property. The area of observation was limited to a radius of approximately 75m from the observation point. Birds seen flying outside of this radius were annotated in the table below.
Day 2	• 4 point counts of 10 minutes duration on a transact line inshore of the mangroves on the south western coast of the key • 4 point counts of 10 minutes duration starting at the south western extremity then moving north east along the north beach line

The total area of the site is 24 acres (approx.). In such a small area there is an inevitable overlap between point count radii. For example, Loggerhead Kingbirds, Greater Antillean

Grackles and Kestrels were flying from end to end and side to side within the site boundaries. Adjustment to the observation tables was made accordingly when this was seen to occur.

1.4.4.4 Beach and Turtles

Beach assessments were made over several visits overlapping with other marine coastal habitat assessments. Information regarding observed erosion was garnered through the Montego Bay Marine Park.

Information on the presence of turtles was obtained through interviews with local divers and fishers and from observations made of carcases during initial coastal assessments.

1.4.4.5 Inshore marine habitats

Assessments of the shallow marine habitats began in August 2006 with analyses of aerial and satellite photographs taken between 1992 (Survey Dept.) and 2004 (Google Earth). The aerial photographs were copied as simple line maps onto underwater plastic writing slates and these used for ground-truthing and field interpretation to produce the final benthic distribution map. The tabulated raw data is provided at Appendix 2.

Ground-truthing of features seen on the aerial photographs was performed over several days of calm seas following initial observations made using polarized glasses from the shore and the ends of the groynes. The existing locations of seagrass beds, live corals and reefs were readily visible from these locations and the data gathered by these land-observations was supplemented by observations made while walking through the shallow areas (<1.2m). Details of rubble, pavement, live coral and seagrass areas were observed using mask and snorkel, representative photographs were taken, and further scale or distance ground-truthing measurements made with a 60m fiberglass measuring tape. Further reef and coral mapping was done using GPS in November 2006 but sea conditions were not ideal and water turbidity prevented clear observation of the sea floor.

Specific assessments of near-shore reef areas were done by snorkelling during which the sizes of corals were measured using a 1m graduated PVC scale-bar. Larger specimens and species of note were photographed using a hand-held 7MB digital camera within an underwater housing.

Coral, flora and fauna species lists were done using a random swim assessment method during the above snorkeling assessment of larger coral heads.

Initial field assessments of the western and southern coasts were done on foot from shore, groyne and shallow water using polarized glasses. Faunal assessments were made from these observations and from several past studies in and associated with the area done through the Montego Bay Marine Park.

Detailed assessments concentrated on the habitats close to shore and those likely to be effected by coastal modification and hotel operations and less effort was invested on the outer reef crest and fore reef slope.

Corals

Coral diversity and abundance counts were done during large coral mapping exercises in September and October of 2006 using a semi-random mask & snorkel swim technique over areas of rubble and pavement with particular attention paid to reef areas. Corals observed during seagrass and other exercises within this project are also included. Species and counts were recorded on the mapping slate.

Fish

The presence of marine fauna was noted during the large coral mapping exercises when focus was placed on the different types of substrate; coral, seagrass, groyne or other particular habitat. Fishes observed with polarized glasses during walking assessments of seagrass or mangroves were also included, as were carcasses harvested by fishers that were seen on the beach. Species and counts were recorded on the mapping slate.

1.4.4.6 Marine water quality

Following an initial reconnaissance of the site, two water quality surveys were carried out on 24 October and 13 November, 2006. The objectives of the marine water quality sampling programme were to:

- measure ambient water quality conditions and establish the pre-project baseline condition, and
- identify any impacts associated with current land use practices prior to the construction of the resort.

Five sampling stations were selected in the coastal zone based on their location relative to existing developments and probable surface and subsurface discharge points, as well to reflect potential impacts related to the proposed resort development. The station locations are listed in Table 1.4.1 below and shown at Figure 1.4.2.

Table 1.4.1 Location of water quality sampling stations.

Station	Station description
SW1	Near lagoon, surrounded by mangroves
SW2	About 20 m from shore between two stone groynes, access from seaward side
SW3	About 10 m from shore, third cove from Sunset Beach Resort
SW4	About 10 m from shore, first cove from Sunset Beach Resort
SW5	Approx. 350 m from shore and about 40 m from Sunset Beach Resort perimeter fence

Salinity, conductivity, temperature, and dissolved oxygen were measured *in situ* at all 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.

Samples for chemical analysis were collected at a depth of 0.5m in pre-cleaned 2-litre polyethylene bottles. Analyses were carried out for the following parameters:

◊ pH
◊ Total Suspended Solids
◊ Turbidity

- ◊ Nitrate
- ◊ Phosphate
- ◊ BOD_5

Figure 1.4.2 Location of water quality sampling stations

- ◊ Fats, oil and grease

Bacterial samples (total and faecal coliforms) were collected at the water surface in sterilized 100 ml glass and plastic bottles.

Environmental Solutions Limited Laboratory performed or supervised the analysis of all parameters. Laboratory analyses used certified methodology, primarily from the text '*Standard Methods for Examining Water and Wastewater'*. The quality control programme at the ESL laboratory involves the analysis of duplicate samples for every four samples collected in the field.

The results of the water quality surveys are presented and discussed below at Section 2.2.

1.4.4.7 Socio-economic survey

Rapid urban appraisal techniques in conjunction with desk research were employed to investigate the socio economic aspects of the project area, viz:

- population and settlement characteristics
- land uses and livelihoods
- social infrastructure
- water supply and other utilities
- waste management practices
- community perceptions

These techniques involved windshield observations of the project area and its communities, followed by structured and semi structured interviews with stakeholders, conducted individually or in groups. The questionnaire sheet that was applied for the interviews is exhibited at Appendix 3. Data gathering included document review.

2. PROJECT ENVIRONMENT

2.1 CLIMATE

The climate of the study area is subtropical and typical of the island of Jamaica where climatic conditions are largely determined by the northeast trade winds and local orographic features. Rainfall is the dominant climatic parameter which 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 and April and result from low pressure systems that form over the south-eastern USA. These cold fronts frequently become stationary over Jamaica producing intense rainfall that can last for several days. Tropical systems including storms and hurricanes develop between June and November each year in the north Atlantic tropical cyclone basin. They traverse the Caribbean basin from east to west bringing high velocity winds, intense rainfall and storm surges.

2.1.1 Temperature

The average annual temperature for Jamaica is 27^{o}C. Data for 2002 measured at the Sangster International Airport (SIA) is shown at Figure 2.1.1.

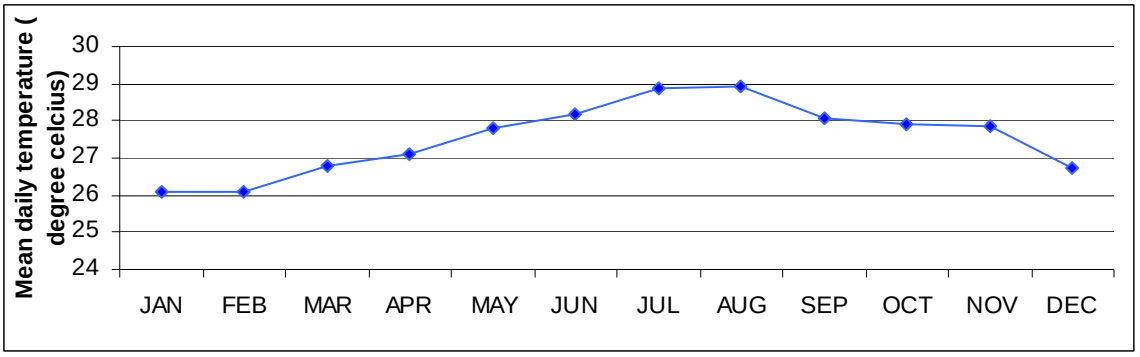


Figure 2.1.1 Mean daily temperatures at SIA (2002).

2.1.2 Rainfall

Rainfall is the dominant climatic parameter that in turn influences variations in temperature, humidity and evaporation. The mean annual rainfall for the island is 168 cm with two rainy seasons between May and June and between October and November during which over 40% of annual rainfall occurs.

Rainfall data collected at the Sangster International Airport (6 km northeast of Seawind Key) between 1951 and 1980 is shown in Figure 2.1.2. The annual mean rainfall is 105 cm with maxima in May and October and a minimum in March.

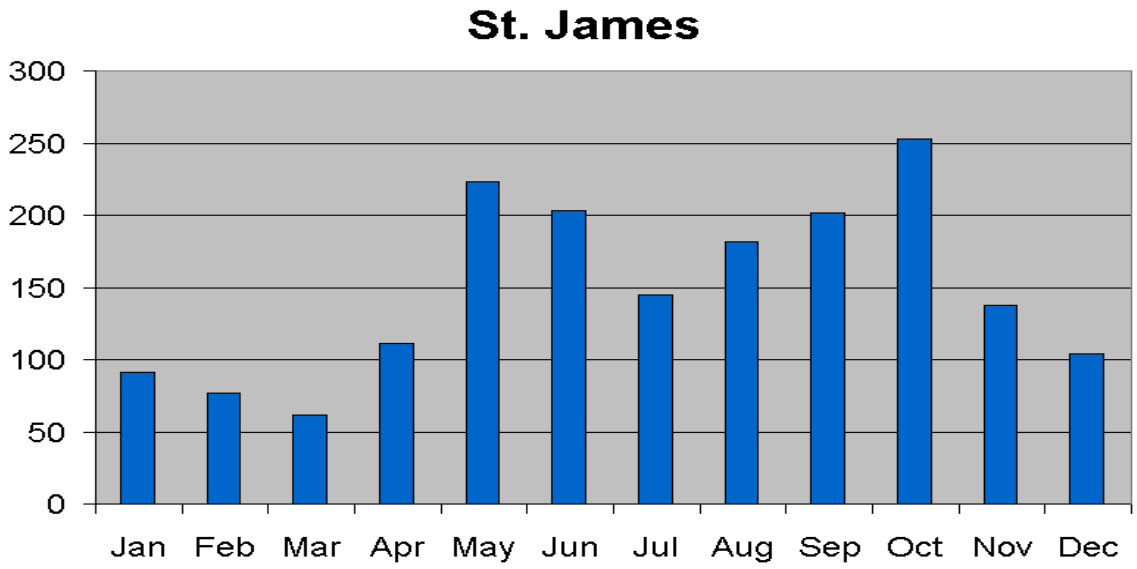


Figure 2.1.2 Annual mean rainfall at Sangster International Airport (1951-1980).

Rainfall in Montego Bay typically occurs as sudden downpours, high intensity rainfall of relatively short duration. Estimated maximum 24-hour rainfall for return periods of between 2 and 100 years based on data collected from the SIA is presented below at Table 2.1.1. The Water Resources Authority estimates that a short term rainfall intensity of 85 mm in 30 minutes is possible at the SIA.

Table 2.1.1 Estimated maximum 24–hour rainfall. (Source: *Estimates of maximum 24 hour rainfall for selected return periods and for 343 rain gauge locations, Jamaica*.)

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

2.1.3 Wind

The wind direction at the SIA is predominantly from the east with recorded wind measurements presented in Figure 2.1.3. The data indicates that winds from the east occur about 45% of time and 29% of the time from the northeast sector, typically between 7 to 21 knots. Mean wind speeds are generally higher in the daytime with a peak of about 15 knots at 2 pm. 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.

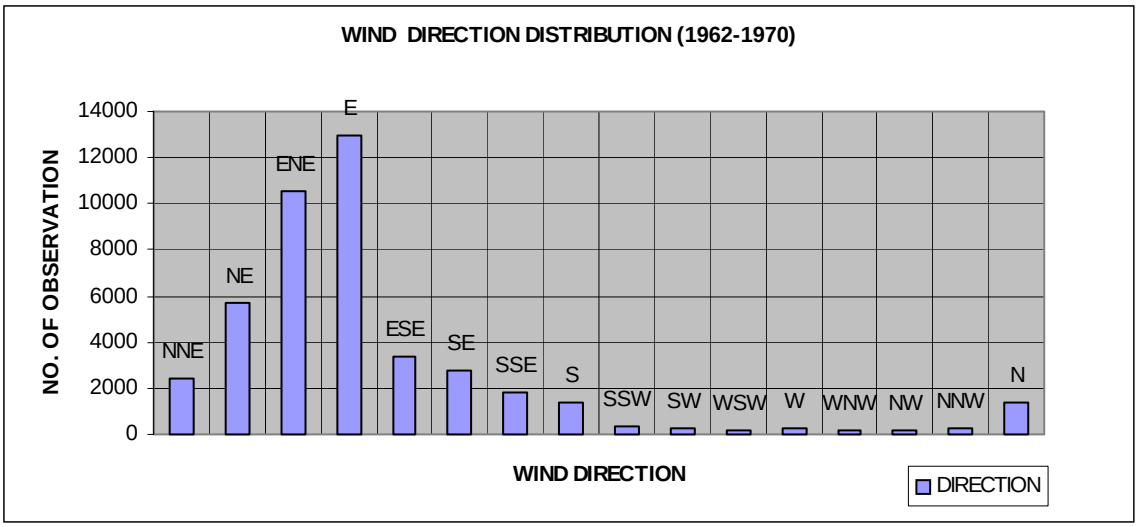


Figure 2.1.3 Wind direction distribution at Sangster International Airport (1962-1970).

2.2 TOPOGRAPHY

The site is entirely flat and low lying with elevations behind the shore ranging between 1.0 and 2.7 metres as shown in Figure 2.2.1. A full scale drawing of the topographic drawing is provided as an insert inside the back cover of the report.

2.3 GEOLOGY & SOILS

In their letter to the Client dated 23 October 2006, the Mines & Geology Division, Ministry of Agriculture & Lands, noted that the 1:50,000 Geology Sheet #3 for Montego Bay described the site and surrounding areas as being comprised of marshland and peat, and that the area had been reclaimed with artificial fill. The agency recommended that a geotechnical investigation of the site should be carried out to characterize the properties of the ground material and depth to ground water so as to inform building design.

This report refers to the findings of a geotechnical study carried out by NHL Engineering entitled *'Soil Investigation Report, Proposed Hotel Development Project, Free Port Hotel, Montego Bay, Jamaica'* dated October 2006. The soils were assessed from analyses of borings made at 33 locations dispersed over the site.

2.3.1 Soils

The subsoil layers applicable for evaluating engineering behavior and construction concerns can be characterized as three distinct types as shown in Table 2.3.1. The typical site profiles are shown at Figures 2.3.1 & 2.3.2 below. Ground water was encountered in all boreholes between the depths of 1 to 2 m, depending on the location.

Table 2.3.1 Seawind Key – characterization of soils.

Layer	Depth	Description	# of boreholes
Top	0 – 1.5 m	Dense gravelly coarse to fine sands + some coral rock	All
Mid	1.5 – 3 m	Loose/soft – very loose/soft peaty medium to fine sands & some silts	All
Bottom	3+ m	Dense gravelly coarse to fine sands + some coral rock	All

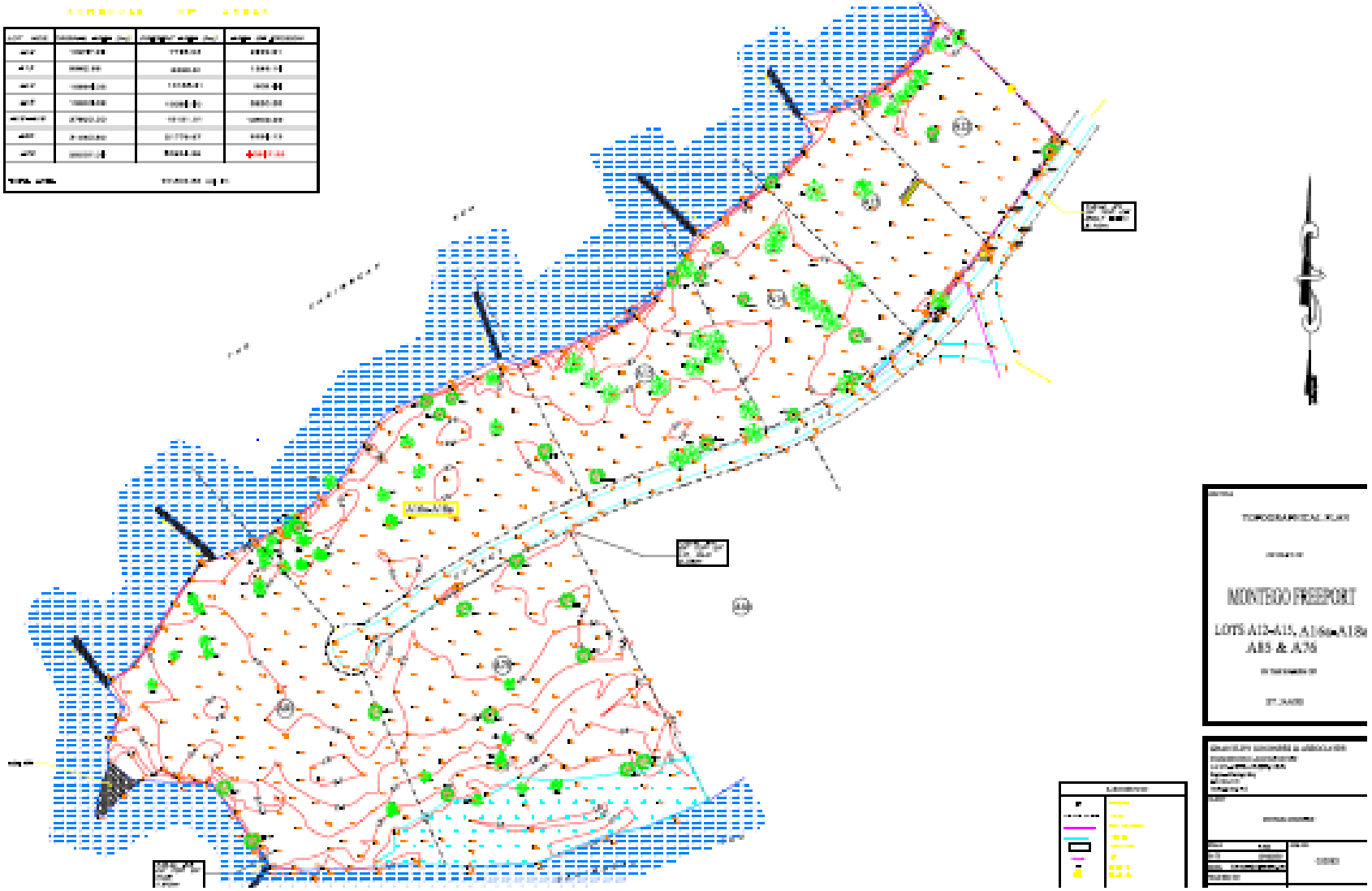


Figure 2.2.1 Topographic map of the site showing location of large trees.

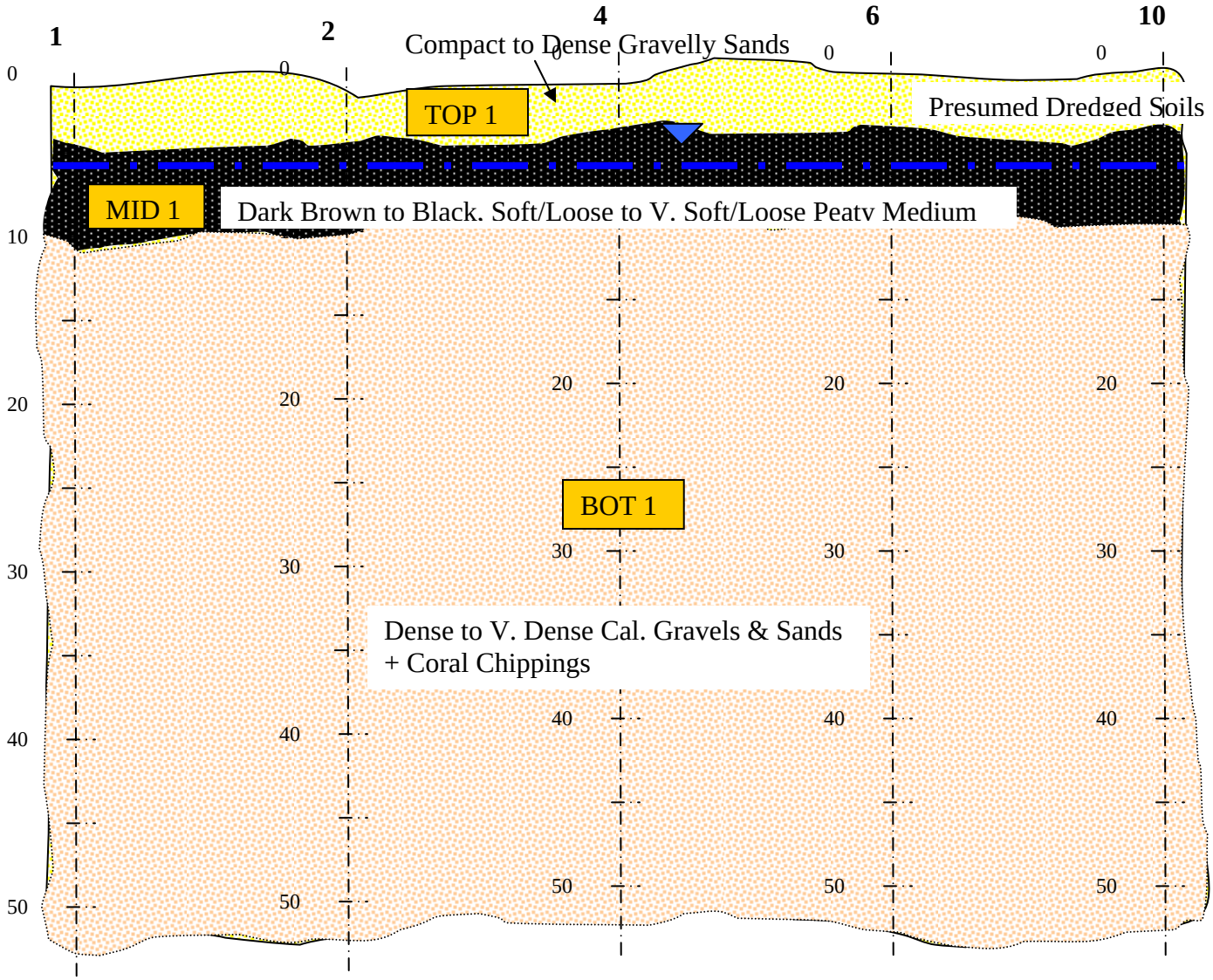


Figure 2.3.1 Typical presumptive profile – boreholes # 1, 2, 4, 6 & 10 (not drawn to scale).

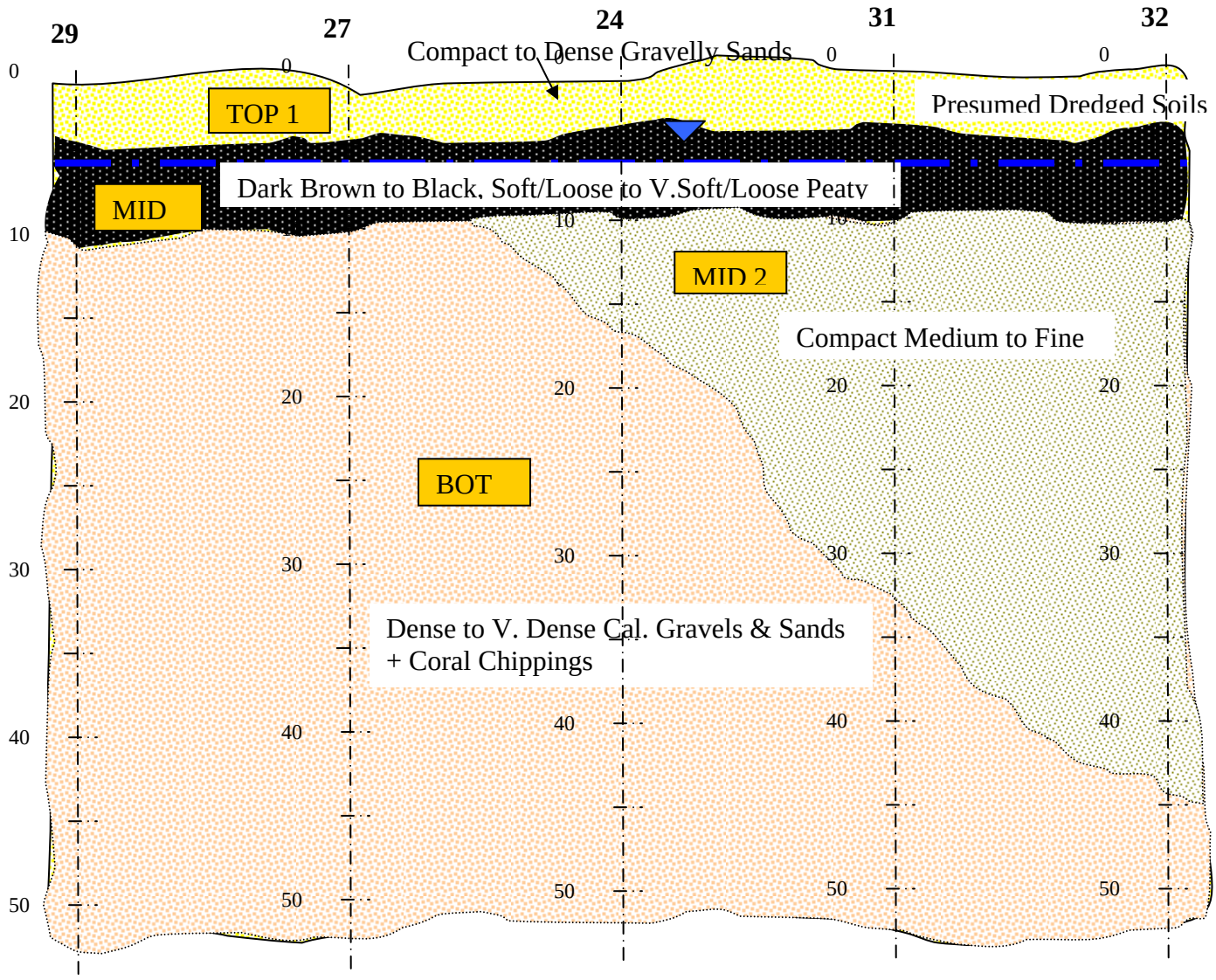


Figure 2.3.2 Typical presumptive profile – boreholes # 29, 27, 24, 31 & 32 (not drawn to scale).

The soils encountered were fairly uniform in distribution, both vertically and horizontally, across the site as shown in the figures above. The predominant soil types were gravelly coarse to fine sands plus some silts. The in situ densities were generally in the compact to dense range with the exception of the depth range 1.5 to 3.5 m where the soils were very soft/loose to loose peaty fine sands. The upper 1.5m was presumed to be dredged material that could be scarified (with care against contamination) and stockpiled for general site use by the developer.

Based on the above information, the following problems could be anticipated on the site:

i) Significant soil deformation within the upper 3.5m of material;
ii) Liquefaction within the relatively loose granular strata due to the possibility of extreme seismic events and the presence of a high water table; and
iii) Flooding and/or beach erosion due to periodic strong wave activity and/or by extreme events such as tsunamis.

Consequently, the use of conventional shallow pad and strip foundation would not be recommended without soil modification.

The following recommendations appeared to be the most economical given the resources available:

a) Excavation and stockpiling of the upper 1.5 m of dredged soils and removal of the remaining soils to a depth of 3.5 m for disposal. This would involve working below the water table which could require the use of techniques such as “wellpointing” to lower the water table to facilitate the works. This would be expensive.
b) Drive piles below building foundations and geogrids to reinforce pavements and base/subbase courses.
c) Use vibro-displacement stone columns below all building footprints to increase soil relative densities and to transfer the column loads below the loose peaty layers. This would require verification testing after compaction.
d) Given that the problem (peat) layer is relatively close to the surface and that the soils are predominantly granular, the use of dynamic hammer densification of the site could be the most feasible option. This involves the calculated dropping of a predetermined weight of hammer from a predetermined height to impart sufficient

energy to compact the soils to a required density and depth. This would require verification testing after compaction.

e) Preload the areas with borrowed fill to produce the settlements prior to construction. Verification of the level of compaction achieved would have to be made by using probes and blow count measurements. Settlement predictions in biodegradable soils are not very accurate and this method may not achieve complete settlement during the preloading period.

The application of any of the above methods should be evaluated based on cost and availability of equipment and raw material.

2.4 HYDROLOGY & DRAINAGE

In their letter of 23 October 2006, the Water Resources Authority (WRA) noted that the project site 'is underlain by coastal limestone which constitutes a coastal aquiclude. The permeability of this unit is very low and does not support the development of springs and wells except for areas of increased permeability mainly associated with faults'. As noted in Section 2.3.1 above, the water table is high and occurs at about 1 m below soil surface level. The WRA point out that any ground water found on the site would be brackish or saline in nature and could only be made potable after extensive treatment.

The site does not have any discernable surface drainage features and direct precipitation percolates down into the water table.

2.5 OCEANOGRAPHY

This section is based in part on information provided by the coastal engineers engaged to the project, Smith Warner International Ltd., and contained in their January 2007 report entitled *Report on the coastal engineering aspects of the Secrets Hotel Development, Seawind Island, Montego Bay*.

2.5.1 Bathymetry & substrate

The bathymetry around Seawind Key is shown at Figure 2.5.1. The shoreline fronting the Seawind Key property is just over 1km and the site is surrounded by water that is for the most part less than 2m deep up to 100m from shore. Along the northern side of the cay, the remnants of a reef crest top the slope of the inshore shelf which falls away to depths in excess of 200m. On the southern side of the cay in Bogue Lagoon, the depths do not exceed 4m. The best natural areas for swimming occur at the eastern half of the northern shore front where water depths range between 1 to 2m. SWIL (2007) provides a detailed description of the inshore bathymetry.

Due to the material making up the peninsula and owing to their exposure to strong waves, the beaches tend to be comprised of coarse material. In the past, protective groynes have been installed along the northern shore to control beach erosion. The substrate inshore is variably comprised of fine sand and rubble or rocky pavement. Much of the rubble and sand is covered by seagrass.

2.5.2 Currents & waves

Water currents off Seawind Key are influenced by local factors as well as those operating on a larger scale. Local factors include breaking waves whereas tides, winds and oceanic currents are influences that operate at the larger scale. The results of the drogue studies showed that inshore currents moved parallel to the coast line from NE to SW at speeds ranging between 2 - 5 cm/sec but those off shore had a more westerly heading and moved at speeds up to 11 cm/sec.

Wave measurements (0.25m) were made at a time of year that reflected calm sea conditions and not those that would occur during hurricane or winter 'norther' events. The former approached the shoreline from NNE, NNW and NW directions. They thus approached obliquely with a drift to the SW that also determined the prevailing longshore sediment transport mechanism. These observations were consistent with the visual clues noted at the shore.

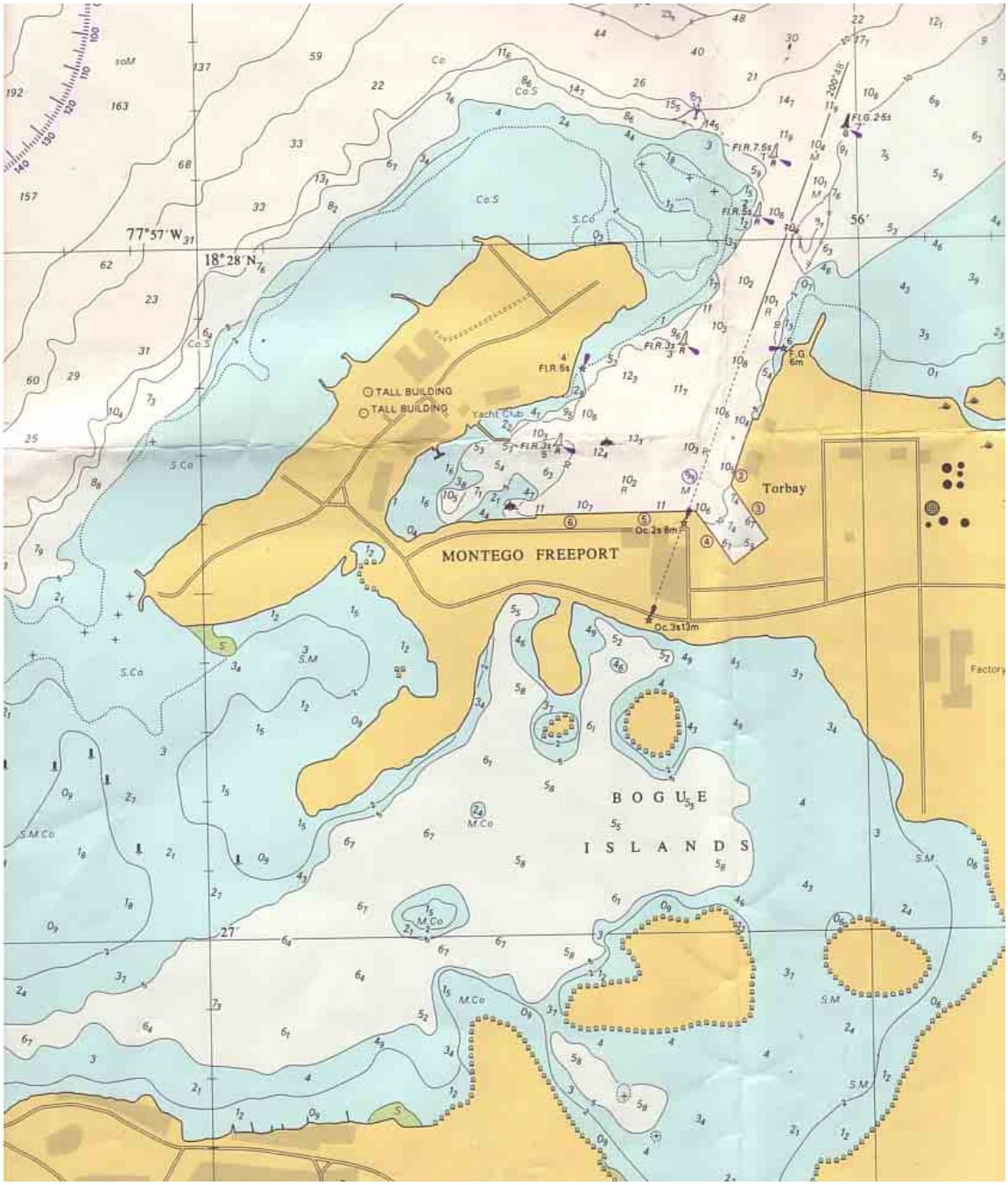


Figure 2.5.1 Bathymetry of Montego Freeport & Seawind Key. Depths given in metres – blue shaded area <5m. (Taken from British Admiralty Chart #468, ed. 25/08/1995)

Beach erosion takes place during strong wave events such as those experienced during northers (November to February) and the hurricane season (June to November).

2.6 HAZARD VULNERABILITY

The location of the project area on the northwest coast of Jamaica and within the Caribbean basin makes the site particularly susceptible to the effects of hurricanes and other tropical systems, cold fronts from North America during the winter, earthquakes and related tsunamis.

2.6.1 Tropical weather systems

Tropical systems bring intense, short-medium duration rainfall events, and these often cause flooding in Montego Bay and its environs. The low-lying and flat topography of the Montego Freeport makes it prone to ponding from these flood-producing conditions. In addition, as has been noted elsewhere, the access road to the project area floods during the smallest rainfall event as a consequence of poorly maintained drainage infrastructure.

2.6.2 "Northers"

Weather systems associated with cold fronts from North American air masses during the winter months bring windy and rainy conditions to the Montego Bay area as well as high swells to the coastline. High waves sometimes erode the coastline and often induce inland flooding.

2.6.3 Hurricanes

Jamaica lies in the path of hurricanes and other tropical weather systems that typically develop and move through the Caribbean basin between June and November (Figure 2.6.1). Tropical cyclone activity has intensified over the past ten years and it is anticipated that this trend will continue with more frequent and intense hurricanes.

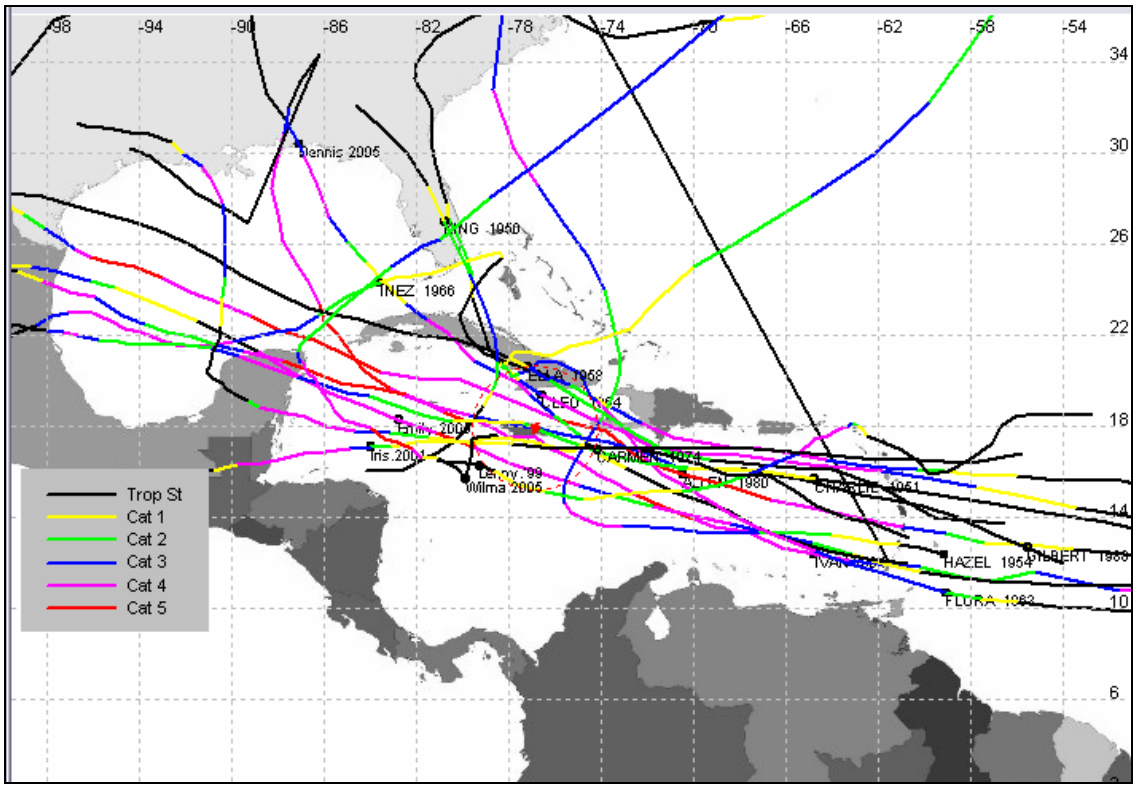


Figure 2.6.1 Hurricane tracks in the Caribbean (1950- 2005).

High velocity winds generated by hurricanes can exceed 160 miles per hour and have the capacity to cause significant damage (Table 2.6.1). Montego Bay usually experiences wind from the east and north east with speeds typically between 7 to 21 knots. 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.

2.6.4 Storm surge

The location of the project area along the northern coastline of Jamaica makes it highly susceptible to the effects of storm surge associated with hurricanes. The entire area is low lying and is therefore susceptible to inundation and accelerated erosion from increased wave action. Storm surge as a result of hurricanes several kilometres off the coast can also affect the coastline.

Table 2.6.1 The Saffir/Simpson scale used to categorize hurricanes based on wind speed and damage potential.

Wind Speed (1-minute sustained)			
Category	*m/s*	*mph*	*Damage*
HC1	33 - 42	74 - 95	Minimal
HC2	43 - 49	96 - 110	Moderate
HC3	50 - 58	111 - 130	Extensive
HC4	59 - 69	131 - 155	Extreme
HC5	> 69	> 155	Catastrophic

As part of the Caribbean Disaster Mitigation Project (CDMP), a storm hazard pilot project was developed for Montego Bay in 1999. Mapping of the 1 in 25 year return period surge (Figure 2.6.2a) indicated that of a total land area of 1400 hectares within the coastal zone of Montego Bay, approximately 480 hectares (or 34%) will be impacted by storm surge. In addition, it was found that land areas associated with conservation, resort and transportation (airport) were the most seriously affected (Storm Surge Mapping for Montego Bay, Jamaica. USAID-OAS Caribbean Disaster Mitigation Project, September 1999).

Both the 1 in 25 year and 1 in 50 year event storm surge will have a major impact on the proposed site and its immediate environment. Some critical infrastructure for Montego Bay would also be threatened (see Figures 2.6.2b & 2.6.2c above). The banks of the North and South Gullies, and the Montego River, would likely be overtopped as elevated water levels at sea would affect the flood regimes in these watercourses.

A study carried out by Smith Warner International Ltd. (SWIL) in May 2005 at Rose Hall, east of Montego Bay, indicated that storm surge inundation levels could potentially reach 4 meters. This included a sea level rise of 2 meters and a wave run-up of 2 metres.

The storm surge analysis component of the coastal engineering study carried out specifically for the Seawind Key project (SWIL, 2007) determined that the highest waves and surges would occur when the waves approached the site from the northeast. The

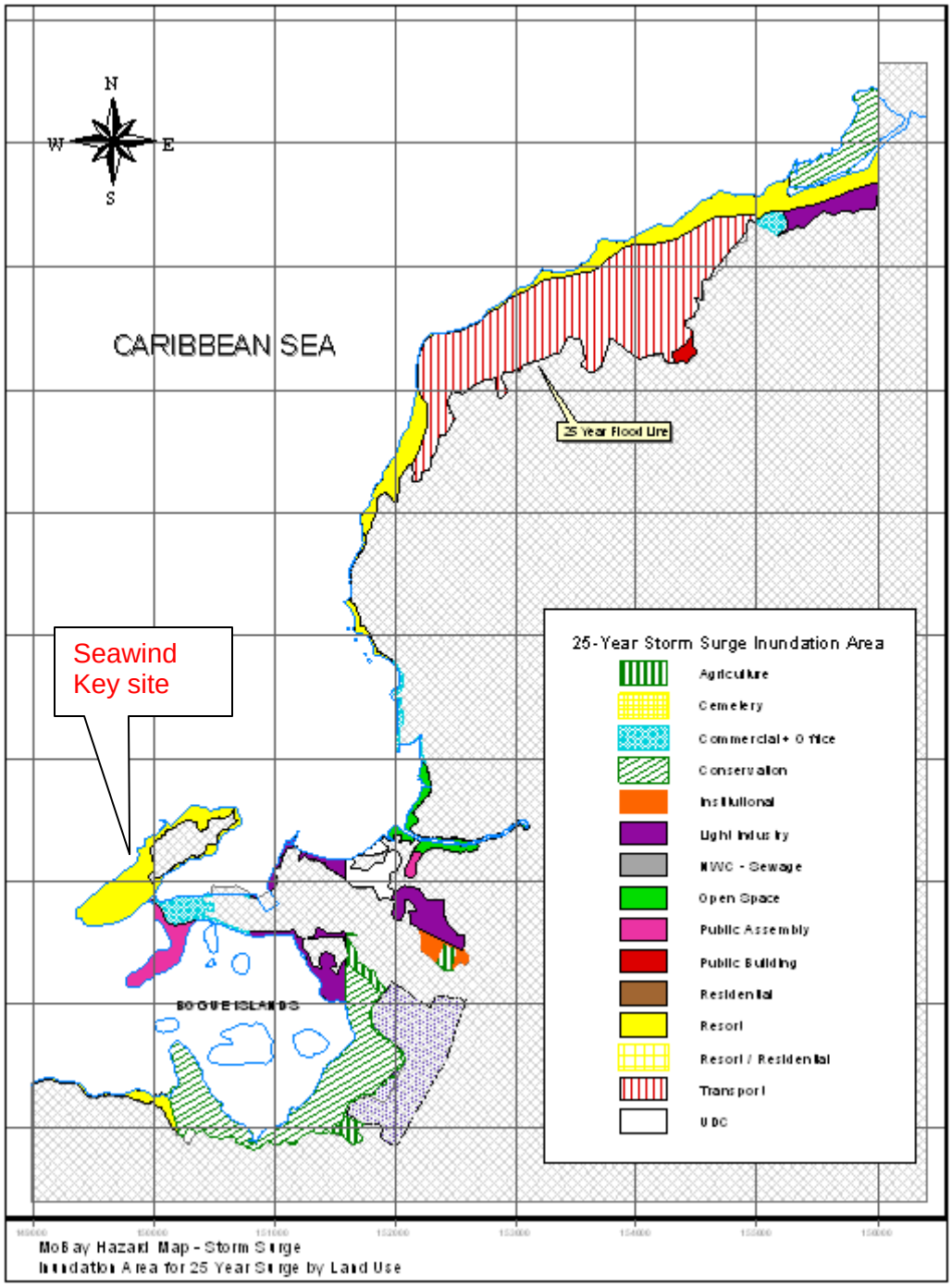


Figure 2.6.2a. Inundation area for the 1 in 25 year hurricane surge.

(Source: Storm Surge Mapping for Montego Bay, Jamaica. USAID-OAS Caribbean Disaster Mitigation Project, September 1999)

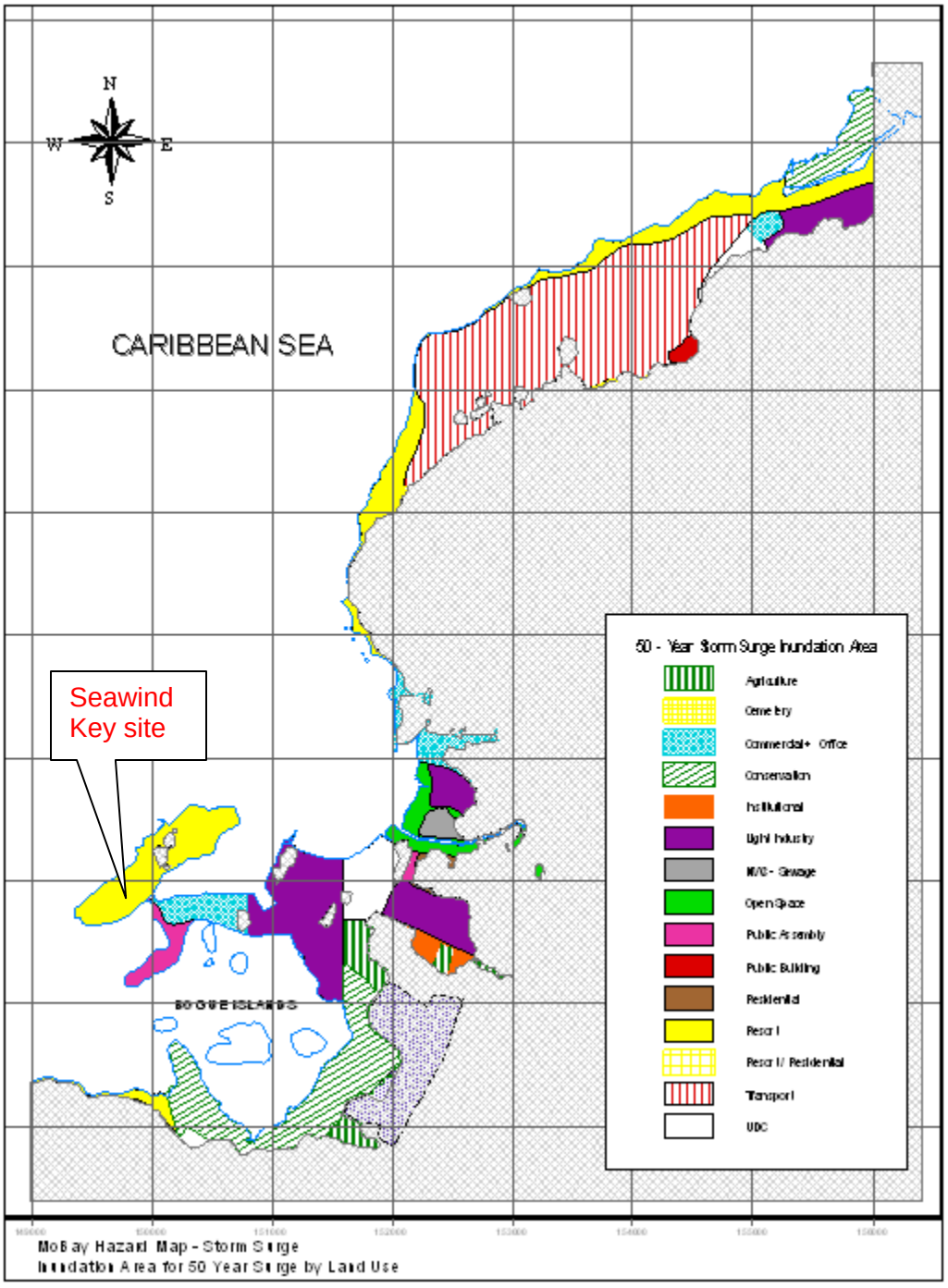


Figure 2.6.2b. Inundation area for the 1 in 50 year hurricane surge.

(Source: Storm Surge Mapping for Montego Bay, Jamaica. USAID-OAS Caribbean Disaster Mitigation Project, September 1999)

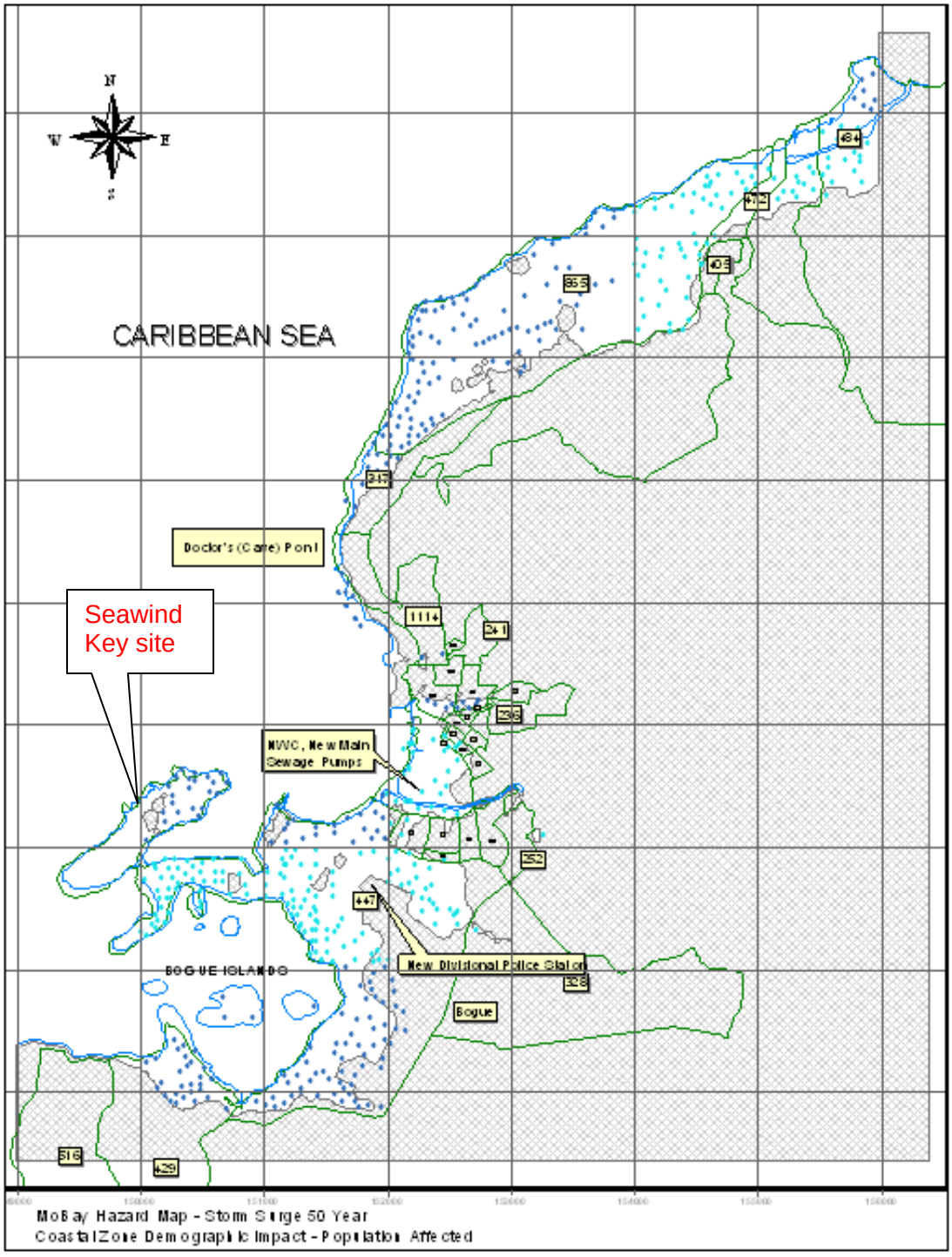


Figure 2.6.2c Impacts of storm surge on population/critical infrastructure.

(Source: Storm Surge Mapping for Montego Bay, Jamaica. USAID-OAS Caribbean Disaster Mitigation Project, September 1999)

maximum surge height was estimated at 1.8m (5.9 ft) and this would be augmented by wave run up of 0.8m (2.6 ft) to give a total water level increase of 2.6m (8.5 ft).

2.6.5 Earthquake & Tsunami

Jamaica's coastline is particularly vulnerable to tsunami hazards because of its onshore and offshore geologic setting (Figure 2.6.3a). 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 tsunamis 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 such a response (Figure 2.6.3b).

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. Most of Montego Bay’s economic activity and the proposed site location are in the coastal zone and any future tsunami is likely to have an impact.

Pereira (1987) has produced seismic zonation maps based on the analysis of historic seismic events and the tectonic setting of Jamaica. These maps indicate that the project area is located in a zone that is more susceptible to low magnitude earthquakes. These low magnitude earthquakes have the potential to cause significant damage especially where buildings are founded on alluvium and poorly consolidated sediment along the

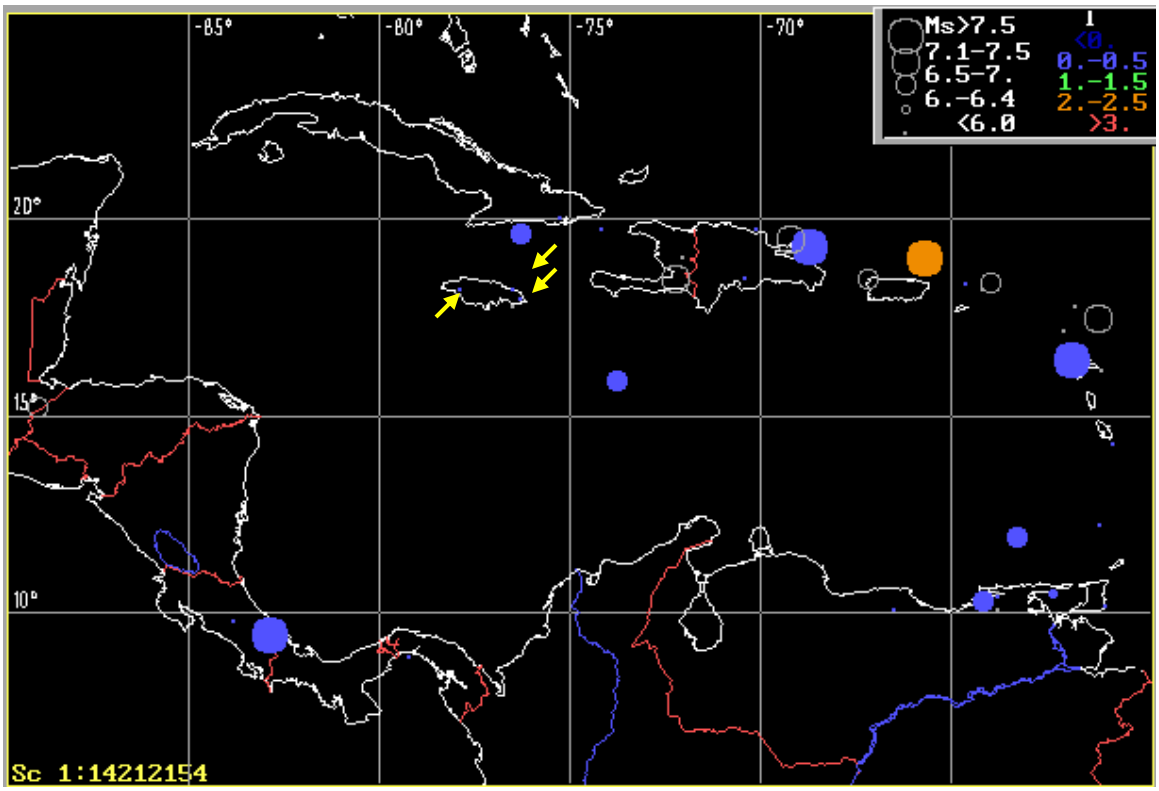


Figure 2.6.3a Historical tsunamigenic events in the Caribbean region.

The size of the circles are proportional to the event magnitude (11 events are missing because of a lack of source coordinates). The map shows three small events in Jamaica [yellow arrows]. (Source: *Tsunamis in Caribbean*, omzg.sscc.ru/tsulab/carib.html).

coastal zone (Figure 2.6.3c). The proposed site location is on reclaimed land, consisting of material that was dredged from the surrounding areas. The NHL (2006) soil report for the project site (see Section 2.2.1) noted that the soils below the water table are susceptible to liquefaction caused by seismic activities exceeding magnitude V. This could no doubt cause extensive loss of property. The study area experienced a magnitude 6.5 earthquake in 1957 with an epicentre located 20 km northwest of Montego Bay. It should be noted here that the foundations of the proposed hotel structures will be appropriately designed and constructed to withstand earthquakes.

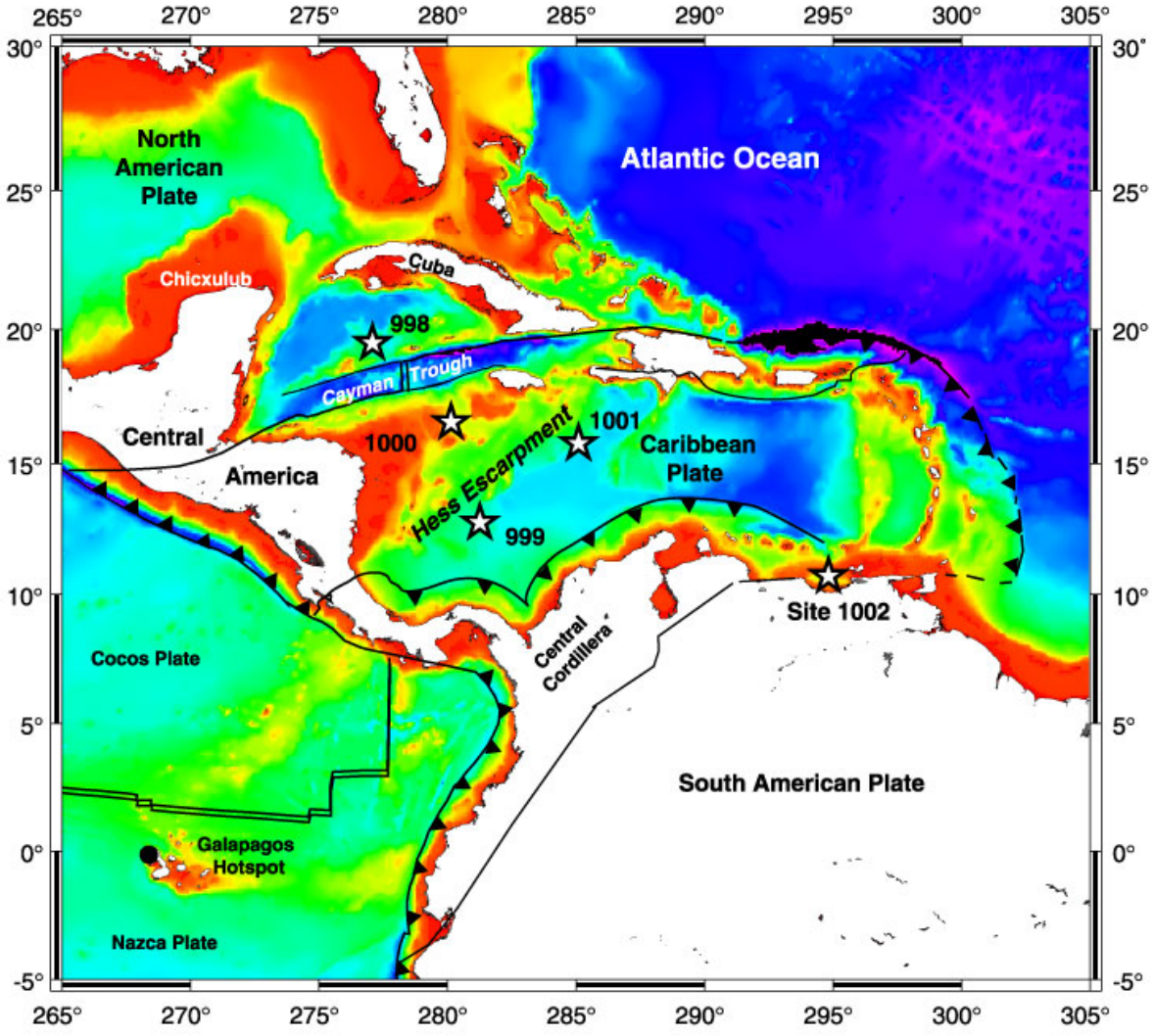


Figure 2.6.3b. Location of plate boundaries for the Caribbean.

(Source: www-odp.tamu.edu/publications/165_SR/chap_09/c9_2.htm)

2.6.6 Sea level rise

It is now fairly well established that sea level is rising as a result of global warming. It has been suggested by scientists at Lawrence Livermore National Laboratory that sea level would rise about 7 metres by year 2300, if we use up the planet's entire supplies of fossil fuel (Figure 2.6.4). If sea level were to rise at the same rate as it did 14, 000 years ago

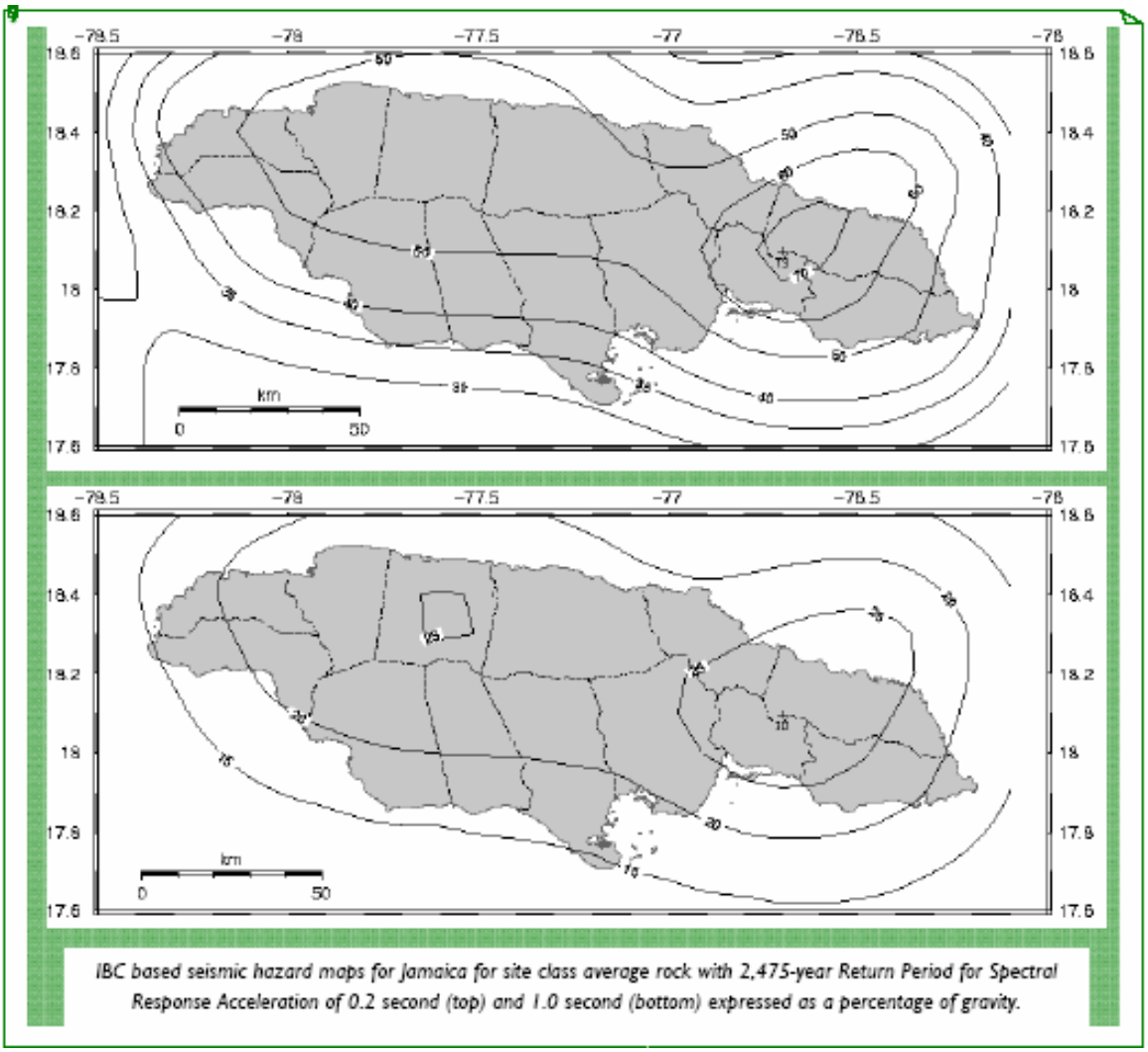


Figure 2.6.3c. **IBC based seismic hazard maps for Jamaica for site class average rock with 2, 475- year Return Period for Spectral Response Acceleration of 0.2 second (top) and 1.0 second (bottom) expressed as a percentage of gravity.**
(Source: Earthquake Unit, University of the West Indies – Mona, 2006)

at a rate of four and a half centimeters per year it would reach seven metres above today's level in just one hundred and fifty years (Robinson et al, 2006). A rise of 7 m would drown most of Jamaica's coastal communities including the Montego Bay coastal zone and at a rate of 4.5 cm/yr, the Seawind Peninsula would be covered in less than 50 years.

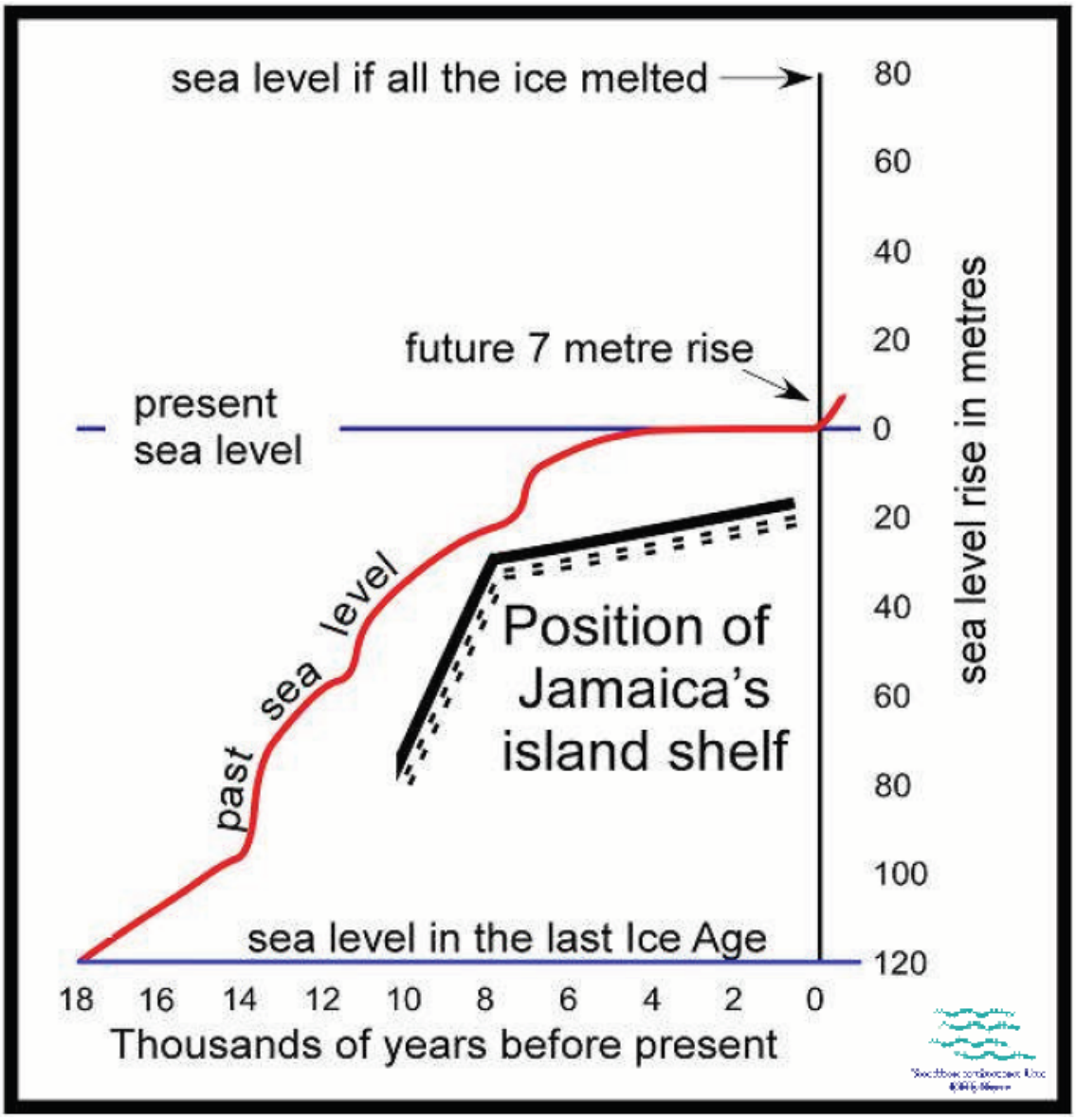


Figure 2.6.4. A summary of the history of sea level rise into the near future.

(Source: "Will Sea Level Rise and drown Jamaica", Gleaner, November 25, 2006)

2.6.7 Technological hazards

Technological hazards associated with the study area include oil spills, fires, accidents, and polluted discharges from vessels. The supply of oil for the entire western Jamaica enters through the port at Montego Bay and fuel storage tank farms are located adjacent to the port area at Montego Freeport.

2.7 TERRESTRIAL ENVIRONMENT

2.7.1 Flora

The results of the vegetation survey show that the area was dominated by a very diverse, well-vegetated, secondary pioneer herbaceous community (Plates 2.7.1 & 2.7.2). Overall, a total of sixty-five (65) plant species were encountered of which the grass, *Sporobolus indicus* was dominant. Despite that, from examination of the site and aerial photography, it would appear that the site has been extensively cleared of undergrowth on several occasions.

Plate 2.7.1 View of site looking towards western end.

Plate 2.7.2 View of site looking north west.

Other important species included the herbs *Waltheria indica* (Raichie), *Conyza canadensis* (Canada Fleabane), *Bidens pilosa* (Spanish Needle) and *Tridax procumbens*; as well as the runners *Merrimia dissecta* (You Know) and *Canavalia*

maritima (Seaside Bean). The Willow Tree (*Casuarina equisetifolia*) and Lead Tree (*Leucaena leucocephala*) were also quite common and the grass *Sorghastrum setosum* was well represented.

The vegetation on the windward fringe/coast and the south-western tip was comprised mostly of *Sesuvium portulacastrum* (Seaside Purslane), Seaside Bean, *Ipomoea pes-caprae* (Beach Morning Glory) and *Sporobolus virginicus*. Dotted in this area were tree species such as the Willow, *Coccoloba uvifera* (Seaside Grape) and *Thespesia populnea* (Seaside Mahoe).

The leeward fringe consisted of mangrove stands comprised of Red (*Rhizophora mangle*), White (*Laguncularia racemosa*), Black (*Avecennia germinans*) and Button (*Conocarpus erectus*) Mangroves. These stands appeared to have been left relatively undisturbed during periods of maintenance and cutting. Interspersed between these stands and just inland were tree species such as the Willow, Logwood (*Haematoxylum campechianum*) and Seaside Mahoe.

The average height of the herbaceous members of the community was approximately 0.5 – 1.5 m with culms of the *Panicum maximum* (Guinea Grass) nearing 2.5 m in some areas. Tree species averaged 6 – 8 m of which the Willow trees were often the tallest at around 10 – 15 m.

There were no endemic or ecologically rare plant species encountered during the field survey but the mangrove stands are of ecological importance.

A complete list of the plant species encountered and their relative dominance are provided in Table 2.7.1 below.

Table 2.7.1. Plant species list observed on 10 September 2006 at SW Seawind Key with corresponding DAFOR ranking.

Botanical Name	Common Name	Occurrence (DAFOR - Ranking)	Growth Form
Dactyloctenium aegyptium	Crow-foot Grass	F	**Grasses**
Panicum maximum	Guinea Grass	A	
Rhynchelytrum repens	Natal Grass	O	
Sorghastrum setosum	-	A	
Sporobolus indicus	-	D	
Sporobolus virginicus	-	F	
Acalypha alopecuroidea	-	R	**Herbs**
Alysicarpus vaginalis	Medina	R	
Asystasia gangetica	-	R	
Bidens pilosa	Spanish Needle	A	
Borreria laevis	Button Weed	R	
Borreria verticillata	Wild Scabious	O	
Centrosema virginiatum	-	A	
Conyza canadensis	Canada Fleabane	A	
Corchorus olitorius	Jew's Mallow	R	
Corchorus siliquosus	Slippery Bur	R	
Crotalaria verrucosa	Blue Rattleweed	F	
Euphorbia heterophylla	-	O	
Euphorbia hyssopifolia	-	F	
Heliotropium angiospermum	Dog's Tail	A	
Macroptilium lathyroides	-	R	
Mimosa pudica	Shame Weed	F	
Privia lappulacea	Velvet Bur	O	
Spilanthes urens	Pigeon Coop	O	
Stachytarpheta jamaicensis	Porter Weed	A	
Stylosanthes hamata	Cheesy Toes	F	
Tridax procumbens	-	A	
Caesalpinia major	Yellow Nickal	R	**Shrubs**
Colubrina asiatica	Hoop Withe	R	
Eupatorium odoratum	Christmas Bush	O	
Jatropha gossypiifolia	Belly-ache Bush	R	
Ricinus communis	Castor Oil Plant	O	
Solanum torvum	Susumber	R	
Tecoma stans	Yellow Elder	R	
Lantana camara	Wild Sage	F	**Shrubby Herbs**
Pluchea carolinensis	Wild Tobacco	A	
Sida rhombifolia	-	A	
Sida sp.	-	R	
Sida urens	-	F	
Urena lobata	Ballard Bush	R	

Botanical Name	Common Name	Occurrence (DAFOR - Ranking)	Growth Form
Waltheria indica	Raichie	A	
Canavalia maritima	Seaside Bean	A	**Trailing Stems/ Climbers/Twiners**
Ipomoea pes-caprae	Beach Morning Glory	F	
Ipomoea sp.	-	R	
Ipomoea tiliacea	Wild Potato/Slip	R	
Merrimia dissecta	You Know	A	
Momordica balsamina	Cerasee	F	
Rynchosia minima	-	R	
Sesuvium portulacastrum	Seaside Purslane	F	
Teramnus labialis	-	R	
Urechites lutea	Night Shade	R	
Cassia sp.	-	F	**Trees**
Casuarina equisetifolia	Willow	F	
Coccoloba uvifera	Seaside Grape	F	
Conocarpus erectus	Button Mangrove	F	
Ficus elastica	Rubber tree	R	
Guazuma ulmifolia	Bastard Cedar	O	
Laguncularia racemosa	White Mangrove	F	
Morinda citrifolia	Hog Apple	F	
Psidium guajava	Guava	R	
Rhizophora mangle	Red Mangrove	F	
Terminalia catappa	West Indian Almond	A	
Thespesia populnea	Seaside Mahoe	F	
Haematoxylum campechianum	Logwoood	O	**Young Trees**
Leucaena leucocephala	Lead Tree	A	

2.7.2 Fauna

Despite the fact that the site has been periodically cleared since its creation in the 1960's, presumably for safety and security reasons, the site is inhabited by a wide variety of animals including insects (see Table 2.7.3 below), snails, birds (see Table 2.7.2 below), amphibians [Cane toad (Bufo marinus), Whistling frog (Eleutherodactylus johnstonei), endemic frog, (unidentified Eleutherodactylus sp.)], reptiles [Common Jamaican anole, Speckled Shaero gecko (Sphaerodactylus argus ?), Clawed gecko (Gonatodes albogularis), Common house gecko (Hemidactylus mabouia)], sea turtles and mammals [black rats, Indian mongoose, feral dogs, feral cats]. Populations of these animals would no doubt fluctuate depending on the degree of habitat disturbance.

Special attention was paid to surveying the birds and butterflies for this EIA since these two groups are of particular interest to many visitors and they could play an important role in the defining the quality of the resort experience.

Green Turtles and Hawksbill Turtles are said by local fishermen to breed on both coasts of the key. They are regularly captured for food and their eggs are taken.

2.7.2.1 Birds

The bird survey included a late afternoon and dusk watch and an early morning watch. These are generally accepted as the periods of the day when bird activity is at its peak. Of the 20 species observed during the survey (see Table 2.7.2), only one was an endemic – the Red-billed Streamertail.

Table 2.7.2. List of birds observed at Seawind site, 18-19 November 2006.

Common Name	Scientific Name	Count	Status*	>75m from point
Magnificent Frigatebird	*Fregata magnificens*	5	b	Yes
Brown Pelican	*Pelecanus occidentalis*	2	b	Yes
Little Blue Heron	*Egreta cearulea*	1	b	Yes
Snowy Egret	*Egretta thula*	1	b	Yes
American Kestrel	*Falco sparverius*	4	b	
Merlin	*Falco columbarius*	1	w	
Royal Tern	*Sterna maxima*	1	b	
Zenaida Dove	*Zenaida aurita*	2	b	
Common Ground Dove	*Columbina passerina*	5	b	
Smooth-billed Ani	*Crotophaga ani*	5	b	
Red-billed Streamertail	*Trochilus polytmus*	1	be	
Vervain Hummingbird	*Mellisuga minima*	6	b	
Northern Mockingbird	*Mimus polyglottos*	2	b	
Loggerhead Kingbird	*Tyrranus caudifasciatus*	4	b	
Northern Parula	*Parula americana*	1	w	
Magnolia Warbler	*Dendroica magnolia*	1	w	
Prairie Warbler	*Dendroica discolor*	3	w	
Palm Warbler	*Dendroica palmarum*	10	w	
Bananaquit	*Coereba flaveola*	1	b	
Greater Antillean Grackle	*Quiscalus niger*	>50	b	

** b=breeding; be=breeding endemic; w=winter visitor*

There were 5 species of winter migrants from the USA and of these the Magnolia Warbler and the Merlin are considered to be less common visitors to Jamaica than the others listed. Winter migrants may spend up to 8 months of the year in Jamaica. The protection of their habitat here is therefore crucial in maintaining population size.

The current habitat for birds is varied and includes mature trees, scrub, grasses and mangrove. It does not though appear to attract a significant number of pelagic birds or resident species. Importantly though, the site is an attractive area for insect eating migrant warblers. The presence of Noni (*Morinda citrifolia*) was observed to be extremely valuable to the several Vervain Hummingbirds (second smallest bird in the world) that inhabit the area. Australian Pine or Willow (*Casuarina equsitifolia*) trees are also often used by this species for nesting.

Mature trees are essential to the site and provide safe roosts for birds and also a valuable source of fruits and insects. The mangrove area on the southwestern shore should be considered to be important as a nesting site for shore birds (and also a key foraging area for shrimp, molluscs, crabs and fish fry). The fruit of the West Indian Almond will provide a food source for both birds and bats. The grass and scrub provide good hunting grounds for the raptors – American Kestrel and Merlin.

2.7.2.2 Butterflies

24 species of butterfly were observed during the survey carried out on 18 and 19 November 2006 (Table 2.7.3). The current extensive flora on the site provides good habitat for a wide range of lowland and coastal butterflies. Sixty five species of plant were described from the recent botanical survey (see Section 2.6.1) and nectar producing plants will be flowering throughout the year, providing good forage for butterflies. It will also be a good breeding ground for the species observed as well for many others that were not present at the time. One endemic species, Bourke's Hairstreak, was observed on Day 2. Conservation of habitat for Bourke's Hairstreak should be carefully considered in relation to the proposed clearance and development of the site.

Table 2.7.3. List of butterflies observed at Seawind site, 18-19 November 2006.

Family	Common Name	Scientific Name	Count
Nymphalidae	Jamaican White Peacock	*Anartia Jatrophae jamaiciensis*	2
	Tropical Fritillary	*Euptoieta hegesia hegesia*	>20
	Buckeye	*Juonia evarete*	>50
	Buckeye	*Juonia genoveva*	>50
	Cuban Crescent Spot	*Phyciodes frisia frisia*	9
	Malachite	*Siproeta stelenes stelenes*	1
Heliconiidae	Tropical Silverspot	*Dione vanillae insularis*	>20
Lycaenidae	Hanno Blue	*Hemiargus hanno ceraunus*	>50
	Bourke's Hairstreak	*Heterosmaitia bourkei*	1
	Cassius Blue	*Leptotes cassius theonus*	>50
	Hewitson's Hairstreak	*Strymon columella cybira*	1
Pieridae	Antillean Great White	*Ascia monuste eubotea*	1
	Poey's Barred Sulphur	*Eurema daira palmira*	>50
	False Barred Sulphur (Cramer's Barred Sulphur)	*Eurema elathea*	>20
	The Little Sulphur	*Eurema lisa euterpe*	>20
	The Sleepy Orange	*Eurema nicippe*	1
	The Cloudless Sulphur	*Phoebis sennae sennae*	>20
Papilonidae	Bahamian (Cuban) Swallowtail	*Papilio andraemon*	2
Hesperiidae	Butler's Branded Skipper	*Euphyes singularis insolata*	1
	Latreille's Cane Skipper	*Nyctelius nyctelius nyctelius*	1
	Tropical Chequered Skipper	*Oileus pyrgus*	>50
	Watson's Cane Skipper	*Panoquina sylvicola woodruffi*	11
	Dolores Skipper (Confusing Branded skipper)	*Perichares philetes philetes*	1
	Long-tailed Skipper	*Urbanus proteus*	>20

2.8 MARINE ENVIRONMENT

2.8.1 Montego Bay Marine Park

The project site is surrounded on three sides by the Montego Bay Marine Park (MBMP) (www.mbmp.org), a national park and protected area, with the site's southern and western shores bordered by the Bogue Lagoon Fish Sanctuary. Established in 1992, the MBMP extends from the Unity Hall area in the west to Whitehouse in the east (Figure 2.8.1). It extends from the upper high tide mark and includes all habitats and waters down to the 100m contour. All uses of natural resources are regulated within the MBMP,

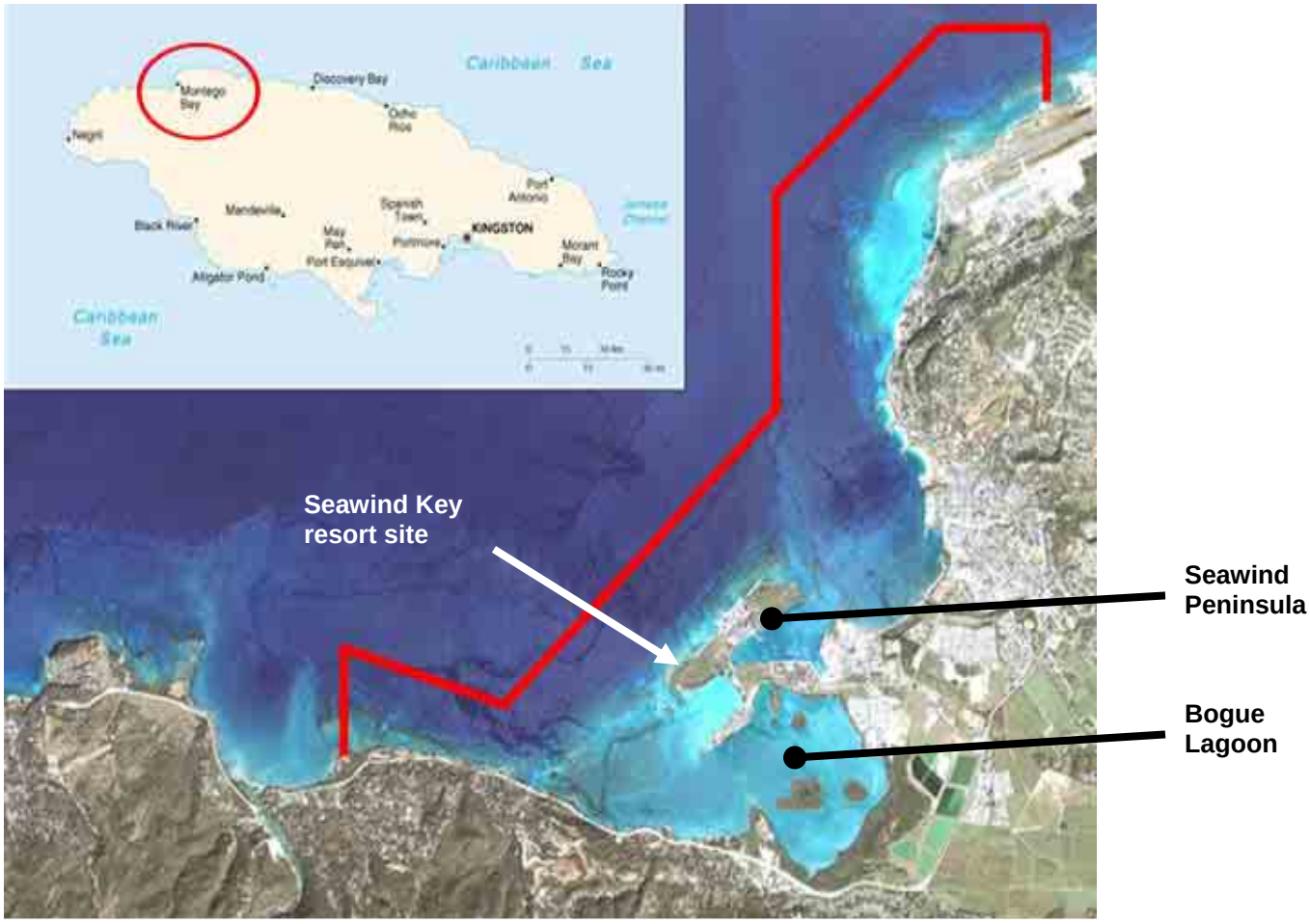


Figure 2.8.1 Satellite image showing extent of the Montego Bay Marine Park (boundary shown by red line).

including killing, removal or modification of any structure or marine or coastal flora or fauna. The MBMP is co-managed by the National Environment and Planning Agency and the Montego Bay Marine Park Trust, a non-government, not-for-profit community organization.

2.8.2 Seawind Key shallow marine habitats

The main features of the inshore marina habitats at Seawind Cay are shown at Plate 2.8.1. The distribution of the shallow inshore marine habitats is shown at Figure 2.8.2. These are discussed in more detail in the succeeding sections. The basic data from which the distribution map was plotted is provided at Appendix 2.

Plate 2.8.1 Aerial survey photograph of Seawind Key (circa 1992) clearly showing shallow underwater features.

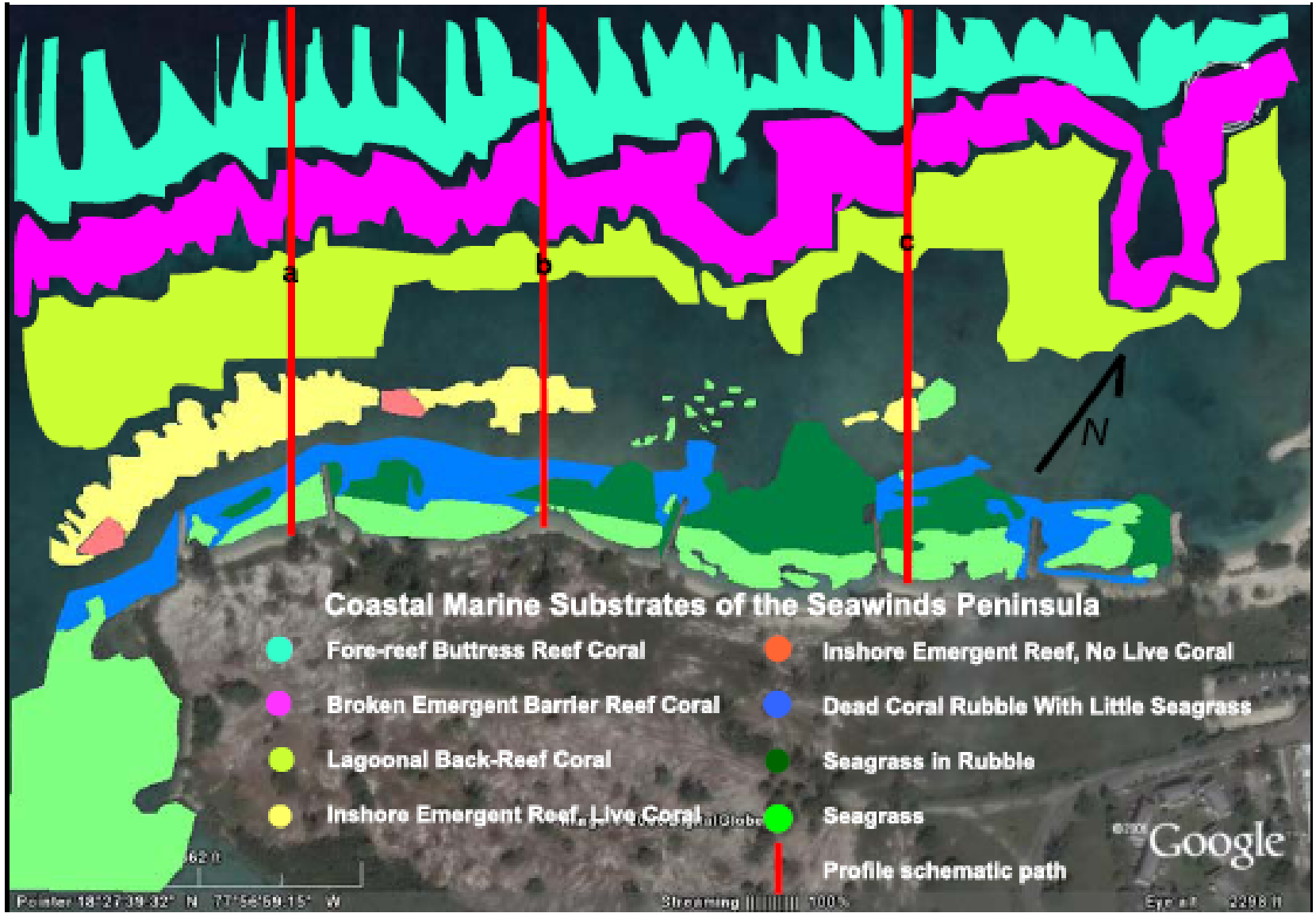
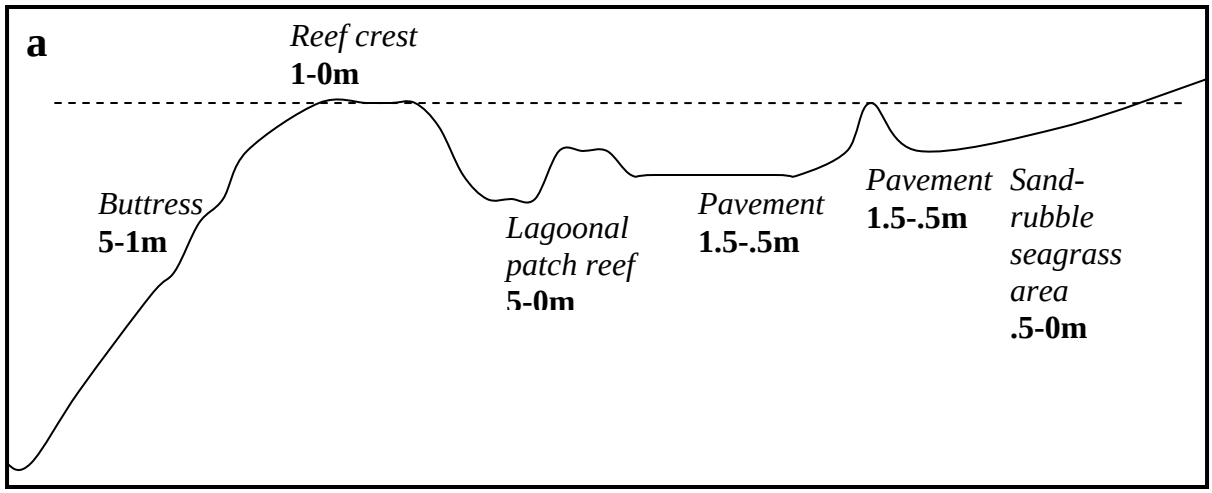
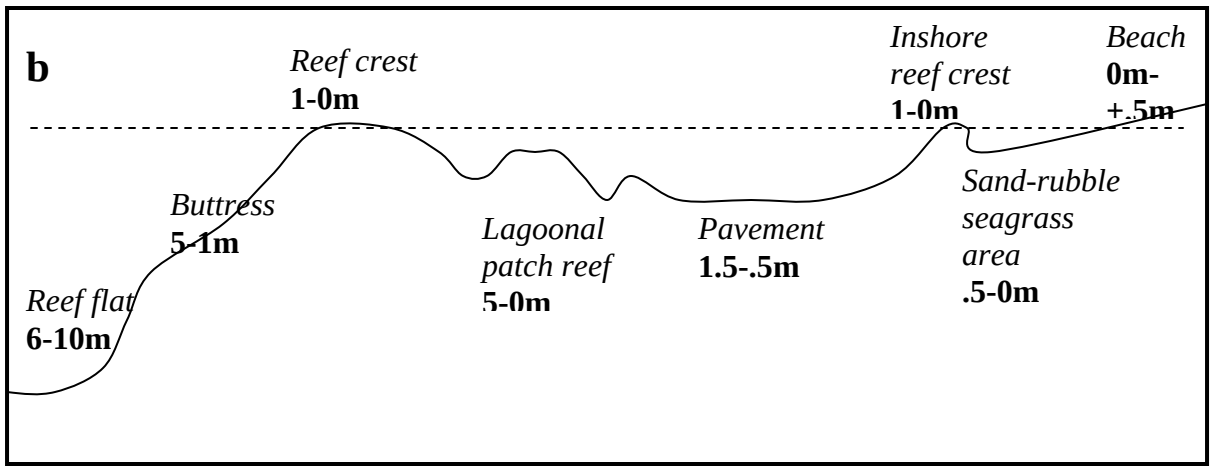


Figure 2.8.2 Distribution of shallow water benthic habitats at Seawind Key superimposed on satellite imagery.





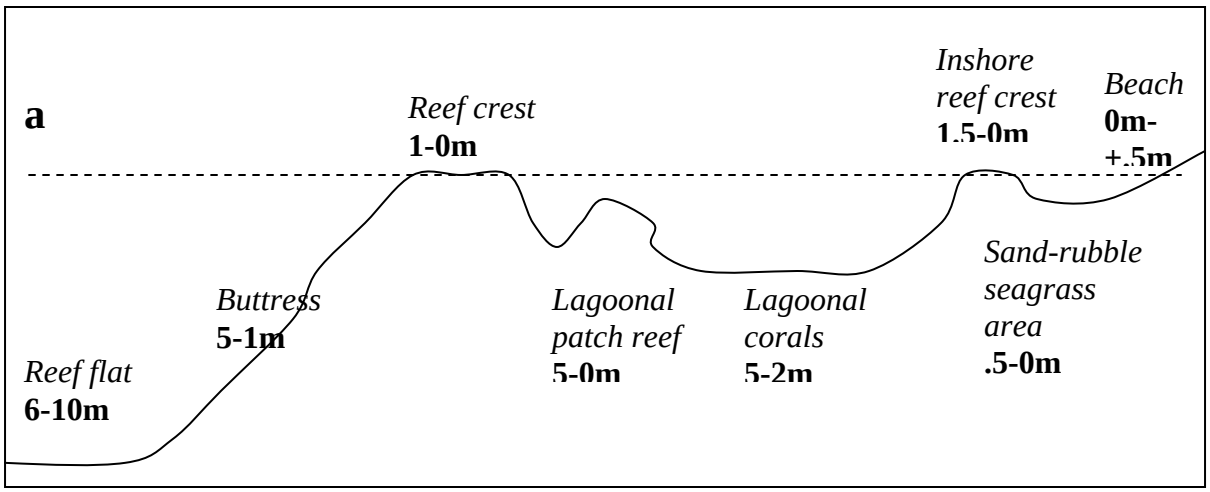


Figure 2.8.3 Schematic reef profiles at 3 transects shown on Figure 2.7.2. (Sea surface in dotted line - Reef form in bold - Depth in italics)

Figure 2.8.3 above depicts the profiles of the reef at transects shown on Figure 2.8.2. Of note are the two (inner and outer) reef crests that characterize this area of the reef. The shoreline reclamation and protection works described later in Section 4.3 are located landward of the inshore reef crest.

2.8.3 Beaches

The beaches along the northern side of the site are partially protected by a barrier reef fronting a shallow back-reef lagoon approximately 200m wide. Although this reef is extensive and often emergent, it provides insufficient protection and the beaches erode during larger wave events such as winter 'northers' and hurricanes. For this reason, several groynes have been put in place in the past to control shoreline erosion such that the shoreline is now divided into segments or cells (see Section 2.5). The beaches are mainly made up of gravels and cobbles above the low-tide mark (Plates 2.7.1 & 2.7.2), and below this mark the fine sands are in part maintained by seagrass meadows. The short beach of the western end of the peninsula does not face waves directly and is protected by a breakwater. Here the beach is comprised of shell fragments and finer sands, again maintained by a dense seagrass meadow close to shore. This beach also retains considerable amounts of rubbish above and below the water line.

Plates 2.7.1 (above) & 2.7.2 Views of beaches along north side of Seawind Key. The latter clearly shows evidence of wave erosion.

The southern shoreline borders the Bogue Lagoon, an estuarine system of shallow seagrasses meadows and fringing mangroves with high turbidity and high productivity. Much of this shoreline is covered by a mangrove stand with two small pockets of exposed beach with fine sands fronting calm shallow waters and extensive shallow beds of seagrass over fine muds.

2.8.4 Mangroves

Reference has earlier been made (see Section 2.6.1) to the small but rich and diverse stand of fringing mangrove trees (Plate 2.7.1) occurring along the southern coast of the site and bordering the Bogue Lagoon Fish Sanctuary. Recruitment of all the three mangrove species is strong along this coast and seaside mahoe (*Thespesia populnea)* is very much present. Crabs, reptiles and birds are well represented and American Crocodiles (*Crocodilus acutus*) are reported in the area from time to time. In consideration of the ecological role and function of the mangroves, no mangrove removal and coastal works are intended along the southern coast of the development site.

Plate 2.7.1 Fringing mangroves along southern side of Seawind Key as seen from their western end.

Constant recruitment of red and black mangroves occurs along the northern and western coasts but survival seems to be restricted to the western end as mature trees are seen only behind the breakwater on the western beach.

2.8.5 Seagrass

Seagrass is plentiful on all sides of the site. The northern and western coasts contain dense stands of *Thalassia testudinum* (turtle grass) in all areas with suitable substrate, although there are patches where the plants have been removed by heavy waves or human disturbance. *Syringodium filiforme* (manattee grass) also occurs in areas of fine substrate and in areas of recently disturbed *T. testudinum*. The seagrass beds appear not to be limited by availability of recruit material as all areas of suitable substrate and even poorer areas, such as gravel and rubble, are colonized. It would appear that the rhizomes of the grasses bind the substrate material well enough under regular storm wave conditions. The shallow lagoon along the site's southern coast contains beds of *T. testudinum, S. filiforme* and *Halodule beaudettei* (shoal grass). Deeper portions of this area (>0.5m) are chronically turbid and the sea bottom could not properly be seen.

The occurrence of seagrass appears to be limited by available space and habitat along this coast rather than being limited by recruitment. As such, appropriate areas for relocation during seagrass removal activities contemplated by the project are not easily found and these may be limited to those areas within the Bogue Lagoon that have been damaged by anchors and boat propellers. It is expected that natural recruitment will take place within the newly created beach areas and for which a maintenance programme may be developed. This would have to include the cooperation and collaboration of the resort operator. Similarly, seagrass may be replanted within portions of these created beach areas after they are completed for aesthetic, habitat and sand stabilization purposes.

Intact removal and replanting of seagrass in the mixed seagrass-rubble beds may not be feasible, as grass and substrate will likely not come up in a useable single "sod" unit. On the other hand, propagules, grass tufts and rhizomes may be salvaged for loose replanting in the areas described above or in areas of lesser quality or likelihood of establishment such as the Montego Bay harbour in the vicinity of the Montego Bay Yacht Club.

2.8.6 Coral reef

Considering the history and water conditions of the site, corals were surprisingly common and robust within the near shore area of the northern coast, with complete massive form colonies > 60cm in diameter. Live colonies of reef building species were mainly observed on short reef promontories producing near shore emergent reefs paralleling the western third of the northern shore in two segments, plus one small patch reef to the middle of the site. Smaller initial colonizer coral species such as *Siderastrea radians, Favia fragum, Porites astroides* and *P. porites f. divaricata* were common throughout the site on and within the rubble and on any areas of pavement or reef. Note that none of the reef surveys were conducted more than 100m from shore.

Coral species encountered around the site are listed below in Table 2.7.1. The list includes species observed in the shallow reef as well as in rubble and seagrass habitats. Large coral colonies were also noted seaward of the coastal corals of the western portion of the site leading back to the main emergent barrier reef. These were not surveyed in detail.

Table 2.7.1 List of corals found off Seawind Key.

Species	S*	Species	S*
Millepora complanata	C	Agaricia sp.	C
Millepora sp.	C	Acropora palmata	P
Siderastrea sideria	C	Montastrea annularis	C
S. radians	A	M. cavernosa	P
Porites porites	C	Madracis mirabilis	P
P. branneri	P	Stephanocoenia michilini	S
P. astroides	C	Dichocoenia stokesii	C
P. porites f. divaricata	C	Favia fragum	C
Diploria clivosa	C	Mycetophyllia sp.	P
D. strigosa	C	Isophyllia sinuosa	P
D. labyrinthiformis	P	Mussa sp.	S
Meandrina sp.	P		

* S = scale of abundance: A= >100, C= 10-99, P=2-9, S=1

2.8.7 Fishes

The coasts of this resort site contain nursery spaces for many species of fish. These include the shallow reef, seagrass beds, and mangrove habitats. In addition the site is adjacent to the Bogue Lagoon estuary. Fish were generally very common, though rarely were any mature fishes encountered, particularly those of commercial species.

The list provided below at Table 2.8.2 is of fishes seen during the recent survey but by no means represents the full complement of species known to occur the area. For example, it does not include temporary residents or nocturnal species such as tarpon, snook, large jack, herring, or shark.

Invertebrates of the local fishery are also represented in this area which use this as nursery habitat. Juvenile, adult and cast shells of Caribbean spiny lobster (*Panulirus argus*) were observed during these and past surveys, and juvenile queen conch (*Strombus gigus*) are harvested illegally along this coast. Caribbean common octopus (*Octopus vulgaris*) and reef squid (*Sepioteuthis sepioidae*) are also common.

2.8.8 Turtles

As mentioned above at Section 2.6.2, it is reported that historically turtles have nested on all beaches of the peninsula as the reclaimed sands and gravels of the current coast are suitable for the nesting of at least some of the species. However community access to these beaches has allowed the continued illegal harvesting of both adults and the eggs. Though nesting may continue, turtle sightings are rare along this section of coast with recent reported sightings including one gravid hawksbill taken by fishermen near the northern beach in August 2006 and one adult leatherback on the deeper shelf offshore in the spring of 2006. Along much of the north coast nesting sites without roads, lighting, houses, dogs, harvesters or other potential disturbances are increasingly fewer and any opportunity to protect and maintain turtle nesting sites is to be encouraged. Use of appropriate beach design, landscaping and lighting will facilitate and promote continued nesting at the Seawind Key site.

Table 2.8.2 List of fishes seen off Seawind Cay.

Family	Species	S*	Family	Species	S*
Parrotfish	Scarus iserti	A	Surgeonfish	Acanthurus chirurgus	C
	Sparisoma radians	C		A.bahianus	C
	S. atomarium	C		A. coeruleus	C
	S. aurofrenatum	C	Flatfish	Bothus maculiferus	P
	S. viride	P	Scorpionfish	Scorpaenodes caribbaeus	S
Butterflyfish	Chaetodon striatus	P		Scorpaena plumieri	P
	C. capistratus	P	Hawkfish	Amblycirrhitus pinos	P
Angelfish	Pomacanthus paru	P	Trumpetfish	Aulostomus maculatus	P
Grunts	Haemulon plumierii	A		Fistularia tabacaria	S
	H. flavolinaetum	A	Goatfish	Pseudopeneus maculatus	C
	H. aurolineatum	C		Mulloidichthys martinicus	C
	H. parra	C	Filefish	Stephanolepis hispidus	P
Snappers	Lutjanus analis	S	Mojara	Eucinostomus melanopterus	C
	Lutjanus apodus	C		E. lefroyi	P
	Lutjanus griseus	C		Gerres cinereus	C
	Ocyurus chrysurus	C	Eel	Gymnothorax vicinus	P
Damselfish	Stegastes partitus	C		G. miliaris	P
	S. leucostictus	C		Echidna catenata	S
	S. planifrons	A		Myrichthys breviceps	P
	Chromis cyanea	C	Jack	Caranx ruber	A
	Microspathodon chrysurus	C		Caranx crysos	C
	Abudefduf taurus	S	Needlefish	Tylosurus crocodilus	C
	A. saxatilis	C		Ablennes hians	C
Basses	Hypoplectrus sp.	C	Squirrelfish	Holocentrus rufus	C
	Cephalopholis cruentatus	P		Myripristis jacobus	A
	Serranus tigrinus	P		Heteropreacanthus cruentatus	P
	Alphestes afer	S	Cardinalfish	Apogonidae sp.	A
Squirrelfish	Holocentrus rufus	C	Gobies	Gobisoma evelynae	C
	Myripristis jacobus	A		Ctenogobius saepepallens	P
	Heteropreacanthus cruentatus	P		Coryphopterus glaucofraenum	A
Trumpetfish	Aulostomus maculatus	P	Blennies	Labrisomus nuchipinnis	P
	Fistularia tabacaria	S		Malacoctenus triangulatus	S
Wrasse	Thalassoma bifaschiatum	A		M. gilli	p
	Halichoeres bivittatus	A		M. macropus	C
Barracuda	Sphyraena barracuda	C		Acanthemblemaria spinosa	C
Lizardfish	Synodus intermedius	P		Chaenopsis ocellata	P
Pufferfish	Canthigaster rostrata	S		Ophioblennius macclurei	C
	Sphoeroides spengleri	S		Opistognathus whitehursti	S
	S. testudineus	S	Ray	Urolophus jamaicensis	P
	Diodon holocanthus	P		Aetobatus narinari	P
	D. hystrix	S			

* S = scale of abundance: A= >100, C= 10-99, P=2-9, S=1

2.9 COASTAL WATER QUALITY

Montego Freeport is uniquely situated with distinct surface water systems on its three boundaries. The objectives of the coastal water quality assessment adjacent to the Seawind Key resort site were to:

- Determine the condition of the coastal water quality in the area.
- Determining the nature and extent of existing coastal/land use impacts on coastal water quality prior to the construction of the Seawind Key resort.
- Establish the level of compliance with local and international coastal water quality standards.

The coastal water quality data collected over the two sampling periods for this project are presented at Table 2.9.1 and the parameters discussed below. Table 2.9.2 presents 9data collected in 2002 from Montego Bay (ESL, 2002) and is provided for comparative purposes.

Table 2.9.1 Seawind Key - coastal water quality data.

PARAMETERS	SAMPLE STATIONS (Oct 24, 2006)					SAMPLE STATIONS (Nov 13, 2006)					NRCA Ambient Marine Water Standards
	SW1	SW2	SW3	SW4	SW5	SW1	SW2	SW3	SW4	SW5	
pH (pH units)	8.2	8.2	8.1	8.1	8.2	8.3	8.2	8.1	7.9	8.1	**8.0 – 8.44**
Temperature (^{0}C)	32.6	30.7	31.5	31.1	30.4	30.2	30.3	30.1	30.1	29.9	-
BOD_5 (mg/L)	Bdl	Bdl	Bdl	Bdl	Bdl	14.0	7.0	9.0	9.0	16.0	**0.57-1.16**
Dissolved Oxygen (mg/L)	5.96	5.06	5.43	6.2	4.88	3.98	5.01	4.26	3.80	4.34	**4.5-6.8**
Salinity (ppt)	33.8	28.5	28.9	28.7	34.5	30.5	26.7	30.7	30.6	29.2	**-**
Nitrate (mg/L)	0.42	0.19	1.12	0.42	0.16	0.087	0.047	0.068	0.105	0.050	**0.001-0.081**
Phosphate (mg/L)	0.67	0.06	0.09	0.11	0.03	0.04	0.07	0.01	0.03	0.03	**0.001-0.055**
Oil & Grease (mg/L)	1.75	1.13	1.13	4.00	1.63	2.1	2.5	2.3	1.4	1.3	-
Total Coliform (MPN/100ml)	<3	<3	4.0	43.0	<3	9	3	<3	<3	<3	**48-256**
Faecal Coliform (MPN/100ml)	<3	<3	4.0	<3	<3	9	3	<3	<3	<3	**<2-13**
Turbidity (NTU)	0.57	0.20	0.24	0.29	0.32	0.58	0.70	1.09	0.40	0.29	**-**

Table 2.9.2 Marine surface water quality measurements at Montego Bay on May 8, 2002 (ESL, 2002).

PARAMETERS	SAMPLE STATIONS						NRCA Ambient Marine Water Standards
	1	2	3	4	5	6	
pH (pH units)	8.0	8.1	8.1	8.1	8.0	8.1	**8.0 – 8.44**
Temperature (^{0}C)	28.3	28.0	28.0	28.2	28.8	28.1	-
BOD (mg/L)	1	1	0	1	4	0	**0.57-1.16**
Dissolved oxygen (mg/L)	6.31	6.24	6.36	6.48	6.63	6.46	**4.5-6.8**
Salinity	35.3	35.4	35.3	35.1	30.9	35.3	**-**
Total suspended solids (mg/L)	1.83	1.81	1.16	1.97	2.14	1.02	**-**
Nitrate (mg/L)	0.105	0.062	0.031	0.143	0.464	0.186	**0.001-0.081**
Phosphate (mg/L)	0.03	0.01	0.01	0.01	0.16	0.00	**0.001-0.055**
Total Coliform (MPN/100ml)	3	<3	<3	<3	1100	<3	**48-256**
Faecal Coliform (MPN/100ml)	<3	<3	<3	<3	240	<3	**<2-13**

2.9.1 Temperature & pH

Temperature and pH readings for the stations monitored off the project site were typical for tropical coastal waters.

2.9.2 Salinity

Below average salinity levels were recorded at most of the sample sites. This is an indication that the coastal waters are being affected by freshwater sources.

2.9.3 Dissolved Oxygen (DO)

Average dissolved oxygen levels for the five monitoring stations were within NEPA's ambient standards for water. The variations may be attributable to the differences in water temperature which directly affect dissolved oxygen concentrations.

2.9.4 Biochemical Oxygen Demand (BOD5)

The biochemical oxygen demand results for the two sampling trips were quite low. BOD was not detected at any of the five monitoring stations during the first monitoring event while it ranged between 7 and 16 for the second. The fact that the surface water was fairly well oxygenated with low turbidity and faecal bacterial levels, suggests that this is not unusual. The slightly higher BOD levels measured during the second monitoring

event are consistent with the lower dissolved oxygen and somewhat higher turbidity level. Low DO levels are an indication that organic matter is present in the area in significant amounts. The low BOD levels are consistent with the historical data (Table 2.8.2).

2.9.5 Nitrate

There are variations in the levels of nitrates at the different sampling locations. Generally, these levels are not in compliance with the national standards and indicate significant enrichment. The control station, SW5, though still showing elevated nitrate concentrations, had the lowest levels on both sampling occasions. It could be reasoned that the entire monitoring area is influenced by non-point pollutant sources. This would be consistent with the fact that the coastal waters along the north coast of Jamaica suffer from nitrate enrichment.

2.9.6 Phosphate

The second monitoring event recorded positive results in that only one of the sites did not comply with the standard. The initial monitoring event however was not the same, and in some instances showed elevated levels of phosphate.

2.9.7 Oil and Grease

Levels of oil and grease were generally low at all the sampling stations.

2.9.8 Turbidity

Turbidity is a measure of water clarity. Turbidity levels recorded for the sampling stations for the current investigation were all fairly low, with levels somewhat higher on the second sampling event.

2.9.9 Total and Faecal Coliform

Bacterial levels recorded in the monitoring area were well within the established standards set by NRCA.

2.9.10 Summary

There are temporal variations in the marine water quality. The lowered salinity levels indicate that freshwater intrusion is taking place in the coastal waters. The neighbouring Bogue Lagoon could be a contributor as 99% of its load is comprised of freshwater sources, including stormwater and groundwater seepage and springs (Louis Berger and ESL, 1996). That report also pointed out that at the time the Bogue Lagoon was not receiving any direct discharges of sewage albeit nutrient concentrations were high. It further reported that nutrient loadings to the Bogue Lagoon were 50-68 metric tons per year (MTY) of total nitrogen, 34-38 MTY of bioactive nitrogen, and 4 MTY of total phosphorus. The BOD loading was estimated at 28 MTY. The outfall from the city's waste stabilization ponds do not present a direct threat to the bacterial quality of the coastal water in Bogue Lagoon as the treated sewage effluent is discharged into the Montego River at a point some 800 metres upstream from its mouth to the Montego Bay (Figure 2.9.1).

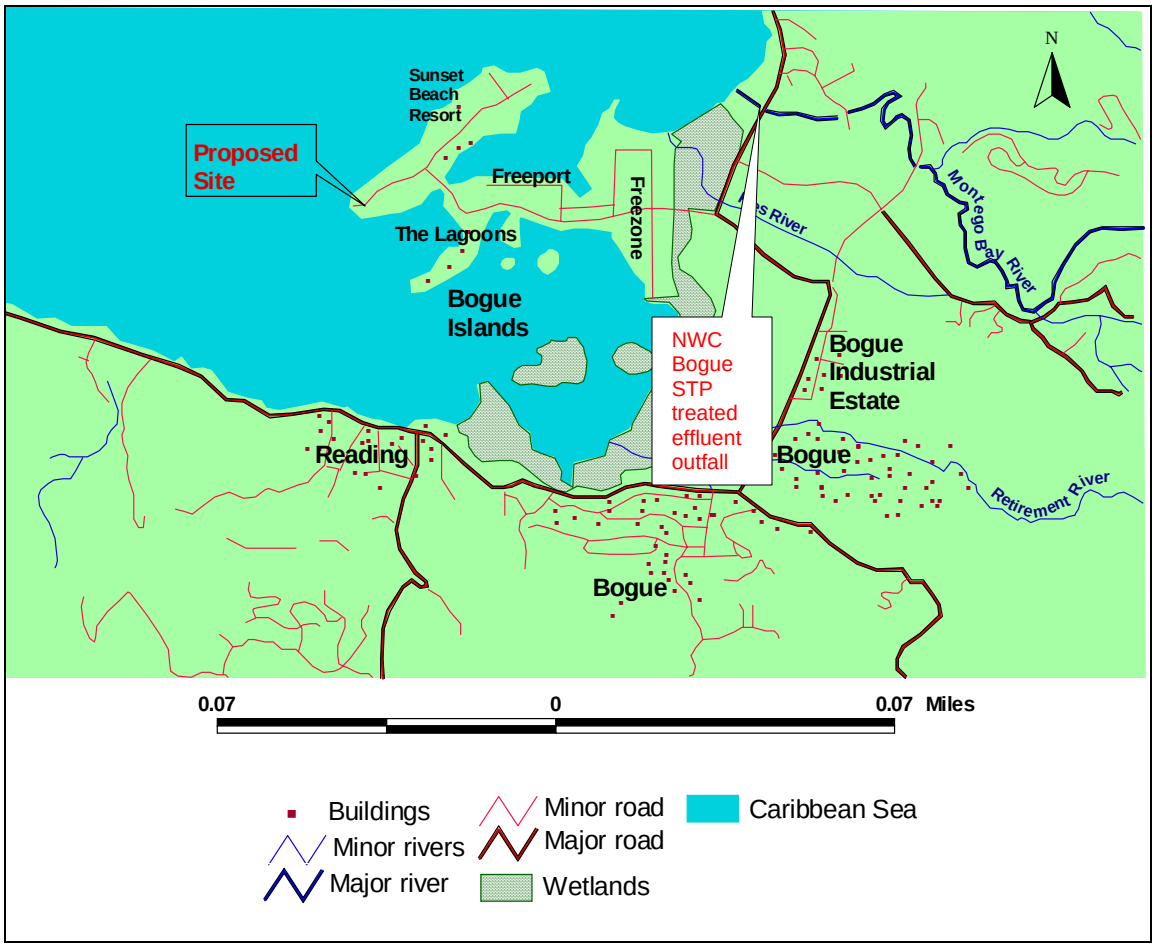


Figure 2.9.1 Map showing outfall of NWC sewage treatment plant at Montego River.

Data collected by ESL on the other side of Montego Freeport in 2002 (see Table 2.9.2) reflected fairly good water quality and values typical of Jamaican coastal waters. Any additional development in the area should ensure that their activities do not result in pollution of this sensitive area.

Water quality management during construction and operation will be critical for this project. The proposed shoreline modification works and general construction activities for the proposed development in addition to current activities (hotel, residential and commercial) in the immediate area are potential point (direct discharge) and non-point (indirect discharge such as subsurface seepage etc.) sources of contaminants to the coastal zone.

2.10 SOCIOECONOMY & COMMUNITY

2.10.1 Zone of Immediate Influence

The focus of this section is limited to what will be defined as the project's zone of immediate impact since it is within this defined zone that the project concept most clearly points to these two-way impacts. Similarly, it is within this zone that existing communities and neighbourhoods have a clearer and more useful perspective on how the project will impact them (Figure 2.10.1). It is beyond the scope of this document to quantify fully these impacts, however, some conclusions are drawn where these can be supported by data and judgment.

- The Freeport - comprising most of commercial enterprises in the project area.
- The Free zone - the bonded area comprising 25 establishments.
- Resort & residential communities.
- Sunset Beach Resort and Spa
- Townhouse complexes on Seawind Key
- Montego Bay Yacht Club
- The Lagoons
- Bogue Village
- Bogue Community
- Reading
- Bogue Industrial Estate - original industrial estate dating back to the late 1950's and currently comprising about 50 enterprises.

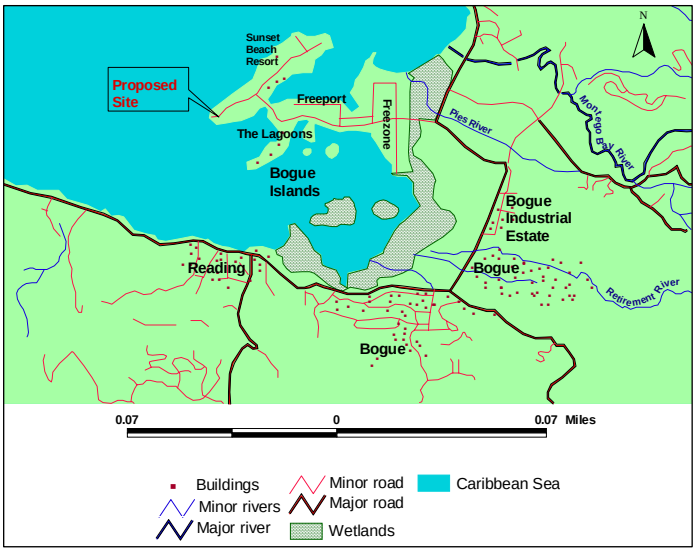


Figure 2.10.1 Project's zone of immediate impacts.

2.10.2 Regional Setting

The project is located within the larger regional setting of the Greater Montego Bay Area but also amidst the significant tourism development that exists from Negril in the west to Ocho Rios in the east.

The Greater Montego Bay Area (GMBA), for which a development plan to the year 2014 was drafted and eventually promulgated by the Greater Montego Bay Redevelopment Co. (GMRC) in 1997, 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 seen 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 Free zone.

The area has close to 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 31% of visitor arrivals to Jamaica. and four main hotel properties lying within the Rose Hall Development area account for about 37% of visitors to Montego Bay. The Project, which will contribute another 700 rooms and be the second largest hotel in the GMBA after Iberostar Hotel (950 rooms) must therefore be regarded as significantly positioned, in relation to Montego Bay's tourism product.

2.10.3 Population

The 2001 Census indicated a population of 174,120 for the parish of St. James, and 55% (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. The unemployment rate in the GMBA is estimated at 17% with 65% of current economic activity consisting of family type businesses.

Employment opportunities provided by the project and the anticipation of associated developments is one of the main justifications felt by the Bogue and Reading communities in relation to the Project as also the employers and workers within the Freeport and Free Zone.

As a general characterization, the Free Zone and Freeport are communities that have over the last 20 years grown rapidly in size. Large, medium and small scale employment, mainly in distribution, manufacturing and services, predominate. The cruise ship pier is perhaps the single most important economic contributor within the area.

Social infrastructure, which is dealt with below, is not a pressing issue in the Free Zone and the Freeport areas as their populations are essentially non-residential, moving in and out on a daily basis. The permanent residents living closest to the project site fall within an economic group that is not overly dependent on state social services, particularly health education and welfare services. However in the wider project area, adequate social infrastructure is likely to become a serious issue, particularly since the recent Bogue Village development which has introduced approximately 7,000 middle and lower middle income earners into the area.

In relation to the capacity of the social infrastructure services within the Greater Montego Bay Area, the proposed resort project is likely to be more redistributive than incremental in its overall impact. This is based on the assumption that a significant proportion of its work force will be imported from among the pool of trained or trainable workers (who are either underemployed or unemployed) already existing in the GMBA. This applies to both construction labour with core skills as well as hospitality-trained hotel staff. The demand for imported labour from outside of the GMBA is unlikely, and would be contrary to the commitment of the developers to focus on local training and employment. There exists in the local labour market un-quantified pool of trained hotel skills. This is attested to by planners, municipality leadership, employers and community membership itself. Further, HEART matriculates about 1,000 hospitality graduates annually, from its seven training academies and associated projects within it's NW Region, only some of whom find employment in the GMBA. It is known that there is an active export recruitment market for their hospitality graduates. Anecdotal information suggests that this trend is partially facilitated by limited local job opportunities. Similarly there are properties that are only recruiting 'nil work experience' hospitality trained students to better expose them to 'product' training. The Project will therefore make a necessary contribution to reducing this un-quantified but recognized pool of unemployed or underemployed trained skills.

Nevertheless, the migration of job seekers into Montego Bay from within and outside of the parish, and the resulting shortage of adequate housing and sprawl are two realities that have led to serious social and environmental dysfunction. The communities of Flankers, Canterbury, Lilliput and Barrett Hall are often cited as examples. The project will also contribute to the movement of these job-seeking unemployed into the GMBA.

Since the growth of squatting communities is widely accepted as a signal threat to the environment the appropriate focus becomes housing solutions and the creation of jobs to finance them. It is within this context that Government should deepen its planning responses to the development/squatting nexus. A series of township development studies are currently being commissioned within the Ministry of Tourism Entertainment and Culture to determine development planning needs and direction in the main tourism areas. The findings and recommendations of these studies can be expected to inform planning strategies going forward.

2.10.4 Land Use & Prescriptive Rights

The main land use in the Freeport and Free Zone areas of the project area is manufacturing and commerce. More immediately, the project site is bound by residential and hotel land uses already mentioned. To the South is the Bogue Lagoon, described in more detail elsewhere, and directly across the lagoon is the mainly upscale residential community of Reading. Bogue Village, already referred to, is likely to provide an important source of housing for Seawind Key workers. The Montego Bay Community College is also located within this area as too are a police station, a fire brigade station, and a post office.

In relation to the wider land use context, the area has for many years been converted from agricultural land use to commercial and residential use.

Given NEPA's responsibility for administering the Beach Control Act, it is sensitive to any issues related to prescriptive rights with respect to beach access (see below Sections 3.1.3 & 3.1.15). Persons so affected have the onus of proof placed on them

and the Beach Control Act requires that at least five persons make such a claim. This study is required to establish that due diligence has been done to determine whether any groups of persons have claimed or may claim prescriptive rights in relation to beach access at Seawind Key (see EIA TOR at Appendix 1). The interview survey carried out suggested that local residents are satisfied with the provision for beach access that is being offered by the public facility to be operated by the hotel. Current observations and reports indicate that a few persons enter the site to fish from the groynes and that there are a few spear fishermen who access the site mainly from the sea. Boats do not seem to beach there except perhaps to poach turtle eggs. Therefore, given the provision being made for a public beach facility managed by the hotel operators, the observation that no individuals or groups use the site on a regular basis, and the fact that no one has come forward to claim infringement of their prescriptive rights, it would appear safe to conclude that the hotel development is not affecting same.

2.10.5 Public Health & Safety

a) Health Services

The nearest public health facility in relation to the Project comprises a single Type 3 clinic located in Catherine Hall. The Type 3 clinic carries a limited complement of services and provides a medical doctor and a dentist and dental nurse although not always daily. Health interests readily concede that neither the staffing levels, equipment nor space are adequate to enable this clinic to function optimally. This situation is compounded by the completion of the Bogue Village housing development which falls within the clinic's catchment area. The advent of the resort project will exacerbate the severe resource problems for the Clinic, since it is the 3 public health inspectors associated with this clinic that carry the responsibility for monitoring health issues associated with the Freeport, Free zone and other communities within the project area.

The nearest hospital is the Cornwall Regional Hospital (Type A) with a recently expanded bed capacity of 375. Montego Bay is also served by a long established private medical practice. The Doctors Surgi Clinic, a 3 bed facility, is located in the Freeport and close to the project site.

b) Fire Service

A fire brigade station temporarily located in the Freeport provides services to the general area. It has one unit which, while carrying a limited supply of water, is capable of using water from the Bogue Lagoon if necessary. Currently backup assistance is available from the main station at Barnett Street, the Mount Salem station, and Falmouth.

c) Police Stations

St. James falls within Area 1 of the Jamaica Constabulary Force, which includes the two other parishes of Trelawney & Hanover. The project area falls within the Montego Bay Division and the divisional headquarters are located in the Freeport a short distance from the project site. The Catherine Hall Police Station is also located within the divisional headquarters complex. The nearest other police stations are the Barnet Street, Mount Salem and Granville stations, all within reasonably close proximity to the site in relation to travel time.

d) Crime

The officer in charge of crime at the station reported that the crime rate within the general project area is not considered high. This is the general view confirmed by the rapid appraisal interviews conducted for this study. Nevertheless, the crime rate in the Montego Bay Division has occasioned much public criticism and concern. Stakeholders claim that crime fighting resources within the Montego Bay Division are inadequate to contain the eleven active criminal gangs known to operate within the parish. They cite as evidence an average annual growth rate in murders of 17% since 2002, with a total of 175 up to September in 2006. Although 70% of these crimes are committed in some 6 squatter communities, none of which are near to the project site, tourism has been relatively sheltered from the impact of crime.

2.10.6 Electricity

Jamaica Public Service Company supplies electricity to the GMBA, and recent improvements at the Bogue plant have greatly enhanced power supply to the GMBA.

2.10.7 Telecommunications

Telecommunication services are provided in the GMBA by all the service providers in Jamaica, but mainly Cable & Wireless Jamaica Limited. Data transfer services are provided by the Montego Bay Digiport facility.

2.10.8 Water

Potable water is supplied to the GMBA from the Great River and Queen of Spain valley water treatment plants which have a combined output of 32 million gallons per day supplying a current estimated demand of 24 million gallons per day. Table 2.10.1 indicates that the projected demand through 2015 is higher than current supply but that there are adequate reserves to be tapped into.

Table 2.10.1 Water resources available to St. James (MCM/Year).

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

2.10.9 Solid Waste Disposal

The Retirement waste disposal site is currently being upgraded to function as a sanitary landfill. The site receives about 80 tons of solid waste per day and serves the parishes of St. James and Hanover. The resort project will need be serviced by Western Parks and Markets.

2.10.10 Traffic and Transportation

A traffic survey has been commissioned for the project, the results of which are not yet available. Observations made during the rapid appraisal survey and corroborated by discussions with the Traffic Department of the Catherine Hall Police Station suggest that

both ingress and egress from the site need not present a challenge, and can easily be accommodated by appropriate entrance design. This is because the project site is at the end of the traffic corridor, so to speak.

Traffic will be introduced from three sources:

a) Workers - a significant percentage of the hotel's labour force will probably arrive by public transport and the hotel's design should allow for commuter handling.

b) Guests - arrivals and departures will probably peak in relation to airline flight movements which generally tend to be outside of peak traffic hours although earlier flight check- in times may offset this. JUTA taxis for hotel guests can be managed by stacking.

c) Service vehicles - deliveries of supplies tend to be scheduled either weekly or fortnightly and usually comprise single lifts. Nevertheless, for large properties the effect will be daily receivables. The traffic handling plan will estimate the vehicle loading from this source.

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. Recent road improvements within the GMBA has improved traffic flow and eased traffic congestion, and the North Coast Highway Improvement Project is expected to further improve traffic movement after its completion. The Donald Sangster International Airport serves as the hub for 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.

2.10.11 Archaeological & Cultural Heritage

The project site, being completely established on reclaimed land, is not a sensitive archaeological or cultural heritage site. However within areas bordering the zone there are significant cultural heritage attractions that the project can draw upon as part of the tourism product. This comprises plantation heritage assets and local arts and crafts

markets, as well as several historical monuments and buildings within the city of Montego Bay itself.

It had been opined that the site may once have been used for a cholera cemetery. Efforts to confirm this via written enquiry were made of the National Library and Archives as well as of the National Heritage Trust. To date no evidence has been forthcoming. Nevertheless, if it is warranted that a cautionary approach be taken the National Heritage Trust could be invited to hold a watching brief during site clearance. In this regard it should be noted that the project does not intend to undertake any major excavation works for foundations since these will be piled.

2.10.12 Concerns identified by the community

Interviews were conducted with 33 individuals and 27 establishments (see Appendix 4). The Consultants were able to identify a number of impact issues that surfaced sufficiently frequently to be .representative of wider concerns and worthy of mention.

a) Land use issues

While the great majority of respondents were supportive of the resort project and recognized its potential social and economic benefits, a small percentage (roughly 5%) felt strongly that the site represented a poor choice of land use. These persons felt that the site could be better used for more meaningful educational impact. An idea which surfaced across socio-economic groups proposed a Montego Bay Marine Park Museum or Educational Center, a place where young people could go to learn about the park. A few thought residential units would add more to the potential charm of the lagoon. A minority were actually against the hotel, a reflection perhaps of the 'anti mega developments' that has traction among the environmental NGO community. Other ideas were for the land to be developed as an eco-tourism attraction or a fish and bird sanctuary. Reference was made in one instance, to the number of native birds to be seen on the site.

b) Flooding

During inclement weather, flooding occurs along the Bogue main road, in the Bogue Industrial Estate, and in areas of the Freeport. Whether this is mainly due to impeded

surface water run-off or man-made berms, the manifestation of it is the overtopping of drains and water emerging through manhole covers which results in traffic snarling and properties flooding.

c) Security

Security is a concern for both residents and establishments in the area. In Montego Bay generally, urban sprawl is continuing and there is a real concern that the traditional sense of security and community cohesion has slipped away. Although not necessarily supported by the crime statistics within the Project area, there is a sense that what is happening within the squatter communities could move outwards.

d) Visual aesthetics

This was a concern of residents in the coastal hills at Reading. They wished some assurance that the hotel design was sufficiently low rise and tastefully camouflaged that their attractive vista would not be lost. This is a concern acknowledged by the developers who intend that the hotel design will be tasteful and unobtrusive.

2.10.13 Conclusion

To the extent that the project is:

1) responsive to the consensus that tourism development provides the best opportunity for economic growth and employment,
2) located in an area zoned for resort development (St. James Development Order 1982), and
3) supported by the majority of survey respondents, and
4) subject to the requirements of the appropriate environmental safeguards, the development can be considered in a positive light.

In relation to its likely impact on the human environment it presents clear benefits as perceived by the communities themselves:

- Employment, both direct and indirect
- Increased business
- Improved property values

- Beautification of the area
- Important addition to the tourism product
- Positive competition for the hotel sector in Montego Bay

3. ENVIRONMENTAL LEGISLATION, POLICY & REGULATIONS

3.1 LEGISLATION, REGULATIONS & ORDERS

The environmental policies, laws and regulations of Jamaica relevant to the proposed Seawind Key Resort development project are listed and commented upon below.

3.1.1 Natural Resources Conservation Authority Act (1991)

This is the main environmental legislation that relates to the proposed project. This Act establishes the Natural Resources Conservation Authority (NRCA) with primary responsibility for ensuring sustainable development through the protection and management of the country's natural resources and the control of pollution. This is done mainly through an environmental permit and licence system.

The Act enpowers the Authority to:

- issue permits to the person responsible for undertaking any enterprise, construction or development of a prescribed category in a prescribed area [Section 9]. This section, the Prescribed Area Order, designates all of Jamaica as being within the prescribed area;
- issue licences for discharge of trade or sewage effluent or for construction or modification of any works for such discharge [Section 12 (1) (a) and (b)];
- request information or documents as the Authority thinks fit [Section 10 (1) (a)];
- request an environmental impact assessment containing such information as may be prescribed [Section 10 (1) (b)];
- request information on pollution control facilities [Section 17];
- revoke or suspend permits.

The Act also incorporates the earlier Beach Control Act, Wildlife Protection Act and Watersheds Act.

The environmental permit application and the project information forms for this project were submitted to NEPA in October 2006. On the basis of the review of that application, NEPA requested an environmental impact assessment of the project as communicated by letter dated 19 December 2006.

3.1.2 Town and Country Planning Act (1958)

The law establishes the Town and Country Planning Authority with responsibility for Development Orders to control both rural and urban land development, ensure proper sanitary conveniences, co-ordinate building of roads and other public services. Planning approvals for the project will have to be obtained from the Town Planning Authority at NEPA.

3.1.3 Beach Control Act (1956)

This legislation was passed to ensure the proper management of Jamaica's coastal and marine resources by a system of licencing of activities on the foreshore and the floor of the sea. The Act also addresses other issues such as access to the shoreline, and other rights associated with fishing and public recreation, as well as the establishment of marine protected areas. The law applies only to the foreshore; while it provides for the designation of protected areas, it does not address the basis for such designation, nor does it deal with the management of coastal resources landward or seaward of the foreshore. It is currently undergoing substantive review to address more contemporary legal and management issues including the expansion of the judge's discretion on sentencing, an increase in fines and the introduction of valuing natural resources based on defined criteria.

The Beach Control Law requires that an application be made for the modification of any beach/coastline and sets out requirements for the posting of public notices. As soon as the coastal engineering studies and designs have been completed applications will be made to NEPA for:

a) BCA Licence for use of the foreshore and floor of the sea for commercial/recreational activities, and

b) BCA Licence to undertake any foreshore modification work (dredging, beach nourishment, jetties, groynes construction, etc.),

3.1.4 Wild Life Protection Act (1945)

This Act is primarily concerned with the protection of specified species of fauna. This Act has also undergone review particularly in the area of increased fines and the number of animals now enjoying protected status. Further amendments are being undertaken to address a variety of other issues relating to the management and conservation of these natural resources, and the inclusion of flora. It Prohibits removal, sale or possession of protected animals, the use of dynamite, poisons or other noxious material to kill or injure fish, and it prohibits discharge of trade effluent or industrial waste into harbours, lagoons, estuaries and streams. It authorizes the establishment of Game Sanctuaries and Reserves.

Protected under the Wildlife Protection Act, inter alia, are six species of sea turtles. At least one of these reportedly nests at the Seawind Key site.

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

The island 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.

3.1.6 Natural Resources Conservation (Permits and Licenses) Regulations (1996)

These regulations give effect to the provisions of the Prescribed Areas Order. Hotel/resort complexes of more than 12 rooms are included on the prescribed list.

3.1.7 Natural Resources Conservation (Sewage Effluent) Regulations (Draft)

These regulations, when brought into effect, will cover the discharge of sewage effluent, and the operations, monitoring and reporting mechanism of sewage treatment facilities. The new resort at Seawind Key intends to collect and convey sewage through the existing sewerage system to the NWC waste water treatment plant at Bogue.

3.1.8 Water Quality NRCA Act (1990)

The NRCA has primary responsibility for control of pollution in Jamaica's environment, including the pollution of water. National standards exist for industrial and sewage effluent discharges to rivers and streams.

3.1.9 Water Resources Authority Act (1995)

The Water Resources Act established the Water Resources Authority (WRA). This Authority is authorized to regulate, allocate, conserve and manage the water resources of the island. It is also responsible for water quality control and to provide technical assistance for any projects, programmes or activities relating to development, conservation and the use of water resources.

3.1.10 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);

3.1.11 Quarries Control Act (1983)

This Act repeals the Quarries Act of 1958 and makes provisions for quarry zones and licenses, quarry tax, enforcement and safety. The proposed project should ensure that any earth materials used for the proposed construction of the resort are obtained only from licenced quarries.

3.1.12 Public Health Act (Air, Soil and Water Pollution) Regulations (1976)

Under the ambit of this act, the Environmental Health Unit, Ministry of Health, is required to review the design and plans for sewage treatment.

3.1.13 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 SWMA 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. Under the Act, solid waste can only be placed at an approved or designated site. The designated site for the western Jamaica is at Retirement, St James.

3.1.14 Jamaica National Heritage Trust Act (1985)

The Act establishes the Jamaica National Heritage Trust. It provides for protection of areas, structures and objects of cultural significance to Jamaica by declaration of any structure as a national monument where preservation is of public interest due to historic, architectural, traditional, artistic, aesthetic, scientific or archaeological importance. This

includes the floor of the sea within the territorial waters or the Exclusive Economic Zone. There are no known historical or archaeological sites that could be affected by the proposed resort development project.

3.1.15 The Office of Disaster Preparedness and Emergency Management Act (1998)

This Act established the Office of Disaster Preparedness and Emergency Management (ODPEM), to develop and implement policy and programmes to achieve and maintain an appropriate state of national and sectoral preparedness for coping with emergency situations. The proposed project should ensure that it collaborates with this agency in the preparation of the appropriate emergency response plans in relation to natural hazard events such as hurricanes.

3.1.16 Natural Resources Conservation (Montego Bay Marine Park) (Declaration) Order (1992)

The Montego Bay Marine Park was established in 1992. The Order describes the area and its boundaries. This order bans dredging, excavating, discharge of pollutants, littering, use of explosives and poisons and fishing within the protected area boundaries except subject to permit, and allows research and collection for educational and research purposes under permit.

3.1.17 Fishing Industry (Fish Sanctuaries) Order (1979)

The Fishing Industry Act of 1975 is related to the regulation of the fishing industry and serves to conserve and manage the fisheries resources by addressing such issues as licensing. Under the 1979 Order fish sanctuaries may be declared by the Minister, in which no fishing is allowed. The Bogue Islands Lagoon have been declared as a Fish Sanctuary and this is now incorporated within the boundaries of the Montego Bay Marine Park.

3.1.18 Tourist Board (Water Sports) Regulations (1985)

These regulations govern the operation and conduct of water sports.

3.1.19 Prescription Act (1882)

The relevant section of this old law pertains to beach access in the context of the Beach Control Act (1956), as follows:

> *" When any beach has been used by the public or any class of the public for fishing or for purposes incident to fishing or for bathing or recreation, and any road, track or pathway passes over any land adjoining or adjacent to such beach has been used by the public as a means of access to such beach without interruption for the full period of 20 years, the public shall, subject to the proviso hereinafter contained, have the absolute and indefeasible right to use such beach land road or pathway as aforesaid, unless it shall appear that the same was enjoyed by consent or agreement expressly made or given for that purpose by deed or writing"*

3.2 ENVIRONMENTAL POLICIES

3.2.1 National Policy for the Conservation of Seagrasses (1996)

This policy guides the issuing of licenses or permits for activities such as dredging, disposal of dredged material, beach development, and effluent disposal, which directly or indirectly affect seagrass communities. Seagrass meadows occur all around the hotel site at Seawind Key.

3.2.2 Mangrove and Coastal Wetlands Protection - Draft Policy and Regulations (1996)

This policy provides a review of the issues affecting wetlands in Jamaica as well as Government's role and responsibility. Five main goals are outlined which include guidelines for wetlands development, cessation of destructive activities, maintenance of natural diversity, maintenance of wetland function and values and integration of wetland

functions in planning and development. There is a small mangrove stand located at the edge of the site facing the Bogue Lagoon.

3.2.3 Coral Reef Protection and Preservation – Draft Policy and Regulations (1996)

This document reviews the ecological and socio-economic functions of coral reefs, the issues affecting coral reefs, and Government's role and responsibility in their protection. Five main goals are outlined which include reduction of pollutants, reduction of over-harvesting of reef fish, reduction of physical damage from recreational activities, improving the response capability to oil spills, and control of coastal zone developments. The proposed resort project must endeavour to ensure that its onsite and shoreline reclamation activities do not threaten or harm the remaining coral reefs around the headland.

4. PROPOSED PROJECT

4.1 OVERVIEW

The project involves the construction and operation of a 700-room hotel complex located on 9.7 hectares (24 acres) at the southwest tip of Seawind Key, Montego Freeport, Montego Bay. The resort will be operated by A M Resorts ('Secrets - Preferred Hotels and Resorts') as two separate hotels, each with 260 junior suites and 90 luxury suites, sharing a common lobby, administrative office and 'back of house'. The duration of the construction works is estimated to last 24 months and the approximate life span of the project is 30 years.

In height, the buildings will range from 3 to 5 storeys. The combined footprints of all the buildings, excluding recreational areas (pools and terraces) and parking areas, will amount to 27,245m^2. The layout of the site is shown at Figure 4.1 and the full scale drawing of the site layout is provided as an insert at the back of the report.

Artistic impressions of Seawind Key Resort.

The architectural design of the project seeks to create two distinct but related styles, so that each hotel will have its own identity, and sense of intimacy and exclusivity, rather than a feeling of one very large and monotonous complex. One hotel, Secrets "A", will reflect Jamaica's traditional Georgian architecture from its English colonial past, while Secrets "B" will be more contemporary but still within a style that reflects its Jamaican

and Caribbean island setting. The sense of intimacy of scale on the project will be further enhanced by the variation in building heights from 5 storeys to 4, 3, 2 and 1 storey, and the buildings clustered in smaller segments rather than in large monolithic blocks. Further, the roofing materials will also have variety, with the use of a wood shingle look as well as metal roofing, and the buildings will be painted in soft variations of colours.

Figure 4.1 Seawind Key Resort site layout plan.

Other elements that will enhance the quality of the development will be lush landscaping using locally available plants and trees, and the use of local building materials where available. Wood will also be used extensively around the lower 2 floors, to add warmth and earthiness to the pedestrian experience when walking in and around the resort.

The maximum occupancy of the resort will be 1,480 guests served by approximately 1,200 persons; roughly an employee/room ratio of 1.5:1. Under the terms of the agreement with the Urban Development Corporation, the project is to include development and management of an area designated as a public beach park at the eastern end of the property and open to local residents who used that beach.

Apart from the erection of the room blocks and associated buildings, other major elements of the construction works will be the reclamation of 15,500 m^2 (0.4 ac) of sandy beach along the northern side of the peninsula, to at least partially restore the original land configuration of the 1960's, and construction of the structures (groynes and breakwaters) to protect that new shoreline. These works are described below at Section 4.3.

From the outset the developers have included the environmental consultants in the planning and design of the resort so as to ensure a development in which the key environmental issues and constraints have been identified up-front and taken into consideration during the design process. This approach makes for efficient design and avoids costly redesign and 'retro-fitting' adjustments later.

4.2 SITE CLEARANCE & PREPARATION

Most of the site will have to be cleared of its existing vegetation to accommodate the buildings and structures. This will be done in a manner that will allow protection of trees not contained within the footprints of buildings. Selected shrubbery (especially plants used by butterflies) and small flowering trees will be removed by a landscaper and stored at a site to be designated for replanting later during site landscaping. Other cut vegetation and trees will be sent to the Retirement dump for disposal. Burning

vegetation and organic material on the site will not be allowed. The mangrove stand along the southern shore of the property fronting Bogue Lagoon will not be disturbed.

Site clearance will also result in the loss of the existing playing field next to the Sunset Beach Resort & Spa (Plate 4.2.1).

Plate 4.2.1 View of playing field at eastern end of development site.

4.3 BEACH/SHORELINE RECLAMATION

Based on the original land survey, it is estimated that about 32,000m^2 (8 ac) of shore land along the north side of the site has been lost due to wave and storm erosion. It is the developer's intention to reclaim at least some of that land and partially restore the site to its original configuration. In order to protect the reclamation and the new beaches that will be created, groynes and breakwaters will be constructed. These have been designed by coastal engineers and the initial proposals have been presented (SWIL, 2007). Boulders of the required density with weights ranging between 2 – 5 tons have been specified.

Figure 4.1 above shows the reconfigured shoreline as presently proposed. Essentially, four sandy embayments are to be created that will provide relatively calm bathing areas complemented by about 10 – 12 m^2 of sandy beach space per room. Eight groynes and several breakwaters are proposed to enclose and protect the 15,500 m^2 of new land. The proposed marine works will also entail the excavation of the shallow rocky

pavement at the western end of the site to deepen the water and make it more amenable to bathing. The volume of material to be excavated to create swimming depths of 1.5m has been estimated at 14,000m^2. The excavated material will be used as land fill for the shoreline reclamation. This will be supplemented by locally quarried granular limestone material (100 – 300mm mean diameter) and larger rocks to fill the proposed reclamation area.

About 20,000m^3 of sand will be used to construct beaches 10m wide with slopes of 1:8. Three sources of sand have been identified: i) reserves located just offshore the project site, ii) mining from an approved upland site, and iii) imported material. The SWIL report acknowledges the difficulties related to using local offshore reserves.
A summary of the sea floor encroachments and volumes of materials required to achieve the coastal works design is provided below at Table 4.3.1.

Table 4.3.1 List of estimated quantities (extracted from SWIL, 2007**).**

Items	Encroachment on sea floor (sq.m)	Encroachment on seagrass (sq.m)	Volume of material (cub.m)	Type of material
Breakwater `A'	890	0	3200	Boulders
Breakwater `B'	1768	348	6600	Boulders
Breakwater `C'	248	62	500	Boulders
Breakwater `D'	264	47	500	Boulders
Breakwater `E'	223	0	500	Boulders
Breakwater Clusters	1040	0	1560	Boulders
Groyne `A'	986	163	1400	Boulders
Groyne `B'	335	266	3600	Boulders
Groyne `C'	774	90	860	Boulders
Groyne 'D'	649		2000	Boulders
		Total volume of boulders	**20720**	Boulders
Excavation of seabed	14000	7278	10200	Rubble and silt
Reclamation	15500	7813	25000	Limestone shingle
Sand Nourishment			18300	Sand
Total	**36677**	**16067**		

Owing to current uncertainties regarding the exact disposition and quality of corals that would be affected by the proposed shoreline protection works, it is difficult to determine the impacts on existing coral communities. The final iteration proposed by SWIL in their report seems to offer the least impact on living corals. Given the parlous state of corals and reefs in Jamaica the recommendation is made here that the final alignment and placement of the protective structures be done on site by pegging the exact location of

live corals worthy of protection and demarcating an 8 - 10m buffer zone around those. That outer line effectively becomes the limit for the footprint of any artificial structure.

From an impact assessment and environmental management perspective, critical information not contained in the SWIL report is that relating to the methods to be employed in substrate excavation and construction of the groynes and breakwaters. In other words, the information presently to hand speaks to the direct impacts of the proposed coastal works (e.g. areas of encroachment on the sea floor) but not to facilitating assessment of the more indirect impacts related to the construction methodology to be employed.

4.4 SEAGRASS REMOVAL & REPLANTING

Excavation and land reclamation works will entail the loss of an estimated 16,067m^2 area of sea floor presently covered by seagrass. NEPA's policy normally is to require that threatened areas of seagrass should be removed and replanted. However, in this instance, there are no areas of bare substrate in the immediate vicinity of the coastal works suitable for the replanting of seagrass, note having been made above at Section 2.8.4 that seagrass beds around the proposed resort site appear to be space limited rather than recruitment limited. However, there are areas of exposed substrate in Bogue Lagoon (caused previously by boat propellors) that could be used as replanting sites as well as areas of bare substrate at the western end of the Montego Freeport harbour in the vicinity of the yacht club that could also be used for that purpose.

Two basic options are available for the removal and replanting of seagrass. The first is done entirely manually using teams of persons (5 divers + 10 workers) working in shallow water (max. depth = 2 m) digging out sods of seagrass (+ rhizomes) with hand tools and transferring these by rafts to the areas to be replanted. There the sods are pinned to the sea floor so as to hold them in place and facilitate re-rooting in the new substrate. This technique is time-consuming and– average rates of 50 m^2 per day can be achieved – and the removal and replanting of 16,000 m^2 could take up to 320 days depending on the size of the work force used and weather conditions. Re-establishment success rates of 80% are achievable with this method.

The second method is more mechanical and untested. It proposes the use of a modified excavator bucket fitted with a cutter and a special plate to cut and lift mats of seagrass in manageable sections. The mats will be cut in 0.6x0.6m (2ft x2ft) squares and lifted from the seabed. The excavator would be positioned either on the shore or on a construction pad and harvesting would start from the shoreline and work seawards. The excavator would have a reach of over 10m (33ft) and would thus sit well away from the existing beds. The operator of the excavator will be guided by personnel at the harvest location and it is intended that the mats would be removed with the rhizomes and sediment attached. This technique is untested but is potentially a quicker harvesting procedure. However, more so than with the manual method, it is possible that mechanical excavation, with less manual control, will result in greater sediment disturbance and the resulting turbidity will curtail the visibility of the guidance personnel thus slowing down the harvesting process. Also there would inherently be less control over the cutting and lifting process, possibly leading to more wastage of material. The 'cohesivness' and structure of the sod and its amenability to pinning down on the substrate would also need to be investigated.

4.5 EXCAVATION & FOUNDATIONS

The geotechnical study carried out on the site (NHL, 2006) determined that the likely modes of failure for shallow foundation placed on this site were load induced shear failure and/or failure related to vertical or lateral deformation. Therefore, a foundation type that reduced or mitigated the effects of these possibilities was most appropriate for this site. The developers have also decided not to use an option that would first require excavation, de-watering and removal of the peaty sediments and thereby avoid creating environmental issues related to well-pointing and disposal of sediment rich water.

The types of building foundation(s) to be used have not yet been determined but three options are to be evaluated on the basis of cost and availability of equipment and raw material. The selected option will be one of those listed below.

a. Driven piles - a relatively long, slender columns, provided to offer support or to resist forces, made of preformed material having a predetermined shape and size that can be physically inspected prior to and during installation, which is installed by impact hammering, vibrating or pushing into the earth. Driven piles can accommodate a wide variety of subsurface conditions. Driven piles consist of natural materials or pre-manufactured structural shapes built to precise tolerances utilizing high strength materials and reliable quality control. This is an environmentally friendly option as driven pile installations usually produce no spoils for removal and therefore no exposure to, or costly disposal of, potentially hazardous or contaminated materials. The site is thus left clean and ready for the next construction activity. Using this methodology, the proposed project would require approximately 2,000 piles with an average length of 12 m, i.e. 24,000 ml or about 1,680 m^3 of concrete. The piles would likely be manufactured on site.

b. Vibrated stone columns – This technique is an economical and environmentally friendly process that treats weak ground to enable it to withstand low to moderate loading conditions. Soils with appreciable silt or clay content do not respond to deep vibratory compaction. To improve these cohesive soil types to allow building and other heavy construction, it is necessary to create stiff reinforcing elements in the soil mass. The stone column technique, also known as vibro-replacement or vibro-displacement, is a ground improvement process where vertical columns of compacted aggregate are formed through the soils to be improved. These columns result in considerable vertical load carrying capacity and improved shear resistance in the soil mass. Stone columns are installed with specialized vibratory probes, generally having a horizontal mode of vibration. Column diameters of 2 to 5 feet can be achieved, depending upon soil conditions and design requirements. The vibrator first penetrates to the required depth by vibration and air or water jetting or by vibration alone. Gravel is then added at the tip of the vibrator and progressive raising and re-penetration of the vibrator results in the gravel being pushed into the surrounding soil. The soil-column matrix results in an overall mass having high shear strength and a low compressibility. Using this methodology, the project would require approximately 2.000 stone columns with heights of 10 m, i.e. 20,000 ml or 2,500 m^3 of gravel.

c. **Micropiles -** Micropiles, also referred to as minipiles or pin piles, are small-diameter reinforced piles that are drilled and grouted to support structures. These piles usually utilize some type of steel bar or bars and/or steel casing pipe. The bars are grouted into the ground and/or the casing pipe is filled with grout. The pipes used for micro or minipile installations are in segments that feature threaded lengths that allow them to be fitted together. Because the pipes are inserted one at a time in lengths of three to four feet, drilled installation methods can be used for new construction applications where surrounding structures are sensitive to vibration. From an environmental perspective, micropiles do not require large access road or drilling platforms. The materials used are environmentally safe. Using this methodology, the project would require approximately 5.000 micropiles with lengths of 12 m, i.e. 60,000 ml or 678 m^3 of concrete. The piles would likely be manufactured on site.

The level of the site will be raised to 2.4m above sea level to protect the site and buildings against extreme storm waves and surges. Approximately 50,000 m^3 of soil will have to be imported onto the site for that purpose. This action will change the topography of the site and the existing drainage pattern in a manner that has been taken into account in the design of the site drainage plan (see Section 4.6.7)

4.6 CONSTRUCTION SYSTEM & CONCRETE BATCHING PLANT

The buildings will be constructed of traditional block and steel placed on concrete platforms supported by piles. There is no information available currently on the requirements for space and equipment for the proposed manufacture of piles on the site.

Consideration is being given to having a small concrete batching plant located on the site to produce the volume of concrete that will be required during construction. Alternatively, concrete would be supplied from a batching plant(s) in and around

Montego Bay. The issues related to having a batching plant on the site is discussed below at Section 6.4.

4.7 INFRASTRUCTURE, UTILITIES & SERVICES

4.7.1 Access & roads

Access to the site (lobby and back-of-house) will be via a paved roadway and, in addition, there will be several parking areas. The access road will be impermeable and road runoff will be drained to swales and sinkholes on the southern side of the road. The parking areas will be made with a permeable surface augmented by accessory drainage to the south

4.7.2 Water demand, supply & conservation

The estimated daily water consumption of the proposed Seawind Key resort complex is about 700 m^3, inclusive of the requirements for irrigation of the grounds. The hotel's water supply will be metered and the water will be stored in reservoirs with a capacity of 3 days consumption, i.e. 21,000 m^3. The main reservoir for drinking water will be divided into two sections to facilitate cleaning and maintenance and it will be fitted with a chlorinator. A separate tank will store water for fire protection and irrigation. Water demand will be augmented by the requirements for at least five swimming pools and their associated evaporation losses.

Water is presently supplied to developments on the peninsula via a 200 mm Ø (8") mains placed beside the main access road. It has been noted that the area experiences periodic water shortages, especially when the water tanks of cruise ships in port are being replenished (Seawind Key Public Consultations, Doctor's Cave, 15 September 2006). The National Water Commission has confirmed its ability to supply water to the resort by letter dated 11 July 2006 as exhibited at Appendix 5.

Measures presently being considered to reduce water consumption at the new resort include:

- Water pressure booster system used to maintain a constant water presuure which could allow savings of up to 50 m^3 of water each day,

- Efficient hot water delivery system to reduce volume of water wasted while waiting for hot water in the tap,
- WC cistern with double flushing mechanism (3/6 liters) or flush stop mechanism. Its effectiveness depends on the guest's choice but daily savings up to 50 m^3 could be achieved,
- Taps with flow and temperature restrictors could potentially save up to 20 m^3 per day,
- Use of treated sewage effluent for irrigation,
- Water from pool cleaning filters could be reused and mixed with other water in the irrigation tank. Daily savings of up to 150 m^3 could be achieved, and
- Grey water from taps, tubs and showers could be reused, once filtered and treated, in WC cisterns or for irrigation. This measure could save up 110 m^3 of water each day.

4.7.3 Central air conditioning

To refrigerate the water for the air chillers it is proposed to use 1000 m^3/hour of salt water taken from on-site wells and passed through a titanium heat exchanger. The discharge, 5ºC hotter, will be pumped back to ground through separate wells situated at some distance from the first. The design of the system has not yet been completed and the location of the wells has not yet been determined. Although usable ground water resources are not implicated, it would be advisable to obtain the comments and advice of the Water Resources Authority.

4.7.4 Sewage management

At full occupancy, using a factor of 300 litre/person/day, an estimated 454,249 litres (454m^3) of sewage will be generated on a daily basis. This sewage will be collected and pumped via existing mains to the NWC waste water treatment plant approximately 3km away at Bogue. On site, the sewage pipes will be placed underground with mainholes provided at every angle and positioned at almost every 40 meters. Kitchen waste water will be connected to the sewage line after first passing through a grease trap. Given the flat nature of the resort site it will be necessary to install lift stations to pump sewage to

the sewer mains alongside Southern Cross Boulevard. The latter may have to be upgraded to ensure efficient operation of the conveyance system.

4.7.5 Electricity demand, supply and conservation

The operational daily requirement for electricity by the resort has been estimated at 3.5 MW. This will be supplied by the Jamaica Public Service Co. Ltd., which operates a power plant nearby at Bogue. This plant consists of five gas turbines generating 83.5 MW and a new 120MW combined cycle generating plant. The supply will be delivered from existing mains running along the main road to the peninsula. The incremental demand imposed by the resort will be within the capacity of the system and this has been confirmed in writing by letter from the utility dated 24 January 2007 and exhibited at Appendix 6.

The resort will also be installing a 3.5 MW standby generator that will run on diesel fuel. This fuel will be stored in a 2,000 litre tank(s) placed above ground and surrounded by a spill-containment wall to retain a volume of at least 1.25 times the volume of the tank or as otherwise specified by the fuel supplier. Applications will be made for licences from NEPA for air emissions discharge and for fuel storage.

In order to minimise the use of electrical energy, the resort intends to implement the following:

- Install fluorescent lighting throughout
- a/c controlled with switches on room windows
- central lighting control system for common areas
- rooms outfitted with body detectors or card switches

4.7.6 Other energy demand, supply and conservation

The resort intends to use diesel fuel to produce hot water for bathing and sanitation as well as for the stand-by generators and LPG for cooking purposes in the kitchens. The consumption of diesel oil to operate two 570,000 kcal/h burners at 95% efficiency for 4 working hours each day is estimated at 466 kg/day. This is equivalent to an annual production of approximately 1,700 kg SO_2 per year which means that the resort would

not be categorised as a major source of air pollutants under the Natural Resources Conservation (Air Quality) Regulations (2006) and has until April 2008 to apply for a licence to discharge air pollutants. The consumption of LPG to operate 1,000,000 kcal/h of installed power for six hours is estimated at 546 kg/day.

4.7.7 Storm water / site drainage

The site drainage system has been designed for a 1 in 50 years return frequency as stipulated by the National Works Agency. Storm water runnoff will be directed via underground pipes to infiltration wells/sink holes, with a grease trap installed in front of each to each. Manholes will be positioned at every angle and at about every 40m. The site drainage plan is provided at Figure 4.7.1.

A full scale drawing of the drainage plan is provided as an insert inside the back cover of the report. From the drawing it can be seen that all surface drainage from the site will be collected and conveyed towards the south side and away from the northern beach areas. There the drainage pipes will discharge to sink wells with adequate lateral infiltration. Any overflow from these under storm conditions will go to the fringing mangroves along the southern shore and then into Bogue Lagoon, an estuarine system able to tolerate fresh water inputs.

4.7.8 Solid waste management

The total volume of waste generated by the resort that will require off-site disposal is estimated at 2.1 tons per day based on a factor of 1 – 1.2 kg/person/day. This will largely be comprised of organic waste (primarily raw and cooked food waste), and complemented by plastics and glass. This waste will be collected and removed by an approved waste contractor for disposal at the waste dump operated by the National Solid Waste Management Authority (NSWMA) at Retirement, St James. This arrangement is to be confirmed in writing by the Authority.

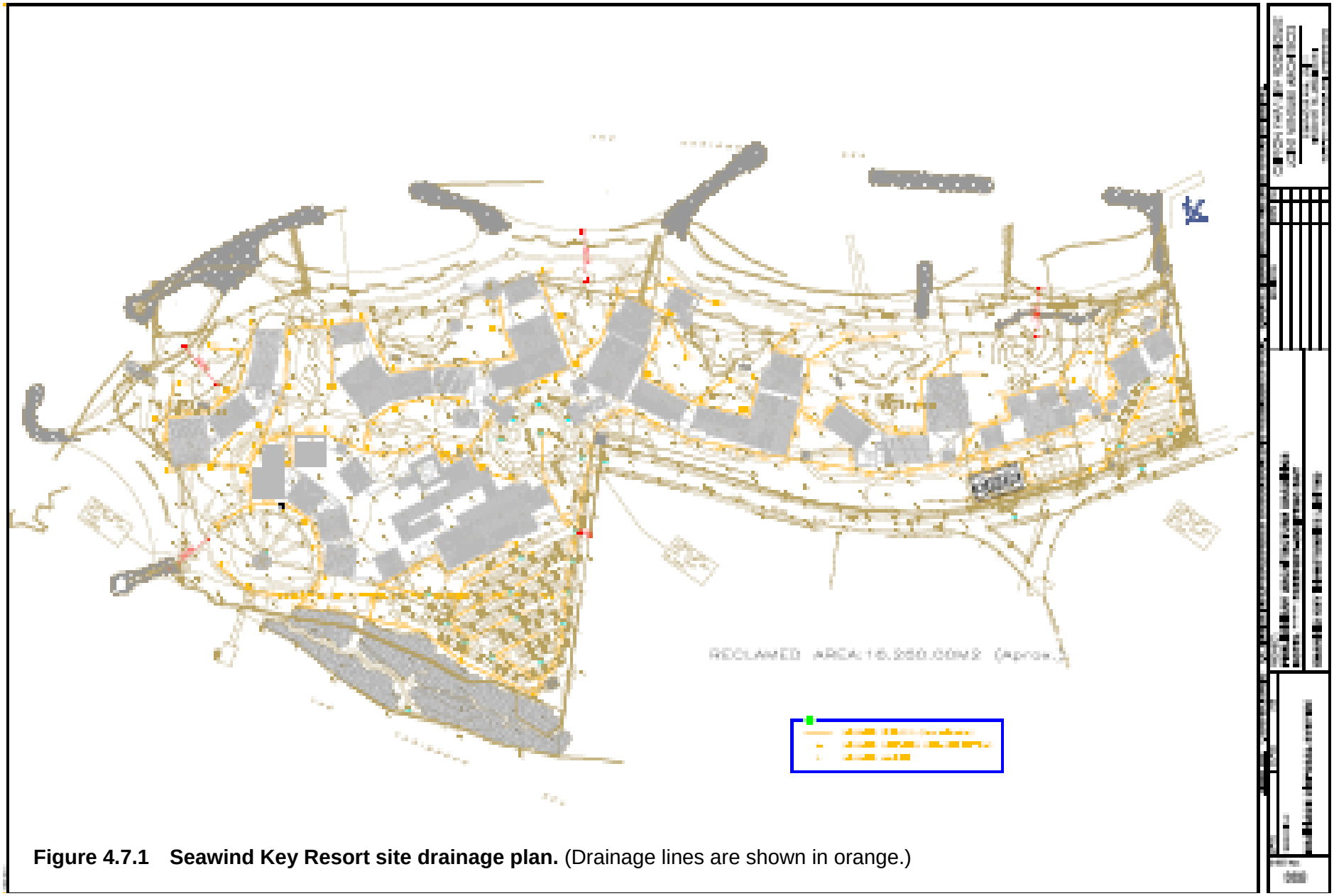


Figure 4.7.1 Seawind Key Resort site drainage plan. (Drainage lines are shown in orange.)

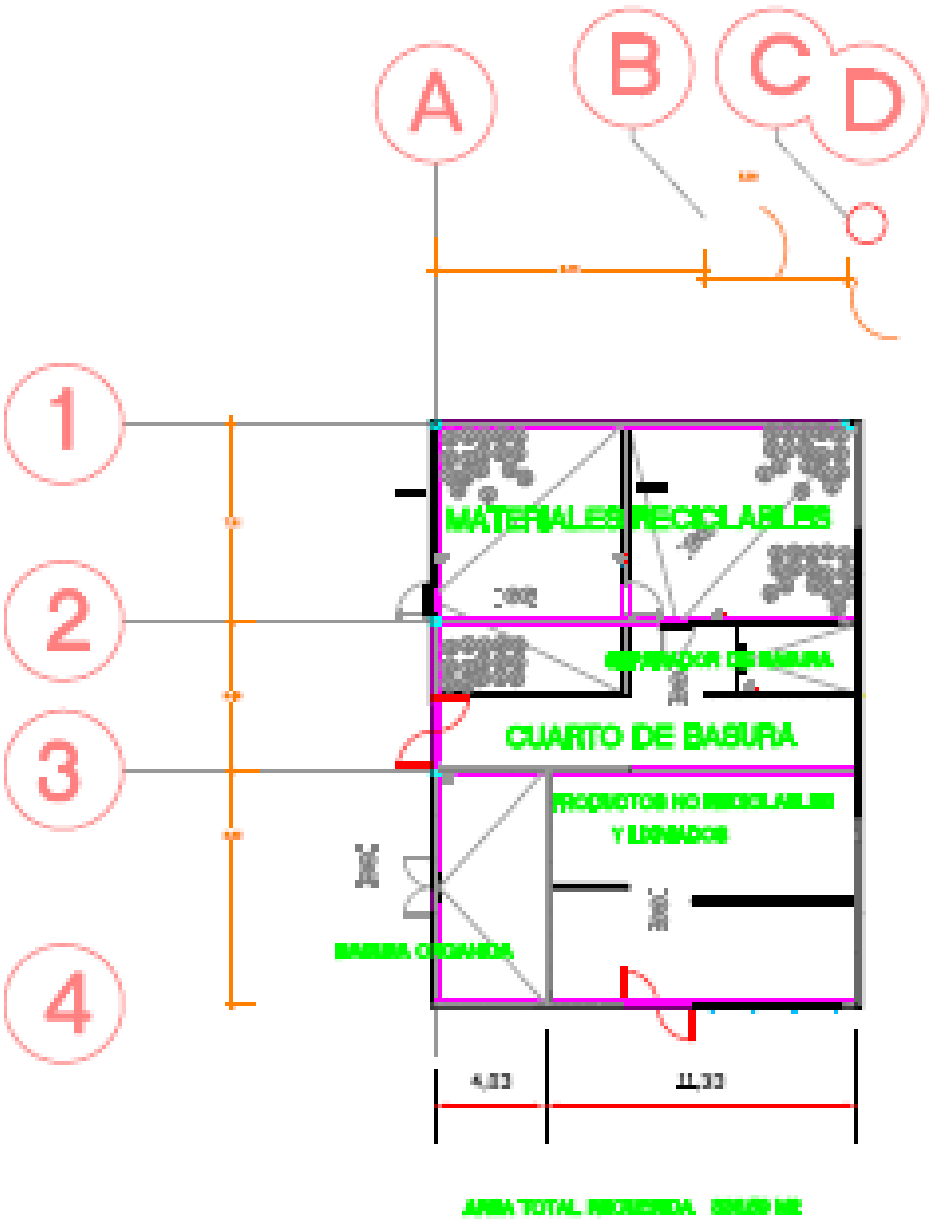


Figure 4.7.2 Layout of solid waste facility.

Organic food waste will be compacted to reduce its volume and stored in a chilled room to reduce biodegradation and effect vermin control until it is collected by a waste contractor. The layout of the solid waste storage facility is shown above at Figure 4.7.2.

4.8 LANDSCAPING AND TERRESTRIAL HABITAT

The detailed design for natural landscaping has not yet been prepared but it should be noted that there is no intention to import exotic plants and potentially invasive species for that purpose. Apart from the open green spaces and lawns, every attempt will be made to utilize native and local plant species in a manner to create a habitat that will support an even more diverse fauna of birds, butterflies, small reptiles and frogs than existed a the outset. The challenge will be to creatively use landscaping as a market differentiator in a competitive industry. Specific reference is made to the recommendations made by the EIA team's naturalist (see Section 2.6.2.1) who called for the replanting and maintenance of trees, including the stand of mangroves, shrubs and grasses currently found on the site, that were critical to the survival of the fauna found there. Species that were specifically identified were the shade trees such as Casuarina, Spathodea and Seaside Mahoe as well as flowering trees such as Poor Man's Orchid and Bottlebrush. The latter would attract insects as food for the birds. Plantings of West Indian Mahogany *(Swietenia mahogoni)*, and fruit trees such as Mango and Guava would be useful. Shrubs to be considered would include Hibiscus, Japanese Hat, Ixora, Philodendron, Heliconia and the Shrimp Plant.

4.9 SEA TURTLE NESTING & BEACH LIGHTING

Sea turtles reportedly nest on the beaches of Seawind Key. The four species found around Jamaica are endangered (Hawksbill and Leatherback) or threatened (Green and Loggerhead) and are all protected by law. Unfortunately they are still heavily poached locally. The resort therefore should put measures in place that will help to protect and maintain turtle nesting sites. This includes ensuring that no bright lights shine out to sea at the shoreline and that a turtle nest monitoring and management programme is implemented during the main nesting season between April and November. A sea turtle management plan should be put in place during the construction phase and for the longer term operational phase.

4.10 MARINE WATER SPORTS

The two hotels will offer the usual suite of water sports including small boat sailing, snorkeling and scuba diving. Water sports will be operated by licensed service providers. It is anticipated that the resort will ensure that guests are well informed about the marine park and that it will encourage adherence to the relevant protected area regulations. It is also expected that the resort will collaborate with the MBMP in the provision of adequate mooring sites for dive boats so as to avoid anchor damage on the reef.

4.11 SKILLS & TRAINING REQUIREMENTS

The resort will offer employment to about 2,000 persons and a wide range of skills will be required to operate it. The departmental categories at the resort will include Administration & General, Rooms, Food & Beverage, Entertainment, Maintenance & Repairs, and Other. Some of the requisite skills will come from abroad but in the main it will be Jamaicans that are employed. The hotel will provide specialized in-house training as necessary to augment entry level requirements.

The employment opportunities provided by the resort will be an obvious and significant benefit to be derived from the project, which in turn should translate into higher standards of living, better socio-economic conditions, and increased social mobility for employees.

4.12 OTHER DEVELOPMENT PROJECTS

Apart from the existing developments at Seawind Key (Sunset Beach Resort & Spa, Montego Bay Yacht Club, and the four townhouse complexes on the eastern side of the peninsula), there are at least three other incipient residential developments proposed for the peninsula. One is a housing subdivision situated immediately next to the Seawind Key resort development and the other two are at the northeast end of the peninsula. An expansion project for Sunset Beach is also being planned.

The implications of these developments will be the further demand on utilities, particularly for water and sewerage. These proposals should be taken into account in

planning for the improvements that will have to be made to the existing services to accommodate the present project, separate and apart from the other physical planning considerations such as transport, traffic, employment, worker housing, etc.

5. POTENTIAL ENVIRONMENTAL IMPACTS & MITIGATION MEASURES

5.1 DEFINITION & CLASSIFICATION OF ENVIRONMENTAL IMPACTS

An environmental impact is any change to the existing condition of the environment caused by human activity or an external influence. Impacts may be positive (beneficial) or negative (adverse). They may also be direct or indirect, long-term or short-term in duration, and wide-spread or local in the extent of their effect. Impacts are termed cumulative when they add incrementally to existing impacts.

In the case of the Seawind Key resort development project, potential environmental impacts would arise during the construction and the operations phases of the project and at both stages positive and negative impacts would occur.

5.2 IMPACT SIGNIFICANCE

The purpose of an EIA is, *inter alia*, to identify the significant impacts related to the project or activity under consideration and then to determine the appropriate means to avoid or mitigate those which are negative.

Significant impacts are defined, not necessarily in order of importance, as being those which:

1. Are subject to legislative control;
2. Relate to protected areas or to historically and culturally important areas;
3. Are of public concern and importance;
4. Are determined as such by technically competent specialists;
5. Trigger subsequent secondary impacts;
6. Elevate the risk to life threatening circumstances; and
7. Affect sensitive environmental factors and parameters.

5.3 IMPACT MATRIX

An impact matrix is a simple but effective tool for identifying the possible impacts of project activities on the environment and this has been done for the proposed Seawind Key Resort Development project (see Table 5.1). Here, the activities carried out during the construction and post-construction or operational phases are arrayed against a selection of environmental factors that are deemed relevant to the site, or which may be affected indirectly as a result of project activities. The construction phase activities have been sub-divided into the three key areas of activity; a) building works, b) coastal works, and c) construction camp activities.

The impact matrix should not be misinterpreted to mean that all the identified impacts would occur during implementation of the project. However, the matrix does serve to identify the potential impacts and significant concerns and this leads to the next step of the EIA process, mitigation, which considers the appropriate measures to remove or ameliorate the adverse impacts that have been identified. At this stage measures to enhance the positive aspects of the development can also be devised.

5.4 IMPACT DESCRIPTION & MITIGATION

The following sections discuss the major project activities and the potentially significant impacts related to those activities. For ease of discussion and presentation, the corresponding impact mitigation measures are presented after the discussion of each impact. A summary of the impacts is given afterwards at Table 5.2.

Table 5.1 Environmental impact identification matrix for Seawind Resort Development Project.

X = Potential interaction or impact	CONSTRUCTION PHASE ACTIVITIES																												HABITATION PHASE ACTIVITIES													
	BUILDING CONSTRUCTION WORKS																								COASTAL				CAMP			HOTEL												
	Loss of land use options	Vegetation clear - habitat/biodivers loss	Vegetation clearance - soil erosion	Loss of recreational amenity	Piling & building foundations	Building - sourcing earth materials	Materials transport	Earth materials stockpiling & storage	Construction works induced traffic	Land surcharge - drainage modification	Concrete batching plant operation	Timber scafolding & form support	Construction waste storage & disposal	Dusting - air quality degradation	Construction works noise	Sewage & litter management	Impervious surface/paving	Installation / upgrading of utilities	Construction works water demand	Replanting & landscaping	Employment	Roadside vending	Visual intrusion on seascape	Coastal excavation & construction works	Sourcing rock, beach fill & sand	Material stockpiling	Employment	Fuel & chemicals storage	Solid waste management	Equipment/vehicle maintenance	Employment / staff training	Water demand	Electricity demand	Sewage collection and disposal	Solid waste management & disposal	Surface runoff & disposal	Vehicular traffic	Night-time entertainment	Turtle nesting	SCUBA & snorkelling	Landscape & grounds maintenance	Mosquito fogging	Public beach facility management	Induced housing demand & squatting
ENVIRONMENTAL FACTORS																																										
CATCHMENT / TERRESTRIAL RESOURCES																																										
Climate / microclimate		X																		X																			X			
Vegetation		X																		X																						
Wildlife		X																		X																	X		X	X		
Soil erosion		X	X															X		X																						
Surface drainage pattern		X	X					X		X							X								X			X						X								
COASTAL MARINE RESOURCES																																										
Water currents / beach dynamics																								X																			
Lagoon water quality			X							X																								X	X							
Coastal water quality			X					X		X	X		X				X							X				X	X					X								
Corals & reefs			X					X			X						X							X				X		X								X				
Seagrass & algae beds																								X											X								
Sandy bottom communities																								X																			
Beaches													X																X					X				X				
Fish & fisheries																																											
CRITICAL ECOSYSTEMS / HABITATS / SITES / SPECIES																																										
Marine protected areas (MBMP & BL)			X																														X				X	X				
Bourkes Hairstreak		X																		X																			X			
Mangroves & wetlands																																			X								
Forest / woodland												X																															
Archaeology / historical sites																																										
DISASTER VULNERABILITY																																										
Flooding																																										
Earthquake					X																																					
Storm surge										X																																
Hurricane wind																																										
Storm waves/swell										X																																
SOCIO-ECONOMIC																																										
Quality of life				X																										X											X
Business opportunity						X	X														X					X																
Community dislocation																						X			X																	X
Land use & value	X																																									
Uncontrolled settlement / squatting																																											X
Landfill capacity reduction													X																					X								
Traditional corridors / amenity / public beach				X																								X													
Traffic issues / road wear-and-tear									X																										X	X						
Community awareness / involvement																																									X	X
Quarrying						X																																				
Water supply											X								X																				X			
Electricity supply																															X											
NWC Bogue STP operation																																X										
PUBLIC HEALTH																																										
Air Quality (dust, odours)						X	X	X					X	X				X							X										X							
Water quality (esp. pathogens)																																		X								
Noise					X				X						X																						X					
Public cleanliness / litter																X					X							X						X								
Visual aesthetics / seascape																				X		X	X					X						X								

5.4.1 CONSTRUCTION PHASE IMPACTS – BUILDING WORKS

5.4.1.1 Site occupation - loss of land use options

Impact: The construction of the resort complex will involve the erection of permanent concrete block and steel structures on what is essentially an artificial green field site. This will result in a loss of the options for alternative land use and thus represents an irreversible commitment of land resources. The loss of optional uses for land resources in the future is generally considered to be a negative impact.
Mitigation: N/A

5.4.1.2 Vegetation clearance – loss of terrestrial habitat & biodiversity

Impact: Bearing in mind that the site is not pristine and that it has repeatedly been bushed, the clearing and removal of trees and ground cover during the site preparation works will result in the loss of much of the existing vegetation and a consequent reduction in arboreal and other habitat for birds and other small fauna. Noise, vibrations, and intrusive activities related to construction works may scare away any animals remaining on the site after vegetation clearance. These are some of the environmental trade-offs for resort development and expansion of the tourism industry. It is anticipated that some of the fauna will return after the construction works, especially after the remaining vegetation grows back or after landscaping and replanting of the site.
Mitigation: Impact mitigation here seeks to retain and restore as much of the original vegetation, including trees, as is practical on Seawind Cay. This would be achieved by protecting the existing trees as much as possible and by a replanting and landscaping programme that focused on recreating habitat favourable to birds and butterflies. However, it is also acknowledged that given the footprint of buildings and ancillary structures on the site (~40%), the proposed construction methodology, and the nature of construction works,

it would require concerted effort to successfully retain and protect the existing trees and shrubbery.

- A draft landscape plan for the resort should be prepared prior to commencement of site clearance that identifies those existing trees that it would be possible to protect, including the stand of mangroves along the southern shore.
- Those trees that can be protected *in situ* should be marked, clearly identified on the site construction plan, and properly protected with hoarding or a fence prior to the commencement of construction.
- The building contractor should be made subject to punitive penalties for any breaches of the tree protection plan and for damage to protected plants. These penalties should be an integral part of the works contract and specifications.
- The landscape plan should seek to utilize low-maintenance native species tolerant of typical coastal conditions which are attractive to birds. It must not include imported and invasive species.
- Based on the landscape plan, an inventory and collection of selected plants and ecologically valuable trees on the site should be made. These plants should be correctly removed, stored and maintained at a properly appointed plant nursery until they can be transplanted back on the site as stipulated by the landscape plan.

5.4.1.3 Vegetation clearance – soil erosion

Impact:

Site preparation, vegetation clearance, building and road construction works would expose soils in the affected areas and leave them vulnerable to erosion by heavy rainfall and surface run-off. The latter would threaten adjacent coastal waters and inshore coral and seagrass habitats with high turbidity and sediment deposition, a negative consequence. However, the flat topography of the site would tend to militate against erosive surface flows under such circumstances and the threat of turbidity should exist only during the early stages of construction before subsequent landscaping and drainage works reduce the susceptibility to soil erosion.

Mitigation:

- Stage site clearance works so as to minimize the area of exposed soil at any given time.

- Re-cover exposed soils with grass and other ground cover as soon as possible.
- Temporarily bund exposed soil and redirect flows from heavy runoff areas that threaten to erode or result in substantial turbid surface runoff to adjacent marine waters.
- Monitor areas of exposed soil during periods of heavy rainfall throughout the construction phase of the project to ensure that any incidents of erosion are quickly controlled.

5.4.1.4 Site preparation - loss of recreational amenity

Impact:

Site clearance and preparation will also include and affect a portion (~ 1 acre) of land immediately west of Sunset Beach Resort & Spa that was used as a playing field by local persons and hotel workers with the consent of the previous owners, Montego Freeport Ltd. (see Plate 4.2.1). This pre-empted use represents a loss of a recreational amenity previously available to the local community.

Mitigation:

An alternative and suitable site for similar recreational purposes (mainly football) is available at the Urban Development Corporation's playing field at Catherine Hall. The range of recreational activities offered at the public facility now to be built at the site has not yet been determined but such may offer other alternatives.

5.4.1.5 Piling & building foundations – noise & vibration

Impact:

The options being considered to support building structures in a situation prone to liquifaction are piles, vibrated stone columns and micropiles. In the first case It is estimated that 2000 x 12m concrete piles will be required for insertion. It is proposed to manufacture these on site thus pre-empting issues related to the transportation of piles to the site. Inserting the piles with a pile driver will result in repeated clanging sounds which may be audible to nearby residents. These sounds, which away from the site will at most be of nuisance value, will occur over the estimated six months during which pile driving will take place. There may also be vibrations associated with piling but this is not considered to be of significant concern as these will be largely absorbed by the coarse

soil type found on the site.

In the case of the second option requiring 2,000 columns, 2,500 m^3 of stone or gravel will have to be transported and stockpiled on the site to be inserted into the ground and then compacted by vibration using specialized machinery. This operation would last for six months but will be a less noisy operation than would be the case for pile driving.

The third option will require placement of 5,000 x 12m micropiles made from 678 m^3 of concrete over a similar six month period. Using speciialised equipment, this would be a fairly quiet operation.

Mitigation:

- Restrict pile driving activities to normal working hours (8.00am to 5.00pm)
- Inform local residents beforehand, via notices and advisories, of pending noisy periods and solicit their tolerance well before the commencement of piling works.
- Workers operating equipment that generate noise should be equipped with noise protection gear. Workers operating equipment generating noise levels greater than 80 dBA continuously for 8 hours or more should use earmuffs. Workers experiencing prolonged noise levels of 70 – 80 dBA should wear earplugs.

5.4.1.6 Earth materials sourcing – illegal quarrying

Impacts:

Earth materials needed for construction (e.g. marl, sand, aggregate) will be obtained from quarry and mining operations. Conscious or unwitting purchase of these materials from unlicensed operations indirectly supports, encourages and promotes environmental degradation at the illegal quarry sites and causes medium to long-term negative impacts at source.

Mitigation:

- Earth materials must be obtained from officially licensed and approved quarries and copies of the relevant licenses made available by the Contractor for inspection at the site.

5.4.1.7 Materials transport – dusting & spillage

Impact:

The various materials required for construction and building (e.g. sand, marl, aggregate, steel, blocks, lumber, asphalt, cement, etc.) will be obtained from sources elsewhere and transported to the site. Transportation of these materials, very often in over-laden trucks, usually results in undue road wear-and-tear.

In the case of fine earth materials, dusting and spillages could occur on the roadways between source and site, particularly when materials are transported in uncovered or improperly sealed trucks. Dusting degrades local air quality and material spillages worsen driving conditions and increase the risk of road accidents. These occurrences represent indirect, short-term, reversible, negative impacts on public health and safety.

A particular issue related to spillages is the transport of cement from batching plants to the construction site. Too often overfilling or careless driving of cement truck results in the spillage of cement on roadways which then spoils the surface of the road when it dries and becomes a nuisance to other road users. It is likely that the Seawind project site will have a batching plant located on the site.

Mitigation:

- All fine earth materials must be enclosed during transport to the site to prevent spillage and dusting. Trucks used for that purpose should be fitted with tailgates that close properly and with tarpaulins that completely cover the materials. The cleanup of spilled earth and construction material on the main roads should be the responsibility of the Contractor and should be done in a timely manner (say within 2 hours) so as not to inconvenience or endanger other road users. These requirements should be included as clauses within the contracts made with the relevant sub-contractors.
- The transport of lubricants and fuel to the construction site should only be done in the appropriate vehicles and containers, i.e. fuel tankers and sealed drums.
- As far as possible, transport of construction materials should be scheduled for off-peak traffic hours. This will reduce the risk of traffic congestion and of road accidents on the roads leading to the site.

- Appropriate traffic warning signs, informing road users of a construction site entrance ahead and instructing them to reduce speed, should be placed along the main road in the vicinity of the entrance to the Seawind Key site during the construction period.
- Flagmen should be employed to control traffic and assist construction vehicles as they enter and exit the project site.
- Spillages of cement on public roadways must be cleaned up immediately by the carrier.

5.4.1.8 Materials stockpiling & storage – coastal water contamination

Impacts:

The improper location of stockpiles and storage of sand, gravel, cement, etc., at the construction site could cause fine materials to be washed into the adjacent marine environment during heavy rainfall events. This would not only represent a waste of materials but would also contribute to turbidity and sedimentation with consequent negative impacts on inshore marine water quality and possibly the ecology of the shallow marine environments.

Mitigation:

- The stockpiling of construction materials should be properly controlled and managed. Fine-grained materials (sand, marl, etc.) should be stockpiled away from the shoreline and from any surface drainage channels and features.
- Low berms should be placed around the piles of sand and marl and/or tarpaulin used to cover open piles of these materials to prevent them from being washed away during rainfall.
- Safe storage areas should be identified and retaining structures put in place prior to the arrival and placement of material.

5.4.1.9 Construction works induced traffic – road congestion

Impact:

Activities related to construction works will undoubtedly induce abnormal levels of vehicular traffic, particularly at the seaward end of Southern Cross Boulevard (main road running through the Freeport peninsula) closest to the site. Related issues of vehicle congestion and poor driving will be at least sources of annoyance, if not accidents, to local residents for the 24 month duration of the construction works.

Traffic impacts are indirect and from a strictly environmental point of view would not be classified as severe. However, from a public relations point of view they are worthy of attention.

Mitigation:

The objective of impact mitigation in this instance should be to reduce inconvenience, particularly to residents and regular users of the main Freeport road.

- Issue notices/advisories of pending traffic inconveniences and solicit tolerance by local residents before the commencement of construction works.
- Meet with local police station (Freeport) to discuss assistance of police in monitoring traffic.
- Assign traffic regulators to places of chronic or potential traffic bottlenecks
- Prepare and provide appropriate signage.

5.4.1.10 Land surcharge – modification of site drainage

Impact:

The ground level of all the main buildings and room blocks will be set at 2.4m above sea level to offset the impacts of storm induced surges. Thus the site will be surcharged using 50,000 m^3 of soil/marl such that the buildings will be built on mounds which in turn will change the original flat aspect of the site and modify the pattern of drainage. The land cover ratio (building footprint as a ratio to land area) for the site will be >0.28., which means that the site will generate considerable volumes of runoff during any period of prolonged rainfall. Unless properly directed, such discharges of fresh water

could lower the salinity of the water near the outfalls and, in turn, adversely affect the health of corals.

Mitigation:

- The storm water drainage system, as described above at Section 4.7.7, should be implemented as it will collect runoff and discharge this to the southern and estuarine side of the site and thus away from corals.
- The earth material used to fill the site must be obtained from licenced sources to avoid issues related to illegal quarrying and mining (see Section 5.4.1.6).
- Stockpiles of fill material must be properly bermed and covered to prevent dusting and washout of material (see Section 5.4.1.8).

5.4.1.11 Concrete batching plant operation

Impact:

Concrete batching plants manufacture ready-mix concrete by mixing cement with other aggregates like sand or water which is then delivered to the construction site in a plastic and unhardened state. The environmental issues related to the manufacture of cement are not considered in this report. The major environmental impacts related to batching plants are:

- Dust (air pollutant) - resulting from the transport, handling and storage of the raw materials. Transport of those materials also generates air pollutants;
- Waste water – alkaline wash out water, which is toxic to fish and other aquatic life, is generated during the cleaning of equipment at the batching plant;
- Solid waste – may be generated from unpacking bagged cement;
- Noise – produced by various pieces of equipment and machinery;
- Other environmental impairments – soil pollution (e.g. oil and grease spillage), damage to trees by transport trucks, etc.

Mitigation:

- Carefully unpack and unload cement to avoid dust production.
- Prevent disposal of wastewater to open environment.
- Use water carefully during all stages of production.
- Re-use wash water as mix water in concrete manufacture.

- Purchase raw materials from local sources and ensure supplies come from licenced quarries.
- Return empty cement bags for re-use and/or recycling purposes.
- Collect oil and grease used in the maintenance of machinery and deliver to recyclers.
- Restrict operations to normal working hours.
- Provide workers with appropriate personal protective gear (e.g. gloves, masks, etc.)
- Apply good house-keeping practices.
- Train staff in environmentally friendly behavior and production.

5.4.1.12 Timber scaffolding & form support – forest resources depletion

Impact:

Local timber is often used in construction projects for scaffolding and to support concrete form work. On large building projects this leads to a heavy demand for logs cut from local forests, often with no record to indicate whether the logs are obtained from approved sources and under conditions of questionable sustainability.

Mitigation:

- The use of local timber should be kept to a minimum with such sources being approved by the Forestry Department.
- Steel scaffolding should be used in preference to timber and the Contractor should ensure that sufficient quantities of scaffolding are available for hire at the time of construction.

5.4.1.13 Construction solid waste - inappropriate storage & disposal

Impact:

Considerable volumes of solid waste will be generated during site preparation and construction works, which would include vegetation and typical construction waste

such as wasted concrete, steel, wooden scaffolding and forms, bags, waste earth materials, etc. This waste will negatively impact the site and surrounding environment if not properly managed and disposed of at an approved dumpsite. Cut vegetation burned on the site would generate smoke, possibly impacting negatively on ambient air quality and human health. Vegetation and solid waste, if allowed to accumulate on the ground, could cause localised pooling and flooding. Pooling of water, in turn, would create conditions conducive to the breeding of nuisance and health-threatening pests such as mosquitoes. Poor construction waste management constitutes a short-term negative impact.

Mitigation:

- A site waste management plan should be prepared by the contractor prior to commencement of building. This should include designation of appropriate waste storage areas, collection and removal schedule, identification of approved disposal site*, and a system for supervision and monitoring. Preparation and implementation of the plan must be made the responsibility of the building contractor with the system being monitored independently.
- Special attention should be given to minimizing and reducing the quantities of solid waste produced during site preparation and construction. To reduce organic waste, softer vegetation may be composted onsite and used for soil amendment during landscaping.
- Vegetation and combustible waste must not be burned on the site.
- Reusable inorganic waste (e.g. excavated sand) should be stockpiled away from drainage features and used for in filling where necessary and/or possible.
- Unusable construction waste, such as damaged pipes, formwork and other construction material, must be disposed of at an approved dumpsite.
- The National Solid Waste Management Authority should be consulted to appoint the waste disposal site for the project.

* Presently the official dump for Montego Bay and western Jamaica is at Retirement, St. James.

5.4.1.14 Dusting – air quality degradation

Impact:

It can be anticipated that a lot of air borne particulate matter (dust) will be generated by earth moving activities during site works, during the off-loading of marl, and the movement of vehicles over unpaved surfaces. This situation will be worst during the dry season and when winds are most prevalent. Given the relative remoteness of the site and the direction of the prevailing winds, air borne particulates should not pose a hazard to residents in the vicinity or downwind of the construction site but they could adversely affect the health of workers (respiratory issues) on the site. The occurrence of dusting would be short-term, lasting only for the duration of the construction activity (~24 months).

Mitigation:

- Access roads and exposed ground must be wetted in a manner and at a frequency that effectively keeps down the dust.
- Stockpiles of fine materials (e.g. marl) should be wetted or covered with tarp during windy conditions.
- Workers in dusty areas on the site should be issued with dust masks during dry and windy conditions.

5.4.1.15 Construction noise – auditory nuisance

Impact:

The use of heavy equipment during site clearance, road construction and building works will inevitably generate noise, which may create a nuisance for nearby residents, particularly if any pile driving is taking place (see Section 5.3.4). Albeit annoying, this negative impact will be short-term (limited to periods during the 24 month construction works) and is not considered to be a significant threat to the health or well being of humans. Distance will help to ameliorate noises and for this reason the noises from activities taking place on the site should not be more than a nuisance.

Mitigation:

- Restrict noisy construction activities to normal working hours (8am – 5pm).

- Inform local residents beforehand, via notices and advisories, of pending noisy periods and solicit their tolerance well before the commencement of piling works.
- Workers operating equipment that generate noise should be equipped with noise protection gear. Workers operating equipment generating noise levels greater than 80 dBA continuously for 8 hours or more should use earmuffs. Workers experiencing prolonged noise levels of 70 – 80 dBA should wear earplugs.

5.4.1.16 Sewage & litter management

Impact:

Inadequate provision of toilets for use by workers can lead to ad hoc defecation in secluded areas on the site, thus creating unsanitary conditions and sources of fly infestation. Improper disposal of food cartons and other domestic forms of construction camp garbage (including styrofoam) could lead to littering of the site and pollution of adjacent coastal waters.

Mitigation:

- Provide adequate sanitary facilities for workers, e.g. chemical toilets, to prevent bacterial loading to coastal waters.
- Provide solid waste receptacles and storage containers, particularly for the disposal of lunch and drink boxes, so as to prevent littering of the site.
- Special areas should be designated for cooking and eating of meals where adequate garbage containers are available and controls can be imposed on littering.
- Make arrangements for the daily collection of litter from the site and its disposal at the approved dump.

5.4.1.17 Impervious surfacing & paving – increased runoff

Impact:

The construction of buildings and ancillary facilities such as terraces, pools and pool decks, etc., means that the previously pervious site will become covered by impervious surfaces (~ 40%), thereby changing its drainage characteristics. Less rainfall will now be able to percolate into the ground and it will now tend to run off at a faster rate. Unless properly managed, this runoff can induce soil erosion and dilute

sea water in the vicinity of inshore corals, species generally intolerant of high turbidity and low salinity.

Mitigation:

- The drainage system for the resort has been designed (see Section 4.7.7) to properly collect surface water and discharge it to ground or towards the southern side of the property where fresh water inflows would enter the estuarine system.

5.4.1.18 Installation & upgrading of utilities

Impact:

The underground installation of water, sewage and electricity lines will necessitate the excavation of trenches to the site from the main road. This will mean the temporary placement of excavated soils beside the trenches in areas outside of the project site until the utility lines have been laid and the excavations are re-filled. This may lead to the wash out of soil under conditions of heavy rainfall. This is not deemed to be a significant impact but nonetheless a situation requiring care and attention.

Mitigation:

- Schedule trenching works outside of rainy season, if practical.
- Complete the laying of water mains and other lines in the trenches and refill the trenches as quickly as possible.

5.4.1.19 Construction works water demand

Impact:

A considerable amount of fresh water will be required during the construction works, especially for cement mixing and operation of the concrete batching plant, and for wetting of the site to control dust. This will place some amount of strain on mains water supply to the peninsula and may exacerbate current shortage of water supply issues.

Mitigation:

- Collaborate with NWC to ensure satisfactory management of water supply issues.
- Provide adequate water storage facilities on the construction site to meet project

needs during periods of high demand externally and refill the tanks during periods of low demand (e.g. late at night).

5.4.1.20 Replanting & landscaping – habitat enhancement

Impact:

Landscaping and replanting of trees will be carried out to enhance the appearance and ecology of the site. No details of landscaping plans or planting materials are available at this stage but the plant species selected for replanting will in large part determine which types of birds, butterflies, and other fauna, if any, inhabit the site (gardens) after construction. In addition to enhancing the aesthetic appeal of the project site, landscaping provides the means for partially restoring the site's natural elements and ecological habitats. It is therefore a significant mitigation activity with a positive impact.

Mitigation:

- The landscaping plan must seek to avoid the use of non-native and potentially invasive species.
- It should include low-maintenance local species and the types of trees and shrubs used for feeding by local bird species.
- The landscape design should seek to encourage bird life, especially for the endemics, maximize shade and windbreak effect, as well as hide the roofline of the buildings.

5.4.1.21 Employment - income generation

Impact:

At this stage, it is not possible to accurately determine the number of workers that will be employed on the site during the construction phase but at peak construction it is estimated that this number will be about 500 to 600. These levels of short-term employment opportunities at this time would have a significant positive impact on the local economy and on regional unemployment.

Mitigation:

N/A

5.4.1.22 Roadside vending – unsightliness & littering

Impact:

Large construction projects with their attendant work forces attract significant numbers of vendors who erect stalls along the road near the site entrances. Associated with this is the parking of taxis and other vehicles owned by site workers. The overall effect is to create a highly unsightly situation, which includes poor litter and solid waste management practice. This could become a major problem at the Seawind Key site since it is easily accessible and near to an existing resort facility.

Mitigation:

- The contractor should identify, demarcate and fence a specific area within which a specific number vendors will be allowed to operate. This location should be removed from the side of the main road and, ideally, should be large enough to accommodate the worker's vehicles.
- The vendors should be instructed to maintain the area in a tidy fashion and litter bins should be provided with arrangements in place to have the contents of these emptied on a regular basis and disposed of appropriately.

5.4.1.23 Visual intrusion on seascape

Impact:

The development is comprised of 3 - 5 storey buildings located on seafront lands at a fairly remote site. Thus, the resort complex will not impair existing views of the sea from the mainland.

Closer at hand, as seen from the westerly facing shore of 'The Lagoons' housing development which is a little more than 400 m away on the adjacent promontory, the new hotel will be partially screened by the stand of mangroves on the south side of the cay and the 5 storey room blocks should not far exceed the height of the tallest

Casuarina trees (20 - 27m) currently on the site. Plate 5.4.1. provides a photo panorama of Seawind Key as seen from The Lagoons and compares it with the same image below on which is superimposed the outline of the new hotel to give an impression of the future vista looking northwest from the Lagoons.

Mitigation:

N/A

Plate 5.4.1 Panoramas of Seawind Key as seen from The Lagoons, before (top) and after construction of the proposed Secrets Hotel. The Sunset Beach tower is shown at the extreme right-hand side.

5.4.2 CONSTRUCTION PHASE IMPACTS – COASTAL WORKS

5.4.2.1 Inshore excavation, construction of groynes & breakwaters – loss of seagrass & marine benthos

Impact:

Re-establishment of the eroded shoreline, involving beach filling and the construction of groynes and breakwaters to provide shore protection, will require excavation of inshore substrates (sand, rubble and pavement) and the placement of large rocks and boulders in front of the shore (see Section 4.3 above). These works will impact directly and adversely on the inshore ecology and habitats, including seagrass beds. It is estimated that >16,000 m^2 of seagrass beds will be directly affected and therefore these will have to be removed prior to construction to be in keeping with NEPA's policy which normally requires replanting of an area equivalent to that removed.

Excavation of the substrate, whether by drag line or excavator, will place marine sediments in suspension and create high levels of turbidity. Similarly, in the case of newly quarried boulders imported to construct the groynes and breakwaters, fine sediments adhering to the rock surfaces will be washed into the sea during placement. The resultant turbidity could cause direct damage to sessile organisms through suffocation or by adversely affecting their feeding mechanisms.

Since the design and positioning of the groynes has to a certain extent already taken into account the presence of surrounding corals it is not likely that their construction would have a major impact on living corals although it will be imperative to exercise due care and control during groyne and breakwater construction works.

Direct damage to corals and reef habitat is considered a long-term impact given the relatively slow growth rates of corals and the precarious status of coral reefs in an age of global warming. In this context, despite such damage being limited, it should nonetheless be considered as being irreversible.

Turbidity and sedimentation caused by fine particulates would be a short-term impact and not likely to be significant along the northern shoreline given the prevailing water currents which would tend to quickly disperse suspended sediments. In the quieter environments of the lagoon, such turbidity would be longer lasting but not considered significant since these environments are typically subject to such conditions and the organisms inhabiting these areas would be tolerant of short-term turbidity episodes.

Mitigation:

Impact mitigation here seeks to reduce direct damage to the coral reef and coral colonies and to remove and replant seagrass beds that would otherwise be affected by the works. It also seeks to ensure that the newly created coves are well flushed

- Prior to construction, peg out the areas of live corals within the inner crest to establish boundaries for the footprints of the groynes and breakwaters. These limits should allow for an appropriate buffer zone (say 8-10m wide) to separate live coral from the artificial structures.
- Ensure that the rocks and boulders are not placed beyond the pegged footprint area and institute monetary sanctions for non-conformance.

- Employ skilled and experienced operators to move and place rocks during the construction of the groynes and breakwaters.
- Pre-wash new boulders before placing them in the water so as to remove fine sediments, ensuring that washing is done at a location or in a manner that will not cause a washout of fines into the sea or other surface waters.
- Whereas silt screens are normally used to contain the dispersal of suspended sediments, the use of silt screens in this instance must be carefully considered as careless placement will cause them to snag on live corals, thereby causing more and worse damage. If silt screens are used this must be done during periods of calm weather. An alternative that should be considered is the use of sand bags.
- Develop and implement a seagrass removal and replanting plan approved by NEPA for the affected areas, **including relocation of the associated macrofauna**, which takes into account the limited areas available at the site for interim storage and replanting. Suggested areas for replanting include prop-damaged areas in Bogue Lagoon and shallow waters adjacent to the Montego Bay Yacht Club.
- A detailed design and work plan for the coastal works must be prepared and approved by NEPA prior to beach construction. This plan must take into consideration:
  a. Least impact excavation methodology (see Section 4.4),
  b. Footprints of the groynes and breakwaters located precisely so as not damage any live corals, and
  c. Appropriate technology/method for containing turbidity and dispersed sediments.

5.4.2.2 Rock, beach fill & sand sourcing – illegal quarrying & related issues

Impact:

Shoreline reconstruction and protection will require rocks for the building the groynes and breakwaters and groynes, bulk material for filling the reclaimed area of shoreline, and white sand to overlay the newly filled shoreline. The bill of quantities of these materials has not yet been prepared nor has their source been determined.

Nonetheless, the materials must be obtained from approved sources or licensed suppliers as otherwise conscious or unwitting purchase of material from unlicensed operations may indirectly support, encourage and promote environmental degradation at the illegal quarry sites and may cause medium to long-term negative impacts at source.

Of particular concern is the source of white sand to cover the beaches at Seawind Key. Recent practice in Jamaica has been to permit pumping of sand from adjacent reef areas. Nearby to the Seawind site is an area of open sand known locally as the 'Garden of Eels' and home to a population of an uncommon species of fish that burrows in the sand. For that reason it is a popular dive site.

Mitigation:

- Earth materials must only be obtained from officially licensed and approved sources/quarries and copies of the relevant licences made available for inspection at the site.
- The removal of sand from the 'Garden of Eels' must not be permitted so as to protect that particular fish habitat and unique recreational SCUBA dive site.
- Any consideration of sourcing reef sand adjacent to the Seawind must be informed by a detailed assessment of the infauna at the site and take account of the situation of the project in a protected area.
- In view of the above, alternative sources of beach sand should be utilized that would not have an impact on the project area.

5.4.2.3 Material stockpiling

Impact:

Large amounts of imported earth materials will have to be stockpiled on the site to be used for constructing the groynes and breakwaters, for filling the shoreline and for covering the newly created beach. The quantities have been estimated above at Section 4.3 and include 20,720 m^3 of boulders, 25,000 m^3 of shingle, 18,300m^3 of sand. The stockpiling of these materials will occupy a considerable area of the site and threaten the safety of any trees that it may be desirable to protect and keep.

Mitigation:

- So as to maximize the amount of space available for stockpiling coastal construction materials, consideration should be given to staging the coastal works at the outset of the project before the site becomes fully occupied by other activities and the options for storage sites become reduced.
- The selection of sites for stockpiling these materials should be informed by the site plan indicating the trees and any other vegetation slated for protection.

5.4.2.4 Employment - income generation

Impact:

The number of workers that will be employed on the site for the coastal works has not yet been estimated that this number would be about 15 to 20 persons. These levels of short-term employment opportunities at this time would have a significant positive impact on the local economy and on regional unemployment.

Mitigation:

N/A

5.4.3 CONSTRUCTION PHASE IMPACTS – CONSTRUCTION CAMP

5.4.3.1 Fuel & chemicals storage – soil & water contamination

Impacts:

Spilled chemicals can contaminate soil as well as pollute inshore waters and hazardous and flammable substances (e.g. diesel oil, paints, thinner, solvents, etc.) when improperly stored and handled on the site become potential health hazards for construction workers. It is anticipated that refueling and maintenance of large vehicles will take place on the construction site and that, correspondingly, there will be storage of fuel and lubricants on the site.

Mitigation:

- Hazardous chemicals (e.g. fuels) should be properly stored in appropriate and labeled containers and these should be safely locked away. Conspicuous warning signs (e.g. 'No Smoking') should also be posted around hazardous waste storage

and handling facilities.

- Fuel tanks should be properly contained within sealed retaining walls and proper systems and controls implemented to prevent spillages to the ground during dispensing.
- Approved fire emergency and chemical spill control procedures should be put in place for the construction site and a fire safety officer appointed.

5.4.3.2 Solid waste management

Impacts:

The construction of a 700 room resort will undoubtedly generate large amounts of solid waste on a more or less continuous basis. This waste will be comprised of used construction materials (concrete, broken concrete blocks, timber, steel rebar), insulation material, plastic, drums and cans, paint, oil, packaging material, paper, etc. The configuration of the resort site – a narrow peninsula exposed to winds from several directions and surrounded for the most part by water – makes it particularly prone to solid waste management issues. Waste storage capacity is limited and the lighter elements of the waste (paper, plastic. Styrofoam, etc.) are easily blown into the sea.

Mitigation:

The vulnerability of the site to solid waste issues should be acknowledged as a major project management issue from the outset and the whole matter treated under the terms of a comprehensive solid waste management plan. The essentials of such a plan should include:

- Identification of waste type and source
- Containment and control of waste
- Frequent waste clean-up, collection, containment, removal and disposal
- Awareness of potential waste issues among employees and workers
- Commitment to good solid waste management practice

The main contractor should be made responsible for preparing and implementing a waste management plan approved by NEPA.

5.4.3.3 Equipment & vehicle maintenance

Impacts: All sorts of motorized equipment, from generators to trucks, requiring fuel, lubrication and maintenance will be used on the construction site. Many will be fitted with lead batteries. Therefore the potential will exist on the site for spillage and contamination of the soil and the sea by hydrocarbons as well as the careless disposal of batteries.
Mitigation: • Confine vehicle maintenance to specially prepared areas with impermeable pads. • Ensure changed engine oil is collected in drip pans and stored in covered drums until it can be properly removed from the site for appropriate disposal • Ensure used batteries are properly stored and kept under cover.

5.4.4 RESORT OPERATION IMPACTS

5.4.4.1 Employment & staff training

Impact: On completion of the project, the employment of >1000 persons acting in a wide range of capacities is anticipated. This would represent a positive long-term socio-economic benefit arising from the project. This benefit would be enhanced by in-house training of staff.
Mitigation: N/A

5.4.4.2 Use of water & resource depletion

Impact:

- As indicated earlier at Section 4.7.1 the NWC mains supply is sufficient to meet the demands of the Seawind Key development (700 m3). The increased demand for water is therefore not expected to have a negative impact on the water supply to the area.
- If the operation of the resort implies a net increase in the number of foreign visitors to Jamaica it will also mean an increase in the demand on local water resources. The resort should put the following water conservation devices or technologies in place.

Mitigation:

- Provide adequate water storage facilities to ensure adequate supplies for the resort.
- Install aerators/flow restrictors on all taps.
- Install low flush toilets.
- Collect grey-water separately from sewage effluent and re-use for irrigation.
- Install gutters and collect rainwater from building roofs and store for grounds irrigation.

5.4.4.3 Use of electricity

Impact:

JPSCo Ltd. will supply power for the development site from the existing mains running along the main road into the Freeport area. The incremental demand will be within the capacity of the system and this will be confirmed in writing by the utility. The resort should therefore not cause any supply shortages to the rest of the system. However, this increased demand will commensurately increase the utility‘s use of fossil fuel to generate that electricity, and thus the project will indirectly incur negative impacts associated with greenhouse emissions.

Mitigation:

Mitigation measures relate to incorporating and improving energy management and

conservation practices.

- Sub-meters and real-time energy monitoring equipment, timers, photoelectric cells, thermostats, etc. should be installed in the room blocks and other facilities.
- Install translucent shades and fluorescent lighting.
- Pipe insulation, tank lagging (not asbestos!) and heat recovery systems should be installed wherever it is practical to do so.

5.4.4.4 Sewage collection and disposal

Impact:

The 454m^3 of sewage generated by the resort will be collected and pumped via the existing main along Southern Cross Boulevard to the NWC wastewater treatment plant at Bogue, about 3km away.

Mitigation:

N/A

5.4.4.5 Solid waste management & disposal

Impact:

The resort will generate an estimated 2.1 tons of solid waste per day, comprised mainly of organic food waste. Poor waste management at the resort would lead to unsanitary conditions including vermin and fly infestation, odours and unsightly conditions. However, garbage management and good housekeeping will be practiced at the tourism facility and potential issues related to improper solid waste storage will therefore be avoided. It is anticipated that a private waste contractor will be engaged to collect and dispose of waste from the resort.

Mitigation:

- Ensure regular collection of garbage by either public or private waste disposal service.
- Ensure waste is disposed of at the Retirement waste disposal site in St. James.

5.4.4.6 Surface runoff & disposal

Impact: Modification of the site drainage pattern has been addressed above at Section 5.4.1.10. and the design of the drainage system has been presented at Section 4.7.7. Suffice it to say here that surface runoff from the site over the long term will be controlled and directed towards the southern shoreline and the Bogue Lagoon estuary.
Mitigation: N/A

5.4.4.7 Vehicular traffic

Impact: The number of vehicles owned or operated by persons directly connected to the resort is unlikely to exceed 60 vehicles. Operations of the resort will also create traffic comprised of buses and delivery vehicles, say thirty per day. Given the recent and current road and main road improvement works being undertaken in Montego Bay and the North Coast, it is unlikely that this additional traffic induced by the Seawind Key Resort development will cause any undue congestion in the Montego Freeport area over the short to medium term. This matter can be better considered when the results of the comprehensive traffic analysis currently being conducted are released.
Mitigation: N/A

5.4.4.8 Night-time entertainment

Impact: Some concern has been expressed by residents at 'The Lagoons', located about 400m over water from the new resort, that sounds generated at night from night shows at the resort may be loud and disturbing. The resort is sufficiently removed from the residential area to the east that night noises will not be an issue.
Mitigation:

- The design and orientation of the musical entertainment area must be such that audible night sounds do not carry over the water towards the residential area.

5.4.4.9 Turtle nesting

Impact:

Sea turtles are protected species. Sea turtle nesting on the beach at Seawind Key could be threatened if the shore is bathed in lights at night during the nesting season since the nesting females are deterred by light. During the hatching of the eggs, hatchlings are disoriented by bright lights which can cause them to head landward rather than quickly out to sea. Where turtles have successfully nested on the beach, the nests are threatened by trampling when people inadvertently walk over the nests in the sand. These are all factors which contribute to the continuing decline in turtle populations.

Mitigation:

- Enhance turtle nesting by providing planted and shaded areas at the top of the beach that are protected from trampling and direct lighting.
- Design and implement turtle management plan.
- Implement turtle watch programme with local ENGO or school and promote turtle nesting as an attraction.

5.4.4.10 SCUBA & snorkeling - misuse of coral reef resources

Impact:

One of the main natural attractions that will be available to guests at Seawind Key who can SCUBA dive and snorkel is the nearby coral reef. Unless the marine resource is properly managed, the increased use of the site for recreational purposes could result in degradation of the habitat by damage to corals from boat anchors, souvenir collection, and poor diving practice.

Mitigation:

- Provide educational and environmental sensitization material on coral reefs for guests and for hotel staff.
- Promulgate MBMP user guidelines.
- Install boat mooring buoys at sites approved by MBMP for use of dive boats and ban boat anchoring on coral substrate.
- Ban collection of coral reef souvenirs.
- Institute and support coral reef monitoring programme for Seawind Key.

5.4.4.11 Landscaping & grounds maintenance

Impact:

The objective of this activity, apart from general up-keep of the grounds, should be to create a diverse terrestrial habitat that will encourage a wide variety of local fauna, including birds and butterflies. This would serve to restore and enhance the local ecology.

Mitigation:

See mitigation at 5.4.1.2 above:

- The landscape plan should seek to utilize low-maintenance native species tolerant of typical coastal conditions which are attractive to birds. It must not include imported and invasive species.

5.4.4.12 Mosquito fogging

Impact:

Resort hotels in coastal areas where mosquitoes are prevalent often use insecticide foggers as a technique to control the pest populations. This of course kills other beneficial insects, such as butterflies, as well. This causes a serious negative impact, especially in a situation where it is desirable to encourage and maintain butterfly populations.

Mitigation:

Use trapping as an effective and alternative method to control mosquito populations.

5.4.4.13 Public beach facility management

Impact: As part of the land sale agreement with Montego Freeport Limited, the resort is required to provide and manage a beach faciliy available to the public. This is seen as a positive action in that local persons who had access to the beach will still be able to use the resource, albeit for a fee to cover the cost of managing the facility.
Mitigation: • Identify suitable alternative football field

5.4.4.14 Worker housing demand & uncontrolled settlement

Impact: Recent tourism resort development in Jamaica (~ 15,000 rooms by 2010) has not been matched by a corresponding development and construction of housing and the social infrastructure to meet the demand of increasing numbers of resort facility workers, etc. Therefore, squatting and informal settlements despoil the resort towns, worsening and provoking social tensions. Although not directly responsible for the problem. the present project may add to the unplanned settlement problem in the local region – a matter that has recently been brought to public attention by several persons in the Montego Bay community. This issue is viewed as an indirect, cumulative, long-term, reversible, negative and very significant impact.
Mitigation: • Seek provision of adequate housing opportunities and social infrastructure by relevant authorities for hotel workers to reduce incidence of squatting and unplanned development associated with resort development in Jamaica.

5.4.5 SUMMARY OF IMPACTS

The impacts identified and discussed above are summarized below in Table 5.2.

The potential negative impacts of significance during the construction phase are:

- Loss of land use options
- Loss of vegetation and arboreal habitat (biodiversity) during site clearance
- Earth material stockpiling and material washout &/or dusting
- Modification of site topography (land surcharge) & surface drainage pattern
- Concrete batching plant operation - dust and toxic effluent
- Uncontrolled forest cutting to supply timber supports
- Construction solid waste storage & disposal
- Air quality impairment caused by dust
- Sewage & litter generation by work force
- Increased runoff & drainage from impervious surfaces & pavements
- High water usage for construction purposes
- Loss/damage of seagrass beds, corals and other sea bottom habitat during sea floor excavation, shoreline filling, and coastal protection works
- Sourcing of rock, beach fill and sand
- Stockpiling of materials for coastal works
- Fuel and chemical storage & dispensing,
- Solid waste & litter management
- Equipment & vehicle maintenance

Given the poor environmental performance typical of construction sites in Jamaica, particular attention should be paid to the application of best construction practices and the monitoring of the construction works.

The positive impacts of significance related to the construction phase are:

- Re-establishment of the ecology of the site (albeit modified) through replanting and landscaping using local native species where possible,
- The socio-economic benefits derived from employment and provision of services related to construction.

The potentially significant negative impacts related to the resort operation phase are:

- Water consumption & resource depletion
- Energy consumption (electricity & fuel) & green house gas emissions
- Solid waste collection & disposal

- Sewage collection & disposal
- Impairment of sea turtle nesting
- Abuse of coral reef resources by snorkellers and divers
- Death of fauna by mosquito fogging
- Uncontrolled settlement induced by the project

All the identified negative impacts can be successfully mitigated except in the case of the last issue, which requires further and deliberate government intervention.
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Table 5.2 Seawind Key Resort - Summary of construction and operation phase impacts.

ENVIRONMENTAL IMPACT	IMPACT TYPE								MITIGATION		
	Positive		Negative								
	Significant	Not significant	Significant	Not significant	Short Term	Long Term	Irreversible	Cumulative	No Mitigation Required	Mitigation Required	Reference to Mitigation Section
CONSTRUCTION PHASE IMPACTS											
45. Loss of land use options			×			×	×		×		
46. Loss of terrestrial habitat & biodiversity			×		×			×		×	5.4.1.2
47. Soil erosion – marine turbidity				×	×					×	5.4.1.3
48. Loss of recreational amenity – pre-empted use				×	×					×	5.4.1.4
49. Piling & building foundations – noise & vibration				×	×					×	5.4.1.5
50. Earth materials sourcing - illegal quarrying				×	×					×	5.4.1.6
51. Materials transport – dusting & spillage				×	×					×	5.4.1.7
52. Materials stockpiling & storage – coastal contamin.			×		×					×	5.4.1.8
53. Construction works induced traffic - congestion				×	×					×	5.4.1.9
54. Land surcharge – drainage modification			×			×	×			×	5.4.1.10
55. Concrete batching plant operation – dust & effluents			×		×					×	5.4.1.11
56. Timber scaffolding & form support – forest depletion			×			×				×	5.4.1.12
57. Construction solid waste storage & disposal			×		×					×	5.4.1.13
58. Dusting – air quality degradation			×		×					×	5.4.1.14
59. Construction works noise – public health				×	×					×	5.4.1.15
60. Sewage & litter – public health & contamination			×		×					×	5.4.1.16
61. Impervious surfacing & paving – increased runoff			×			×				×	5.4.1.17
62. Installation / upgrading of utilities – soil erosion				×	×					×	5.4.1.18
63. Const. works water demand – supply depletion			×		×					×	5.4.1.19
64. Replanting & landscaping – habitat enhancement	×					×		×	×	×	5.4.1.20
65. Employment – socio-economic benefit	×				×				×		
66. Roadside vending – eyesore & litter				×	×					×	5.4.1. 22
67. Visual intrusion on seascape				×		×	×	×	×		

Table 5.2 (cont'd) Seawind Key Resort - Summary of construction and operation phase impacts.

ENVIRONMENTAL IMPACT	IMPACT TYPE								MITIGATION		
	Positive		Negative								
	Significant	Not significant	Significant	Not significant	Short Term	Long Term	Irreversible	Cumulative	No Mitigation Required	Mitigation Required	Reference to Mitigation Section
CONSTRUCTION PHASE IMPACTS (cont'd)											
68. Coastal excavation & construction works			×			×	×			×	5.4.2.1
69. Sourcing rock, beach fill & sand – coastal works			×		×					×	5.4.2.2
70. Material stockpiling – coastal works			×		×					×	5.4.2.3
71. Employment – income generation	×				×			×	×		
72. Fuel & chemicals storage - spillage			×		×					×	5.4.3.1
73. Solid waste management			×		×					×	5.4.3.2
74. Equipment / vehicle maintenance – soil contamin.			×		×					×	5.4.3.3
OPERATION PHASE IMPACTS											
75. Employment / staff training	×					×		×	×		
76. Water demand – resource depletion			×			×		×		×	5.4.4.2
77. Energy demand – fossil fuel combustion			×			×		×		×	5.4.4.3
78. Sewage collection & disposal			×			×		×		×	5.4.4.4
79. Solid waste management & disposal			×			×		×		×	5.4.4.5
80. Surface runoff & disposal – erosion & contamination				×		×				×	5.4.4.6
81. Vehicular traffic - congestion				×		×		×	×		
82. Night-time entertainment - noise				×		×				×	5.4.4.8
83. Sea turtle nesting – protected species			×			×		×		×	5.4.4.9
84. SCUBA & snorkeling / misuse of reef resources			×			×		×		×	5.4.4.10
85. Landscape & grounds maintenance	×					×		×		×	5.4.4.11
86. Mosquito fogging			×			×				×	5.4.4.12
87. Public beach facility management	×					×			×		
88. Induced housing demand & squatting			×			×		×		×	5.4.4.14

6. PROJECT ALTERNATIVES

6.1 RESIDENTIAL OR LOW-SCALE RESORT DEVELOPMENT

The developer purchased the site from Montego Freeport Ltd. expressly for the purposes of creating a 700-room tourist resort and, therefore, consideration of land use other than that in this context would not be of interest.

The site is zoned for resort or residential development and thus the available development alternatives to the current proposal would either be for a resort at a smaller scale or for a residential project. Either would obviously make a smaller demand on water and sewage services and be more sustainable over the long term but unlikely to provide the short-term economic returns and benefits as compared to the project proposed.

6.2 SEAGRASS REMOVAL, STORAGE & REPLANTING

The manual and mechanical options proposed for seagrass removal are described above at Section 4.4. The manual method, despite being labour intensive and time consuming, is tried and tested and has achieved successful replanting rates elsewhere in Jamaica of 80% and more. The alternative mechanical system, albeit approved by NEPA for use at another location, is as yet untested and may not offer the same degree of manual control although it would allow for deeper extractions. A decision on the method to be employed should await the results of the mechanical method tests.

In the present context, both options face the problem that there are no suitable areas for replanting near to the removal sites and therefore the seagrass sods are going to have to be transported to places at some distance away where areas of suitable shallow open sea floor may be found.

6.3 BREAKWATER CONSTRUCTION

The options available for construction of the breakwaters are by use of large rocks and boulders put in place relatively quickly using excavators working from temporary extensions to the proposed groynes or through use of 'bio-rock' technology that causes calcium accretion on steel frames. Theoretically, the latter would cause fewer disturbances to the sediments and the sea floor but it would take longer to achieve the desired results for wave attenuation.

6.4 CONCRETE BATCHING PLANT

A considerable amount of concrete will have to be used at the resort construction site, particularly if the foundation piles are also to be manufactured there. Having a batching plant on site makes the concrete more readily available and pre-empts the need for transport of mixed concrete to the site along with the attendant issues of spillage on the roads between the mixing site and the construction site. On the other hand, operating a batching plant on the resort site places the onus of environmental management of the plant on the site/project manager since it brings with it the issues of dusting and toxic effluent disposal to an area that is primarily residential and surrounded by sensitive marine habitats. Furthermore, having the batching plant on site may pre-empt the transit of concrete transporters but it would now entail the transport and handling of bulk or bagged dry cement on site, undeniably a more contentious and difficult proposition. If it is desirable not to purchase mixed concrete from nearby suppliers, then consideration should be given to locating the concrete batching plant somewhere else at the Freeport but removed from the Seawind peninsula.

6.5 'NO PROJECT' SCENARIO

This alternative implies that the site would be left in an undeveloped state. With no intervention, the site would become overgrown with opportunistic plant species and gradually the plant community would evolve into a dry coastal forest with an associated faunal complement of birds, etc. In the absence of some form of control and land management and in the context of modern Jamaica, it is almost inevitable that squatters

would settle on the site creating a situation with all the attendant problems related to lack of basic infrastructure and tenure. However, given the current level of presence exercised by Montego Freeport Ltd., it is likely that the absence of development would only mean continuation of periodic use of the shoreline for recreational fishing and turtle poaching.

7. ENVIRONMENTAL MANAGEMENT PLAN

7.1 ENVIRONMENTAL SPECIFICATIONS FOR CONSTRUCTION WORKS

The contractor is required to conform in all respects to the requirements for environmental management of the construction site and works as specified below and to make provision in his/her tender for all costs associated therewith.

7.1.1 Public/worker safety

- The work site shall be adequately fenced so as to ensure the exclusion of children and persons from potentially hazardous site activities and situations.
- The contractor shall ensure that workers on the site are provided with the appropriate safety gear, e.g. hard hats, safety boots, nose masks and ear muffs, etc., as appropriate.

7.1.2 Sourcing, transport and storage of earth materials

- Earth materials used for construction (e.g. sand, marl, and aggregate) shall only be obtained from sources having environmental permits. The contractor will be required to have current copies of such permits obtained from the supplier and available for inspection at the work site.
- Earth materials shall be transported in properly covered trucks such that there is no dusting or spillage.
- Stockpiles of earth materials on the work site shall be constructed with slopes not greater that 2:1 (horizontal to vertical). They shall be placed away from the beach and any surface drainage features and surrounded by berms or covered by tarpaulin so as to prevent the washing out of fines during rainfall events.

7.1.3. Hazardous materials

- Life threatening and hazardous materials (e.g. asbestos, lead fittings, lead-based paints) shall not be utilized on the site or in construction of buildings.

7.1.4 Soil contamination, dusting and noise

- Oils and lubricants shall not be spilled on the ground or to the sea under any circumstances and proper provision shall be made to avoid such occurrences during vehicle maintenance. Oil leaks must be collected in drip pans and these emptied into larger containers for storage and later disposal at a site and in a manner designated by NEPA.
- Turbid water from cement mixers shall first be discharged to a sediment settlement basin and only clarified water allowed overflow to open ground.
- Exposed dry soils and marl on the work site shall be kept properly wetted such that there is no fugitive dust. Soil wetting shall apply particularly to areas where there is vehicular movement.
- Noisy construction activities, e.g. piling, shall be restricted to normal working hours so as to reduce auditory nuisances.

7.1.5 Solid waste management

- All hazardous materials encountered on the site shall be disposed of appropriately and in accordance with NEPA requirements.
- Construction wastes shall be collected from the site each day, stored and contained in a designated area on the work site.
- Garbage containers shall be provided on the work site in sufficient numbers as to effectively minimise littering.
- Construction wastes and garbage shall be removed from the site at least twice weekly and on each occasion their disposal at the NSWMA dump at Retirement shall be verified.
- Litter and waste from the work site shall not be allowed to enter into the sea or any drains.

7.1.6 Sewage management

- Due to the high water table, chemical toilets shall be provided for worker's use.
- Sewage generated on the work site shall not contaminate coastal waters or drains.

7.1.7 Drainage

- Due to the location of the development next to the coastal waters in a marine park, special care shall be taken to ensure that there is no erosion, spillage or transfer of materials, liquids or contaminants from the site into the inshore waters.
- Design of the site drainage plan must ensure that there are adequate sink wells and that overflow of rainfall is discharged to the back of the mangroves along the southern side of the site.

7.1.8 Employment

- Local persons shall be employed on the construction site whenever possible so as to avoid or reduce the potential for community/social conflicts.

7.1.9 Landscaping

- Exposed soils shall be covered with appropriate vegetation (e.g. grasses) after completion of construction works.
- The site shall be adequately landscaped using functional indigenous trees (e.g. bird feeding, fruit, shade) and flowering shrubs following completion of construction works.

8. OUTLINE ENVIRONMENTAL MONITORING PLAN

Prior to site preparation and construction activities, the main contractor should present an environmental management plan (including, *inter alia*, location of construction camp and toilet facilities, location of material storage areas, solid waste management plan, dust control measures, activity schedule, etc.) for review and approval by NEPA, the environmental monitor and the project manager. The developer should present a landscape plan and the trees/vegetation earmarked for protection should be flagged and hoarded by the contractor. The entity selected to carry out environmental monitoring of the construction works should then prepare an environmental monitoring programme based on the above, the requirements of the EIA, and conditions of the development permit.

The major elements of the environmental impact monitoring programme to be implemented during the construction phase of the project are as follows:

- Site clearance to ensure that trees marked for protection are left untouched and that large areas of soil are not left exposed and uncovered for extended periods of time.
- Site drainage and surface runoff, especially during and shortly after major rainfall events, to ensure there is no flooding, ponding, and runoff of surface water towards the beach.
- Compliance of construction works with site management and landscape plans.
- Inspection of quarry licences to ensure earth materials are obtained only from licensed operators.
- Ensure transportation of earth materials is done by covered trucks.
- Stockpiles of fine materials are placed away from drainage features and are not washed into the marine environment.
- The contractor must immediately and completely clean up spills of materials in public areas.
- Solid waste disposal practices to ensure appropriate on-site management and final disposal at approved dump.

- At the labour camp, ensure installation of VIP toilets and methods for the proper disposal of sewage and solid waste.
- Monitor marine water quality to ensure that the construction works are not impacting negatively on coastal water quality. The parameters to be monitored should include salinity, dissolved oxygen, BOD, nitrates, phosphates, turbidity, faecal and total coliforms.
- Deployment of sand bags around works involving groyne and breakwater construction.
- Incorporation of native bird and butterfly feeding plants in new landscape.

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10. APPENDICES

APPENDIX 1. EIA TERMS OF REFERENCE

The document below includes the complete submission made to NEPA, inclusive of a project brief and site location map. It was approved on 19 December 2006. The changes made by NEPA to the original submission are indicated by blue type.

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PROJECT BRIEF

Developer:	Seawind Key Investments Ltd. 10a Chelsea Avenue Kingston 5
Operator:	AMResorts ('Secrets - Preferred Hotels and Resorts')
Environmental Consultants:	Environmental Solutions Ltd. 20 West Kings House Road Kingston 10, Jamaica
Site description:	Low-lying (<2m asl), flat reclaimed land (1960's dredging material) at western end of promontory at Montego Freeport (Figure 1). Borehole data (NHL Eng. Ltd.) show gravelly sands overlying layer of fine peaty soil over calcareous gravels and sands + coral chips. Ruinate vegetation, comprised of sparse trees (Casuarina, seagrape, etc.), shrubs and weeds. Seaward edge fringed by coral reef - faces northwest and bears brunt of 'northers' – shoreline badly eroded. Southern side borders the Bogue Lagoon, a fish sanctuary. Project site occupies 24 acres (97,124 m^2) but title shows 32 acres (125,452 m^2) – difference reflects area lost to shoreline erosion due to wave exposure.
Land use zoning:	Area zoned for residential/resort use in the St. James Parish Development Order, 1982.
Other proposed projects nearby:	Proposed residential subdivision next door, proposed Sunset Beach Resort & Spa expansion, proposed lot developments at eastern end of promontory, proposed expansion of cruise ship berthing, free zone expansion projects.

Figure 1. Satellite image showing part of Montego Bay, Montego Freeport and Seawind Key site.

Environmentally sensitive areas: Project area is situated within the boundaries of the Montego Bay Marine park and lies adjacent to the Bogue Lagoon Fish Sanctuary.

Project description:

- 700 room hotel (Secrets A & B, each with 260 junior suites + 90 luxury suites and sharing common lobby).
- 3 - 5 story room blocks.
- Maximum occupancy = 1,480 guests.
- Employment = ~700 persons.
- Water supply provided by NWC – estimated consumption during operation = 4.9 m litres per day.
- Sewage to be pumped via mains to NWC Bogue Treatment Plant.
- Project includes development and management of public beach park.
- Duration of construction works = 24 months
- Project life cycle = 30 years

Environmental permit & licences:

a) NEPA Permit for construction and operation of resort development
b) BCA Licence for use of the foreshore and floor of the sea for commercial/recreational activities
c) BCA Licence to undertake any foreshore modification work (dredging, beach nourishment, jetties, groynes construction, etc.),

Environmental issues (potential):

<u>Construction phase</u>

- Loss of land use options
- *Visual intrusion on seascape*
- *Displaced use of playing field*
- Site clearance – loss of habitat
- Shoreline restoration & protection – groyne & breakwater construction – removal of seagrass, loss of corals, turbidity
- Sand sourcing – dredging – marine sediment disturbance
- Land excavation & stockpiling of material, removal & disposal of peat soils
- Well-pointing and dewatering
- Soil erosion
- Soil compacting & pile driving
- Building construction methodology
- Construction works
- Labour/camp site
- Cement batching plant

- Equipment maintenance
- Earth materials sourcing & transport
- Timber supply – formwork support
- Materials storage
- Noise
- Dusting
- Modification of surface drainage
- Construction waste disposal
- Sewage and litter disposal
- Replanting & landscaping
- *Employment/Income generation*
- *Traffic & parking*
- *Roadside vending*

Resort Operations/Habitation Phase

- Off-site parking
- Site drainage
- Procurement

Employment
Water supply & supply curtailment
Sewage collection, treatment & disposal
Sewerage upgrading & maintenance
Spa effluents
Solid waste disposal
Use of electricity
Entertainment sounds & noise
Worker housing demand & uncontrolled settlement
Road traffic pattern & taxi parking issues
Recreational misuse of coral reef resources
Public beach facility & use
Replacement of playing field
Employment/Income generation

Natural hazard vulnerability

Hurricane & storm surge
Earthquake & tsunami
Sea level rise

PROJECT SITE LOCATION

TERMS OF REFERENCE

Prepare an environmental impact assessment of the proposed resort development to include the following:

1. *Introduction - Describe the 700 room resort development project at Montego Freeport including the public recreational park. Explain the executing arrangements for the environmental assessment*

2. *Background Information - Briefly describe the major components of the proposed project, the implementing agents, a brief history of the project and its current status. Also refer to its location within the boundaries of the Montego Bay Marine Park (MBMP) and adjacent to the fish sanctuary at Bogue Lagoon.*

3. *Study Area - Specify the boundaries of the study area for assessment to include any adjacent or remote areas that will be directly influenced by the project and which will be considered with respect to the project.*

4. *Scope of Work - The following tasks will be undertaken:*

   Task 1. Description of the Proposed Project - Provide a full description of the project and its existing setting, using maps, satellite imagery, and drawings at appropriate scales. This is to include: general layout, road access, type/size of buildings, building set-backs, pre-construction and construction activities (including vegetation clearance and landscaping); building construction methods and works; shoreline reclamation and protection works; duration of construction phase; plans for providing water and other utilities, waste disposal and other necessary services; sewage treatment system, and storm water collection and disposal. Reference will also be made to the existing issues raised by the local community at the public consultation on 15 September 2006 (see Annex).

   Task 2. Description of the Environment - Assemble, evaluate and present baseline data on the relevant environmental characteristics of the study area including consideration of the following:

   a) *Physico-chemical environment: climate[1] and meteorology, geology, topography, soils, aquifer characteristics, coastal features, drainage and storm water runoff, marine water quality[2], and natural hazard vulnerability. Particular attention will be paid to the artificial land-filled nature of the site, the extent of coastal erosion, sea level rise and its implications for coastal protection.*
   b) *Biological environment: terrestrial and marine flora and fauna; sensitive habitats including mangroves, corals and seagrass beds, with indication of their function and value in the project area; any endemic, rare or endangered species; and species with the potential to become nuisances,*

[1] Temperature, wind, and rainfall data collected at the Sangster International Airport will be used.
[2] Parameters to be measured will include: temperature, salinity, conductivity, DO, BOD_5, TSS, NO_3, PO_4, O&G, total & faecal coliforms.

vectors or dangerous. Special attention will be paid to the butterflies and birds on the site as these will be of interest to future visitors. Note will be made that the terrestrial ecology of the site is highly modified. The inshore marine habitat in front of the site and its water quality, particularly with respect to proposed shoreline reclamation works and recreational use, will be assessed.

c) *Socio-cultural environment: present and projected land use, present and projected population in the study area, projected visitorship, other planned developments in the vicinity of Montego Freeport, recreational use of the area, water and electricity supply, public health, issues related to housing demand and supply, and historical assets of the site. This section will include a description of the surrounding activities in proximity to the project area, especially residential, tourism, industrial and commercial activities, the Montego Freeport cruise ship pier and the Montego Bay Yacht Club. Public perceptions of the proposed development will be assessed through community surveys and public meetings.*

Building architectural design and integration with the character of the area should be addressed.

A Geotechnical Investigation of the site should be conducted.

Task 3. Legislative and Regulatory Considerations - Describe the pertinent regulations and standards pertaining to land use, development, environmental quality, health and safety, and the MBMP. This section will include reference to the St. James Parish Development Order as well as to the more recent Greater Montego Bay Development Plan.

Task 4 Beach Modification - Outline of proposed works on the foreshore and the floor of the sea, including but not limited to any dredging, beach nourishment, shoreline structure construction, seagrass, mangrove or coral removal and replanting.

Prescriptive rights of the public to the access and use of beach areas should be identified and addressed.

Task 5. Determine the Potential Impacts of the Proposed Project - Identify the major issues of environmental concern and indicate their relative importance to the design of the project. Distinguish construction and post-construction phase impacts, significant positive and negative impacts, and direct and indirect impacts. Identify impacts that are unavoidable, irreversible and cumulative. Special attention will be paid to:

a) *Site and vegetation clearance, land preparation and piling works, including removal of subsurface peat muck layer.*
b) *Relocation of football playing field*
c) *Siting and location of construction camp and material stockpile areas*

d) *Modification of existing drainage patterns and surface runoff during construction and post-construction phases as well as means of controlling sedimentation of inshore waters*
e) *Water supply and demand.*
f) *Construction site sewage and waste water treatment.*
g) *Solid waste management during construction phase.*
h) *Impacts related to construction works on land including materials sourcing, transport and storage, building construction methodology, piling, de-silting, noise, fugitive dust, traffic obstruction and employment*
i) *Impacts related to foreshore works, including dredging and groyne construction, particularly with reference to corals, seagrass beds and the Bogue Lagoon, materials transport and storage.*
j) *Impacts related to vehicular traffic induced by the project.*
k) *Replanting and landscaping.*
l) *Potential impacts of the development on adjacent properties and residential areas.*
m) *Visual impacts, from both land and sea vantage points.*

Special reference will also be made to the issues raised by the local community at the public consultation held in Montego Bay on 15 September to air the proposed resort development plans. The list of issues is appended to the TOR.

Reference should be made to the extent and quality of the available data and any information deficiencies and uncertainties associated with the prediction of impacts should be clearly identified.

Task 6. Analysis of Project Alternatives – Describe the alternatives examined for the proposed project that would achieve the same objective, including the "no action" alternative. Distinguish the most environmentally friendly alternatives.

Task 7. Storm Surge Analysis – Conduct Storm Surge Analysis to inform coastal setbacks of buildings and other impact mitigation measures.

Task 8 – Drainage Assessment - An assessment of Storm Water Drainage should be conducted. The EIA Report should cover, but not limited to:

i. *Drainage for the site during construction, to include mitigation for sedimentation to the marine environment*
ii. *Drainage for the site during operation, to include mitigation for sedimentation to the marine environment*

Task 9. Mitigation and Management of Negative Impacts - Recommend feasible and cost-effective measures to prevent or reduce significant negative impacts to acceptable levels and present a draft environmental management plan for the construction phase. Quantify and assign financial and economic values to mitigation measures, in part to determine impact significance.

Task 10. Environmental Impact Monitoring Plan - Prepare a draft plan for monitoring the implementation of mitigating measures and the impacts of the project during the construction phase.

Task 11. Assist in Inter-Agency Coordination and Public/NGO Participation - Assist in coordinating the review of the environmental assessment by the relevant government agencies and proactively obtain the views of local residents and affected groups.

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 and citations for any references used in interpreting those data. The environmental assessment report will be organised according to, but not necessarily limited by, the outline below:*

- *Executive Summary*
- *Description of the Proposed Project*
- *Policy, Legal and Administrative Framework*
- *Description of the Project Environment*
- *Beach Modification Works*
- *Significant Environmental Impacts*
- *Analysis of Alternatives*
- *Storm Surge Analysis*
- *Drainage Assessment*
- *Mitigation Measures*
- *Impact Monitoring Plan*
- *List of References*

Peter Reeson, 28 November 2006

SEAWIND KEY RESORT DEVELOPMENT - PUBLIC CONSULTATION #1

Venue: Doctor's Cave Beach Club Conference Centre
Date: 15 September 2006 – 5:00pm

Key issues raised by attendees during the Q&A period:

- ***Electricity supply*** – incidence of current fluctuations likely to be exacerbated by additional demand for electricity imposed by new resort.
- ***Sewerage system*** – size of sewer mains and lift station pumps inadequate at present and system failures likely to be increased by operation of new hotel (approx. a doubling of the present effluent flows).
- ***Water supply –*** shortages/cessation of water supply to the Freeport area occurs during cruise ship visits – water demand imposed by operations of new resort are likely to worsen such occurrences.
- ***Surface drainage*** – swales along Freeport access road have become filled and no longer function properly to allow free drainage of runoff from peninsula, thus causing flooding of the road. Continuation of such events is likely to provide guests with a poor impression of the resort's environment and local capacity for environmental management.
- ***Visual aesthetics*** – new hotel, despite its remoteness, will change the visual landscape and that should be a factor to be considered during planning of building layout, massing and design.
- ***Beach club*** – the plan to incorporate a swimming facility and beach club for local residents as a part of the development concept was welcomed. It was pointed out that such a facility should not be exclusive.
- ***Water sports*** – the same restrictions imposed by NEPA on the residents of *The Lagoon* development with respect to water use in the Bogue Lagoon, i.e. no jet skis, no floating docks, no scuba diving, etc., should also apply to the new hotel. It was noted that the use of jet skis is not allowed at Sunset Beach Resort & Spa.
- ***Noise*** – it is possible that nearby residents at *The Lagoon* could be disturbed by noise and nuisance sounds arising from guest entertainment events. To the contrary, the AM Travel representative pointed out that the type of entertainment provided at a Secrets brand resort was of the quieter and more romantic sort.
- ***Traffic congestion*** – note was made of the likely increase in vehicular traffic volumes and congestion induced by the new hotel and the need for measures to reduce the associated problems, including taxi stands.
- ***Vending*** – the need to properly control roadside vending typically associated with construction projects was voiced. A possible mechanism suggested was to provide canteens for workers within the work site boundaries.

Peter Reeson
16 September 2006

APPENDIX 2. SEAWIND CAY - BENTHIC HABITAT DISTRIBUTION DATA

APPENDIX 2. SEAWIND CAY - BENTHIC HABITAT DISTRIBUTION DATA

LOCATION	DATE	TRANSECT	DEPTH	QUAD	QUAD AREA	TECH ID	AREA #	SPECIES	SPECIES CODE	MASTER AREA	AREA	INT. AREA	EXT. AREA	NET AREA	COMMENTS	IMAGE AREA
Seawinds Key benthic	Oct 10,06	Western tip		1			1	Seagrass Bed in Sand	SGS	14702.8400	14702.8400			14702.84		461284.5000
Seawinds Key benthic	Oct 10,06	Western tip		1			2	Seagrass Bed in Sand	SGS	182.3344	182.3344			182.3344		
Seawinds Key benthic	Oct 10,06	Western tip		1			3	Seagrass Bed in Sand	SGS	1001.2620	1001.2620			1001.262		
Seawinds Key benthic	Oct 10,06	Western tip		1			4	Seagrass Bed in Sand	SGS	2242.2710	2242.2710			2242.271		
Seawinds Key benthic	Oct 10,06	Western tip		1			5	Seagrass Bed in Sand	SGS	47.3186	47.3186			47.3186		
Seawinds Key benthic	Oct 10,06	Western tip		1			6	Seagrass Bed in Sand	SGS	1026.4980	1026.4980			1026.498		
Seawinds Key benthic	Oct 10,06	Western tip		1			7	Seagrass Bed in Sand	SGS	42.9022	42.9022			42.9022		
Seawinds Key benthic	Oct 10,06	Western tip		1			8	Seagrass Bed in Sand	SGS	2352.0500	2352.0500			2352.05		
Seawinds Key benthic	Oct 10,06	Western tip		1			9	Seagrass Bed in Sand	SGS	1992.4290	1992.4290			1992.429		
Seawinds Key benthic	Oct 10,06	Western tip		1			10	Seagrass Bed in Sand	SGS	1143.2180	1143.2180			1143.218		
Seawinds Key benthic	Oct 10,06	Western tip		1			11	Seagrass Bed in Sand	SGS	97.7918	97.7918			97.7918		
Seawinds Key benthic	Oct 10,06	Western tip		1			12	Seagrass Bed in Sand	SGS	46.6877	46.6877			46.6877		
Seawinds Key benthic	Oct 10,06	Western tip		1			25	Seagrass Bed in Sand	SGS	402.5236	402.5236			402.5236		
Seawinds Key benthic	Oct 10,06	Western tip		1			39	Seagrass Bed in Sand	SGS	40.3786	40.3786			40.3786		
Seawinds Key benthic	Oct 10,06	Western tip		1			40	Seagrass Bed in Sand	SGS	26.4984	26.4984			26.4984		
Seawinds Key benthic	Oct 10,06	Western tip		1			41	Seagrass Bed in Sand	SGS	6.9401	6.9401			6.9401		
Seawinds Key benthic	Oct 10,06	Western tip		1			42	Seagrass Bed in Sand	SGS	10.0946	10.0946			10.0946		
Seawinds Key benthic	Oct 10,06	Western tip		1			43	Seagrass Bed in Sand	SGS	14.5110	14.5110			14.511		
Seawinds Key benthic	Oct 10,06	Western tip		1			44	Seagrass Bed in Sand	SGS	32.8076	32.8076			32.8076		
Seawinds Key benthic	Oct 10,06	Western tip		1			45	Seagrass Bed in Sand	SGS	13.8801	13.8801			13.8801		
Seawinds Key benthic	Oct 10,06	Western tip		1			46	Seagrass Bed in Sand	SGS	14.5110	14.5110			14.511		
Seawinds Key benthic	Oct 10,06	Western tip		1			47	Seagrass Bed in Sand	SGS	21.4511	21.4511			21.4511		
Seawinds Key benthic	Oct 10,06	Western tip		1			48	Seagrass Bed in Sand	SGS	19.5584	19.5584			19.5584		
Seawinds Key benthic	Oct 10,06	Western tip		1			49	Seagrass Bed in Sand	SGS	23.9748	23.9748			23.9748		
Seawinds Key benthic	Oct 10,06	Western tip		1			50	Seagrass Bed in Sand	SGS	23.3439	23.3439			23.3439		
										Total:	**25528.0759**					

APPENDIX 2 (cont'd) SEAWIND CAY - BENTHIC HABITAT DISTRIBTION DATA

LOCATION	DATE	TRANSECT	DEPTH	QUAD	QUAD AREA	TECH ID	AREA #	SPECIES	SPECIES CODE	MASTER AREA	AREA	INT. AREA	EXT. AREA	NET AREA	COMMENTS	IMAGE AREA
Seawinds Key benthic	Oct 10,06	Western tip		1			14	Seagrass Bed in Rubble	SGRB	140.6940	140.6940			140.694		
Seawinds Key benthic	Oct 10,06	Western tip		1			15	Seagrass Bed in Rubble	SGRB	745.7412	745.7412			745.7412		
Seawinds Key benthic	Oct 10,06	Western tip		1			16	Seagrass Bed in Rubble	SGRB	115.4574	115.4574			115.4574		
Seawinds Key benthic	Oct 10,06	Western tip		1			17	Seagrass Bed in Rubble	SGRB	1849.2110	1849.2110			1849.211		
Seawinds Key benthic	Oct 10,06	Western tip		1			18	Seagrass Bed in Rubble	SGRB	154.5741	154.5741			154.5741		
Seawinds Key benthic	Oct 10,06	Western tip		1			19	Seagrass Bed in Rubble	SGRB	5222.0820	5222.0820			5222.082		
Seawinds Key benthic	Oct 10,06	Western tip		1			20	Seagrass Bed in Rubble	SGRB	459.9369	459.9369			459.9369		
Seawinds Key benthic	Oct 10,06	Western tip		1			21	Seagrass Bed in Rubble	SGRB	2163.4070	2163.4070			2163.407		
Seawinds Key benthic	Oct 10,06	Western tip		1			22	Seagrass Bed in Rubble	SGRB	941.9557	941.9557			941.9557		
Seawinds Key benthic	Oct 10,06	Western tip		1			23	Seagrass Bed in Rubble	SGRB	46.0568	46.0568			46.0568		
										Total:	**12046.0561**					
Seawinds Key benthic	Oct 10,06	Western tip		1			27	Exposed Coral Rubble	RBL	1604.4160	1604.4160			1604.416		
Seawinds Key benthic	Oct 10,06	Western tip		1			28	Exposed Coral Rubble	RBL	1351.4190	1351.4190			1351.419		
Seawinds Key benthic	Oct 10,06	Western tip		1			35	Exposed Coral Rubble	RBL	845.4258	845.4258			845.4258		
Seawinds Key benthic	Oct 10,06	Western tip		1			36	Exposed Coral Rubble	RBL	507.8864	507.8864			507.8864		
Seawinds Key benthic	Oct 10,06	Western tip		1			37	Exposed Coral Rubble	RBL	1012.6180	1012.6180			1012.618		
Seawinds Key benthic	Oct 10,06	Western tip		1			38	Exposed Coral Rubble	RBL	189.2744	189.2744			189.2744		
Seawinds Key benthic	Oct 10,06	Western tip		1			31	Exposed Coral Rubble	RBL	3838.4860	3838.4860			3838.486		
Seawinds Key benthic	Oct 10,06	Western tip		1			32	Exposed Coral Rubble	RBL	1098.4230	1098.4230			1098.423		
										Total:	**10447.9486**					

APPENDIX 2 (cont'd) SEAWIND CAY - BENTHIC HABITAT DISTRIBUTION DATA

LOCATION	DATE	TRANSECT	DEPTH	QUAD	QUAD AREA	TECH ID	AREA #	SPECIES	SPECIES CODE	MASTER AREA	AREA	INT. AREA	EXT. AREA	NET AREA	COMMENTS	IMAGE AREA
Seawinds Key benthic	Oct 10,06	Western tip		1			24	Reef with Live Coral	LCR	475.7097	475.7097			475.7097		
Seawinds Key benthic	Oct 10,06	Western tip		1			33	Reef with Live Coral	LCR	6812.6180	6812.6180			6812.618		
Seawinds Key benthic	Oct 10,06	Western tip		1			34	Reef with Live Coral	LCR	1972.8700	1972.8700			1972.87		
										Total:	**9261.1977**					
Seawinds Key benthic	Oct 10,06	Western tip		1			26	Pavement with Live Cora	LCP	83.9117	83.9117			83.9117		
Seawinds Key benthic	Oct 10,06	Western tip		1			29	Reef without live coral	RF	324.2902	324.2902			324.2902		
Seawinds Key benthic	Oct 10,06	Western tip		1			30	Reef without live coral	RF	394.9526	394.9526			394.9526		
										Total:	**719.2428**					

Benthic substrate	Area (sq.m.)
Seagrass in sand	**25528**
Seagrass in rubble	**12046**
Reef with live coral	**9261**
Pavement with live coral	**84**
Reef without live coral	**719**
Exposed rubble	**10448**

APPENDIX 3. SEAWIND KEY EIA - SOCIO-ECONOMIC SURVEY QUESTIONNAIRE

ESTABLISHMENT QUESTIONAIRE

SEAWIND KEY

ESTABLISHMENT_____LOCATION_____

RESPONDENTS. NAME	TITLE	MAILING ADDRESS & TEL #

1. Approximately how many persons does this establishment employ. _____

2. Is your Estab involved in tourism 1 Directly [ ] 2 Indirectly [ ] 3 No [ ]

SHOW ARTIST'S IMPRESSION

3. In relation to this and bordering communities how do you perceive the Project as being

1 Very necessary [ ] 2 Necessary [ ] 3 Not very necessary [ ] 4 Unnecessary [ ]

4. If 3 or 4 please probe reasons _____

5 . Please identify any specific fears or reservations you may have about the Project

---

_____

6. Please identify the main Benefits you see arising from the Project.

---

7. Do you know of any large planned developments within the Free Zone or Port that might conflict with the Project ? 1Y [ ] 2 N [ ]: If Yes _____

8. Is there an alternative land use that you would prefer for this site ?

1 Yes [ ] 2 No [ ] 3D/K [ ]. If yes Explain _____

9. Identify those public services or utilities that are currently inadequate in relation to

community needs: _____

RESIDENTIAL QUESTIONNAIRE **Community Name _____**

Respondent's Name (do not press) _____Contact_____

Community Demographics:

1 Age distribution 0-17: ____% 18-35: ____% 36-59: ____% 60 & over: ____%

2 Average size Family _____

3 Main occupations in this community:

SHOW ARTISTS IMPRESSION

4. In relation to this and bordering communities how do you perceive the Project as being

1 Very necessary [ ] 2 Necessary [ ] 3 Not very necessary [ ] 4 Unnecessary [ ]

5. If 3 or 4 please probe reasons _____

6 . Please identify any specific fears or reservations you may have about the Project

_____

_____

7**.** Please identify the main Benefits you see arising from the Project.

_____

8. What are the main threats that your community poses for the Marine Park_____

9. Is there an alternative land use that you would prefer for the planned hotel site ?

1 Yes [ ] 2 No [ ] 3D/K [ ]. If yes Explain _____

10 Identify those public services or utilities that are currently inadequate in relation to community needs: _____

11 In this community who are the recognized leaders.

SEAWIND KEY

MISC. OCCUPATIONAL **Classification : _____**

Respondent's Name (do not press) _____Contact_____

SHOW ARTISTS IMPRESSION

1. How do you perceive the Project as being ?

1 Very necessary [ ] 2 Necessary [ ] 3 Not very necessary [ ] 4 Unnecessary [ ]

2. If 3 or 4 please probe reasons _____

3 . Please identify any specific fears or reservations you may have about the Project

---

4. Please identify the main Benefits you see arising from the Project

---

5. Is there an alternative land use that you would prefer for the planned hotel site ?

1 Yes [ ] 2 No [ ] 3D/K [ ]. If yes Explain _____

6. Is there an Association representing your type of occupation/activity ? Y [ ] N [ ]

If Yes please advise : Name _____Leader _____

APPENDIX 4. SEAWIND KEY RESORT, SOCIO-ECONOMIC SURVEY, LIST OF PERSONS INTERVIEWED, MONTEGO BAY, 2006

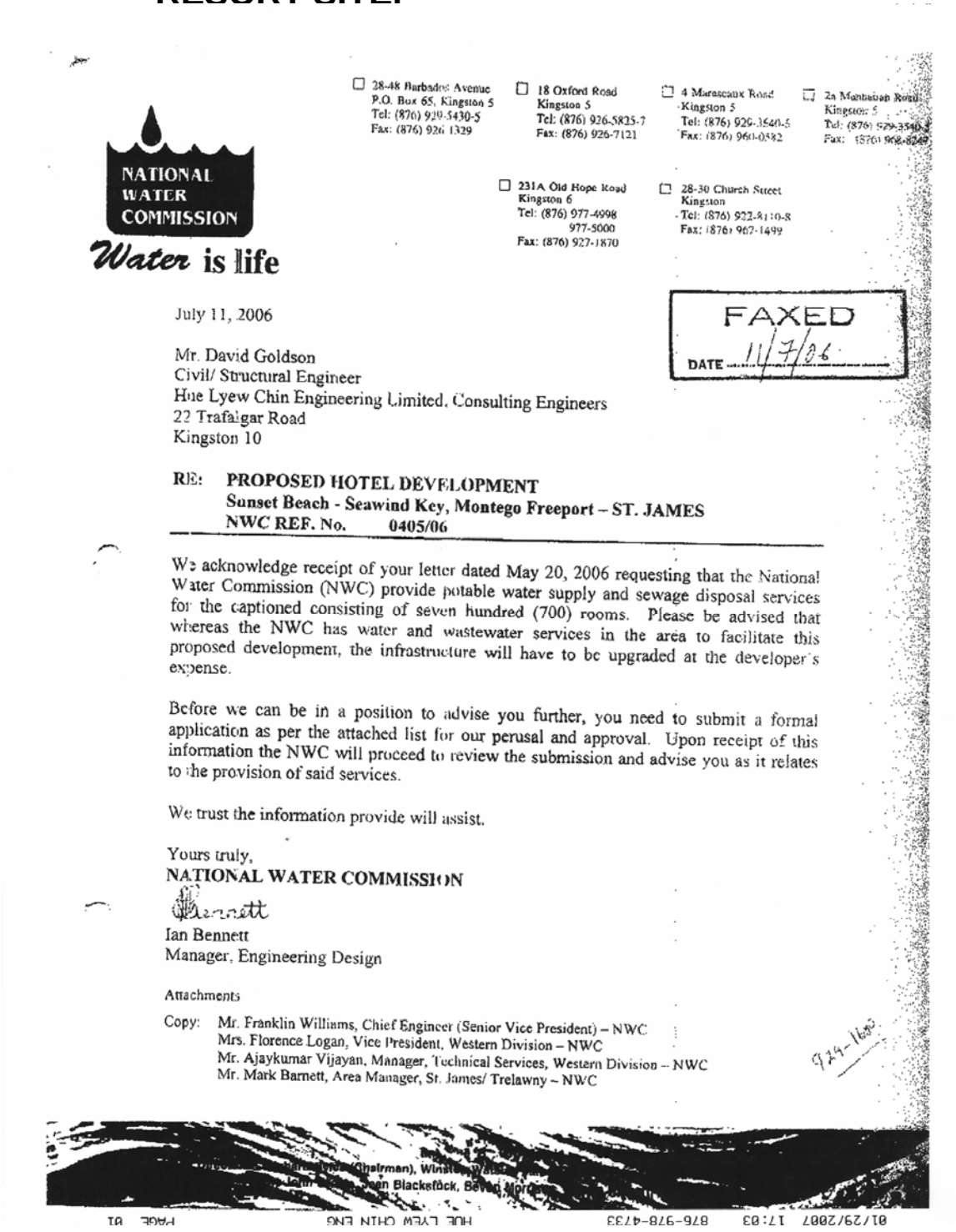
A) INDIVIDUALS

	NAMES	CONTACTS
1	Andries: Michael	Logistics Team Leader, Jamaica Citrus Growers Assn., 971-0548
2	Azan: Nahoud	Managing Director, Texaco Service Center also Resident of The Lagoons, 979-8111
3	Bernard: Kareena	Assistant Manager, Leroy Auto Glass, 953-6811
4	Bloomfield: Evat Mr.	General Manager, Sunset Beach Resort, 979-8800
5	Bowen: Anthony	Port Manager, Port Handlers Ltd., 979-8143
6	Campbell: Marion	Manager , Sunset Beach Resorts , 979-8800
8	Chung: Racquel	Property Manager, The Lagoons, 684-9317-8
9	Clarke: Sgt	JCF Catherine Hall, 684-9082
7	Crichton: Sherrill	Manager Gift Shop, Sunset Beach Resorts, 979-8800
10	Deans: Lloyd	Conultant Bathroom w/House 979-8510
11	Delapenha: Nicole	Resident of The Lagoons, 995-8194
12	Dianna Delisser	Stirling Wharf, 952-5173
13	Forsyth: Andrew	Sales Manager, China Motors Ltd., 952-6695
14	Franklyn: Roosevelt	Estate Officer , LOJ Property Management , 979-8598
15	Harrington: Evelyn	Property Manager, Sea Winds, On The Bay & Commodore Montego Bay Yacht Club 979-8399
16	Hart: Tony	979-8080
17	Jacobs: Ms.	Youth With A Mission, 309-5101
18	James: Olga	Training Manager , HEART Kenilworth, 953-5765
19	Johnson: Olivine	Branch Manager Power Trac 953-6287
20	Landis: Mr. & Mrs	Youth With A Mission, 309-5101
21	Lee: Andrew	General Manager Jamaica Digiport Ltd., 953-6001
22	Lions: Michael	Dock Master Montego Bay Yacht Club, 979-8038
23	Malacara: Paul	General Manager Professional Axxe, 684-9536-7
24	Malcome: Mrs.	Manager, Doctors Surgi-Clinic 979-8874
25	Maponya: Valencia	Parish Health Manager Montego Bay Regional Health Centre 979-7820.
26	Marsh: Mrs.	Montego Freeport Office, 979-8140
27	Martin: Neville	995-9085
28	Marzouca: Carla	Managing Director, Cazoumar Investments Ltd., 978-8180
30	McClaughlin: Sgt	JCF Catherine Hall, 684-9454
31	Mirpuri: Deepak	Manager, Shopsmart, 953-6045 (fax)
32	Patterson: Nadine	NWC Bogue, 952-1640
33	Robinson: Phillipa	Office & Facilities Manager Vista Print Jamaica Ltd., 979-8851
34	Russell: Shari	Assistant Manager , Montego Bay Yacht Club, 979-8038
35	Scarlet: Trevor	NWC, Bevin Road, 940-4447
36	Simons: Korina	Accounts Executive, Gunter Shipping Freeport, 684-9759
37	Smith: Belva	Property Manager , Ocean Pines 979-8169
38	Taff: Clive	Regional Director , Jamaica Tourist Board 952-4425
39	Thomas: Faith	Manager, Montego Freeport Ltd., 979-8140
40	Torp: Ms.	Accounting Clerk, Island Dairies, 684-9286
29	Vikers: Maurice	Sales Representative Caribbean Cement Depot, 979-8828
41	Whyte: Noel	N.O. Whyte & Associates Ltd., 684-9894
42	Williamson: Garfield	President, JUTA Montego Bay, 909-1199
43	Wint Bell: Joy	Reservation Manager, Apple Vacation, 953-6615
44 to 68	24 Residents & Workers in Bogue Village Housing Scheme and the Freeport & Freezone.	Names not requested.

B) ESTABLISHMENTS

	ESTABLISHMENT	CONTACT PERSON	TELEPHONE
1	Apple Vacation	Wint Bell: Joy;	953-6615
2	Bathroom w/House	Deans: Lloyd;	979-8510
3	Caribbean Cement Depot	Vickers: Maurice;	979-8828
4	Cazoumar Investments Ltd.	Marzouca: Carla;	978-8180
5	China Motors	Forsyth: Andrew;	952-6695
6	Doctors Surgi-Clinic	Malcome: Mrs.;	979-8874
7	Gift Shop Sunset Beach Resorts	Chrichton: Sherrill;	979-8800
8	Gunter Shipping Freeport	Simons: Korina;	684-9759
9	HEART Kenilworth	James: Olga;	953-5765
10	Island Dairies	Torp: Suzannie;	684-9286
11	Ja. Citrus Growers Assn.	Andries: Michael;	971-0548
12	Jamaica Digiport Ltd.	Lee: Andrew;	953-6001
13	Jamaica Tourist Board	Taff: Clive;	952-4425
14	JCF Catherine Hall	Clarke: Sgt.;	684-9082
15	JCF Catherine Hall	McClaughlin: Sgt.;	684-9454
16	JUTA Montego Bay	Williamson: Garfield	909-1199
17	Leroy Auto Glass	Bernard: Kareena;	953-6811
18	LOJ Property Management	Franklyn: Roosevelt;	979-8598
19	Montego Bay Regional Health Centre	Maponya: Valencia;	979-7820
20	Montego Bay Yacht Club	Lions: Michael;	979-8038
21	Montego Bay Yacht Club	Russell: Shari;	979-8038
22	Montego Freeport Ltd	Thomas: Faith;	979-8038
23	Montego Freeport Office	Marsh: Mrs.;	979-8140
24	N.O. Whyte & Associates Ltd	Whyte: Noel;	684-9894
25	NWC Bevin Road	Scarlet: Trevor;	940-4447
26	NWC Bogue	Patterson: Nadine;	952-1640
27	Ocean Pines	Smith: Belva;	979-8169
28	Port Handlers Ltd.	Bowen: Anthony;	979-8143
29	Power Trac	Johnson: Olivine;	953-6287
30	Professional Axxe	Malacara: Paul;	684-9536-7
31	Resident of The Lagoons	Delapenha: Nicole;	684-9536-7
32	Sea Winds On The Bay & Commodore Montego Bay Yacht Club	Harrington: Evelyn;	979-8399
33	Shopsmart	Mirpuri: Deepak;	953-6045(fax)
34	Stirling Wharf	Delisser: Dianna;	952-5173
35	Sunset Beach Resort	Bloomfield: Evat Mr.;	979-8800
36	Sunset Beach Resorts	Campbell: Marion;	979-8800
37	Texaco Service Center	Azan: Nahoud;	979-8111
38	The Logoons	Chung: Racquel;	684-9317-8
39	Vista Print Jamaica Ltd.	Robinson: Phillipa;	979-8851
40	Youth With A Mission	Jacobs: Ms.;	309-5101
41	Youth With A Mission	Landis: Mr. & Mrs;	309-5101

APPENDIX 5. COPY OF LETTER FROM NATIONAL WATER COMMISSION CONFIRMING PROVISION OF WATER SUPPLY TO SEAWIND RESORT SITE.



NATIONAL WATER COMMISSION

Water is life

28-48 Barbados Avenue
P.O. Box 65, Kingston 5
Tel: (876) 929-5430-5
Fax: (876) 926-1329

18 Oxford Road
Kingston 5
Tel: (876) 926-5825-7
Fax: (876) 926-7121

4 Marescaux Road
Kingston 5
Tel: (876) 926-3540-5
Fax: (876) 960-0582

2a Montague Road
Kingston 5
Tel: (876) 929-3540-5
Fax: (876) 968-8249

231A Old Hope Road
Kingston 6
Tel: (876) 977-4998
977-5000
Fax: (876) 927-1870

28-30 Church Street
Kingston
Tel: (876) 922-8110-8
Fax: (876) 967-1499

FAXED
DATE 11/7/06

July 11, 2006

Mr. David Goldson
Civil/ Structural Engineer
Hue Lyew Chin Engineering Limited, Consulting Engineers
22 Trafalgar Road
Kingston 10

RE: **PROPOSED HOTEL DEVELOPMENT**
Sunset Beach - Seawind Key, Montego Freeport – ST. JAMES
NWC REF. No. 0405/06

We acknowledge receipt of your letter dated May 20, 2006 requesting that the National Water Commission (NWC) provide potable water supply and sewage disposal services for the captioned consisting of seven hundred (700) rooms. Please be advised that whereas the NWC has water and wastewater services in the area to facilitate this proposed development, the infrastructure will have to be upgraded at the developer's expense.

Before we can be in a position to advise you further, you need to submit a formal application as per the attached list for our perusal and approval. Upon receipt of this information the NWC will proceed to review the submission and advise you as it relates to the provision of said services.

We trust the information provide will assist.

Yours truly,
NATIONAL WATER COMMISSION

Ian Bennett
Manager, Engineering Design

Attachments

Copy: Mr. Franklin Williams, Chief Engineer (Senior Vice President) – NWC
Mrs. Florence Logan, Vice President, Western Division – NWC
Mr. Ajaykumar Vijayan, Manager, Technical Services, Western Division – NWC
Mr. Mark Barnett, Area Manager, St. James/ Trelawny – NWC

APPENDIX 6. COPY OF LETTER FROM JAMAICA PUBLIC SERVICE CO. LTD. CONFIRMING SUPPLY OF ELECTRICAL POWER TO

JAN-26-2007 10:50 PM P.01

Jamaica Public Service Company Limited
CHANGING LIVES WITH OUR ENERGY
6 Knutsford Boulevard, Kingston Jamaica, W.I.
Telephone: (876) 926-3190-9 Fax: (876) 511-2167
Website: www.jpsco.com

Please direct your reply to:-
P O Box 348, Montego Bay

January 24, 2007

Mr. Michael McMorris
Seawind Key Investments
10a Chelsea Avenue
KINGSTON

Dear Sir:

Re: Power Supply – Secrets Resort, Montego Bay, Freeport, Montego Bay

Reference is made to your electronic mail to Miss Serena Lue on January 10, 2007.

You requested that JPS provide you with a letter confirming availability of capacity to supply the required electricity to the captioned entity. The required power capacity was established to be 500 KVA in another e-mail from you.

Our engineers visited the location and have determined that JPS can provide the requested power supply. This provision would necessitate an extension of the existing 24 KV, 3 Phase, primary system and the installation of the appropriate transformer.

We are currently in the process of estimating the cost for such works and will provide you with a quotation as soon as possible.

Yours truly,
JAMAICA PUBLIC SERVICE COMPANY, LIMITED

SANE FACEY (MR.)
CUSTOMER CARE MANAGER
ST. JAMES

APPENDIX 7. COPY OF LETTER FROM NATIONAL SOLID WASTE MANAGEMENT AUTHORITY SPECIFYING DESIGNATED SITE TO BE USED FOR SOLID WASTE REMOVED FROM SEAWIND RESORT SITE.

(To be provided by NSWMA)