Environmental Impact Assessment

NEGRIL PENINSULA RESORT

WEDDERBURNS, WEST END, NEGRIL, WESTMORELAND.

Prepared for: Negril Peninsula Resorts Ltd

Prepared by: S.P.K. ENGINEERS LTD

Civil and Environmental Engineers

15 University Crescent

Kingston 5

Telephone: ***(876) 319 7220***

(876) 927 2709

Email: spkengineers@gmail.com david.walker@negrilpeninsula.com

March 2007

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0.1 Introduction

Working closely and sympathetically with the natural beauty and unique topography of this location, Wedderburns will be gently crafted to create an outstanding mixed use Eco-Tourism resort.

The design approach will respond to the need for planned, sustainable development and recourse to Architecture that applauds the creativity and great tradition of building in a “Jamaican vernacular”.

Operated on a fully serviced basis, resort residences will be constructed using indigenous and natural materials to give the impression of simplicity and organic assimilation within the setting, in so doing, promoting a sense of wellbeing and a holistic ecological balance.

Extending what has become affectionately known as ‘West End Life’, this new destination on the edge of the established resort town of Negril, will provide new beaches and a beach hotel, a marina, two further boutique hotels, which are set within their own oases of calm and offering breathtaking views from two of Wedderburns unique elevated escarpments. A number of carefully planned villas are proposed to be built around locally organized, quiet, spacious hamlets and importantly, all of this will be underpinned by leisure, health, community, civic and upscale commercial spaces.
Whilst exciting in any of its proposed phases, the development of the Negril Peninsula Resort project will be a signpost for responsible growth

and concern for the social and economic welfare of our people and Island Life – our 'real' assets.

The fruition of the Negril Peninsula Resort project will depend largely on the conceptualization and implementation of the technical aspects of the project in such a manner so as to provide the most economically effective solutions.

With the use of technical personnel who are experienced in their fields of endeavour, this document represents the information required for submission to the relevant approving agencies.

In order to comply with the environmental legislation of Jamaica, Negril Peninsula Resorts Limited has contracted the services of SPK Engineers Limited to conduct the EIA, and prepare an EIA report specific to Terms of Reference to be approved by NEPA. The approved Terms of Reference which are included in Appendix 1.

0.2 Executive Summary

The accompanying documents and plans set out the proposal of Negril Peninsula Resort Limited for the development of an Eco-Tourism Resort on the area of land situated deep in the west end of Negril, beyond the Lighthouse and known as Wedderburns, part of Retreat Estate on the Negril Peninsula.
The details will serve to illustrate how its approach will carefully generate a development of significant importance to the economy of Negril and to

the Parish of Westmoreland, setting a new tone and standard for future development.

Working closely and sympathetically with the natural beauty and unique topography of this location and extending what has become affectionately known as ”West End Life”, this New World Destination, on the edge of the established resort town of Negril, will provide a Sustainable Ecologically Friendly, Mixed use Scheme comprising of a Marina, Beaches, Shopping Mall, a Medical Center and a Security Station,1202 Dwellings ranging from Luxury Villas to sea view Condos, Duplexes and a broad range of Apartments. The scheme also includes a Beach Hotel, Spa Hotel, Equestrian Hotel, Retail Outlets, Offices, Restaurants and Municipal Buildings, along with Park Lands and an Amphitheatre for public events.

Set within its own oasis of calm offering breath taking views, Negril Peninsula Resorts unique location will be a locally organized quiet development, with spacious hamlets and importantly, all underpinned by civic, leisure and health facilities, that work in harmony with the community.

The design approach will respond to the need for a planned, sustainable development and recourse to Architecture that applauds the great tradition of building in a “Jamaican Vernacular”.

Operated on a fully serviced basis, resort residences will be constructed using indigenous and natural materials, to give the impression of simplicity and organic assimilation within the setting, and in doing so, promoting a sense of wellbeing and holistic, ecological balance.

Whilst exciting in any of the proposed phases, the development of Negril Peninsula Resort will be a signpost for responsible development with

concern for the socio-economic welfare of our people and Island life- our "Real" asset.

0.3 ENVIRONMENTAL IMPACT ASSESSMENT

0.3.1 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 West End Negril and other potentially affected areas. This allows, where possible, for appropriate mitigation measures to be identified and presented, which 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.

0.3.2 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 Secret Paradise, Westender Inn, and Jackie's on the Reef and fringing coral reef and inshore waters. The town of Negril, along the Whitehall to Orange Hill corridor 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 Appendix II.

0.3.3 Study team

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

◊ Garfield Haughton, M.Sc. - Principal Consultant; Environment, Water & EIA Specialist – Team Leader

◊ Paula Hurlock, M.A. – Geologist

◊ Peter Wilson, M.A. – Marine Biologist

◊ Sherman Cogle. - Environmental Management (Eco-system)

◊ Bertram Bennett, B.Sc. – Botanist (Ornithology)

◊ Howard Prendergast, M.Sc. – Hydro-geologist

0.3.4 Methodology

0.3.4.1 Initial stakeholder consultations

At the outset of the project, a public consultation was held at the Westender Inn in West End Negril on the 15th of December where the project was outlined. A list of attendees can be seen in Appendix III, along with a copy of the brochure that was given to all participants. Responses were also solicited in the form of a questionnaire survey undertaken on the 30th-31st of October 2006.

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, Negril/Green Island Local Area Planning Authority, National Solid Waste Management Authority, Water Resources Authority, The Office of Disaster Preparedness & Emergency Management, Wesmoreland Parish Council and National Water Commission. The recommendations received have been adopted in this EIA and site plans have been revised accordingly where required, for example the inclusion now of an on site sewage treatment plant which has been incorporated on new site plans contained in Appendix XV.

0.3.4.2 Vegetation Survey

The survey concluded that there were several important plant species one being rare but with a careful and planned development there is no reason why these can not be retained in situ, replanted elsewhere on site or moved to another area. Specimen trees should be retained as much as possible these will be tagged and protected.

0.3.4.3 Birds and Butterflies

Survey concluded that although there were several endemic species there were no endangered ones.

0.3.4.3.1. Method of Butterfly Survey

Spotting teams visited the site on several occasions during the particular part of the day when butterflies are most active.

0.3.4.3.2. Method of Bird Survey

Spotting teams visited the site on several occasions during the mornings and evenings when birds are most active and both site check and call checked the different species.

0.3.4.4 Inshore marine habitats

Assessments of the shallow marine habitats began in December 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 were used for ground-truthing and field interpretation to produce the final benthic distribution map. 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. The existing locations of live corals and reefs were readily visible from these locations and the data gathered by these land observations were supplemented by observations made while walking through the shallow areas (<1.2m). Details of rubble, pavement and live coral 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 January 2007 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 snorkeling during which the sizes of corals were measured using a 1m graduated PVC

scale-bar. Larger specimens and species of note were photographed with a 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 coast were done both on foot from shore in shallow water, using polarized glasses and during dives for greater depths. Faunal assessments were made from these observations.
Detailed assessments concentrated on, the habitats most likely to be affected by coastal modification and operation of the fully developed resort.

0.3.4.4.1 Corals

Coral diversity and abundance counts were done during large coral mapping exercises in February and March of 2007 using a semi-random mask & snorkel swim technique with particular attention paid to reef areas. Corals observed during this and other exercises within this project are also included.
Species and counts were recorded on the mapping slate.

0.3.4.4.2 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 or other particular habitat. Fishes observed with polarized glasses during

walking and diving assessments of seagrass were also included. Species and counts were recorded on the mapping slate.

0.3.4.5 Marine water quality

Following an initial reconnaissance of the site, a water quality survey was carried out on 23rd February, 2007. 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.

Two sampling stations were selected in the coastal zone based on their location relative to existing developments and probable surface discharge points, as well to reflect potential impacts related to the proposed resort development.

Salinity, conductivity, temperature, and dissolved oxygen were measured *in situ* at the two positions using a Salinity/Conductivity/Temperature (SCT) meter and 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

◊ BOD5

◊ Fats, oil and grease

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

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

0.3.4.6 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, telecommunication, electricity other utilities
- waste water management
- 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 III. Data gathering included document review.

0.3.4.7 Hydro-geological Study

0.3.4.7.1 Baseline Environmental

Baseline environmental conditions within the proposed project area were established through data generated from actual site investigations and a review of available literature.

0.3.4.7.2 Baseline Data Collection

Field and office visits were made to procure baseline data and information including:

- Topographic, geologic and soil maps of the area
- Rainfall, stream flow and other hydro-geologic data.

The proposed project area was delineated on topographic maps of scales 1:5000 and 1:2500 and also on geology and soil maps. This along with information obtained from field visits, aerial photographs and literature reviews, enabled a hydrological description of the drainage area(s) encroached by the development.

0.4.3.7.3 Design Approach

Run-off impacts Assessment

The run-off impact assessment entails a determination of the pre-development run-off from each of the project drainage (sub-drainage) area for different return periods (2, 5, 10, 25, 50 and 100 years) and a post development run-off for the same return periods. Given the existing physical conditions and the size of each sub-drainage areas, the Rational Formula was used for the calculation of run-off or peak discharge.

For convenience the proposed development area is divided into three (3) main drainage areas:

- Drainage Area 1: upper "shelf"
- Drainage area 2: lower shelf
- Drainage Area 3: This includes low lying coastal lands.

The proposed drainage system will be designed for two flood conditions which are selected based on convenience, acceptable level of flooding and cost for carrying out the works. Drainage designs will be in accordance with the criteria approved by the Ministry of Transport and Works/National Works Agency.

The design of the major systems is simple, to provide for major storm events of 50yr – 100 year return period. The design of the minor (local) systems considers adequate drainage for more frequent rainfall events (2-10yrs return period)

0.4.1 Project Description

The proposed development site is on Wedderburns Retreat Estate, West End, Negril, Westmoreland. There is frontage to the Caribbean Sea to the South, consisting of nine hundred and fifty five (955) lineal meters. To the West lies "Secret Paradise" a new resort Hotel currently under construction on the coast line frontage. A number of other landowners are on the Western boundary, consisting of mainly uninhabited shrub type land. To the East of the site lies "Jackie's on the reef", a new age spa and the "PitKelleney" sub division and to the North there are a number of land owners, with mainly uninhabited, heavily vegetated properties leading to the Mount Airy establishments.

It is proposed to develop an Eco-Tourism Resort on approximately three hundred and sixty one (361) acres, although several areas of existing rock formation and vegetation will be left for wildlife and human pleasure. The development will be mixed used and will provide 6,228 habitable rooms from the three (3) planned hotel complexes on the development and the one thousand two hundred and two (1,202) various types of residential buildings, consisting of apartments, condo's, villa's and houses, all ranging from one (1) to three (3) storey in height.

A full and updated accommodation schedule is illustrated in figure **0.4.1.1** with a site layout shown in figure **0.4.1.2**

6.0 Schedule of Accomodation 26-Mar-07

HOUSE TYPE	NUMBER OF DWELLINGS/ BUILDINGS	HABITABLE ROOMS PER DWELLING/ BUILDING	TOTAL HABITABLE ROOMS	RESIDENTIAL NIA COMMERCIAL GEA PER DWELLING/ BUILDING M2	FT2	TOTAL RESID ENTIAL NIA O R TOTAL COMM ERCIAL GEA M2	FT2
PHASE 1							
Cliff house C+E	14	3	42	67.5	726	945	10,164
Cliff house C+2E	21	3	63	67.5	726	1,418	15,246
Villa 2M	46	7	322	271.4	2,921	12,484	134,366
Villa 3M	66	7	462	271.4	2,921	17,912	192,786
House 2G	12	4	48	90.7	977	1,088	11,724
Penthouse Apts over commercial	82	4	328	112.0	1,214	9,184	99,548
Marina Apts	120	5	600	104.2	1,122	12,504	134,640
Apts over retail BLDG`s C,D,E,F,G TYPE A	57	2	114	60.8	655	3,466	37,335
Apts over retail BLDG C TYPE B	2	2	4	74.7	804	149	1,608
Apts over retail BLDG`s D,F TYPE B	4	2	8	68.8	741	275	2,964
Apts over retail BLDG E TYPE B	4	2	8	69.3	746	277	2,984
Apts over retail BLDG G TYPE B	4	2	8	58.2	626	233	2,504
Apts over retail BLDG C TYPE C	2	2	4	71.4	769	143	1,538
Apts over retail BLDG`s D,F TYPE C	4	2	8	66.3	714	265	2,856
Apts over retail BLDG`s F TYPE D	4	3	12	69.3	746	277	2,984
Beach Hotel	1	92	92	5,726.1	61,635	5,726	61,635
Beach Hotel serviced apartments 3 storey	30	4	120	106.2	1,143	3,186	34,290
Beach Hotel serviced apartments 2 storey	4	4	16	106.2	1,143	425	4,572
Commercial Building A	1	0	0	4,500	48,438	4,500	48,438
Commercial Building B	1	0	0	4,032	43,401	4,032	43,401
Commercial Building C	1	0	0	3,469	37,340	3,469	37,340
Commercial Building D	1	0	0	3,378	36,364	3,378	36,364
Commercial Building E	1	0	0	7,863	84,636	7,863	84,636
Commercial Building F	1	0	0	3,034	32,654	3,034	32,654
Commercial Building G	1	0	0	5,700	61,354	5,700	61,354
Commercial Building H	1	0	0	6,586	70,887	6,586	70,887
Commercial Building J	1	0	0	1,359	14,625	1,359	14,625
Commercial Building K	1	0	0	6,486	69,814	6,486	69,814
Commercial Building L	1	0	0	12,045	129,650	12,045	129,650
Commercial Building M	1	0	0	9,155	98,544	9,155	98,544
Commercial Building N	1	0	0	14,935	160,754	14,935	160,754
Commercial Building O	1	0	0	11,758	126,566	11,758	126,566
Marina Building A	3	0	0	1,081	11,632	3,242	34,896
Marina Building B	1	0	0	1,391	14,976	1,391	14,976
Medical/Police Centre	1	0	0	5,904	63,549	5,904	63,549
PHASE 2							
Villa M	27	7	189	271.4	2,921	7,328	78,867
Villa 2M	100	7	700	271.4	2,921	27,140	292,100
House 2G	210	4	840	90.7	977	19,047	205,170
House 2I	56	4	224	138.0	1,486	7,728	83,216
Spa Hotel Building A	1	0	0	1,541	16,593	1,541	16,593
Spa Hotel Building B	1	0	0	3,369	36,264	3,369	36,264
Spa Hotel serviced apartments C	12	6	72	310.8	3,345	3,730	40,140
Spa Hotel serviced apartments D	6	5	30	234.2	2,521	1,405	15,126
PHASE 3							
Villa M	18	7	126	271.4	2,921	4,885	52,578
Villa 2M	72	7	504	271.4	2,921	19,541	210,312
House G	1	4	4	90.7	977	91	977
House 2G	180	4	720	90.7	977	16,326	175,860
House I	6	4	24	138.0	1,486	828	8,916
House 2I	90	4	360	138.0	1,486	12,420	133,740
Equestrian Hotel	1	92	92	5,726	61,635	5,726	61,635
Equestrian Hotel serviced apartments	2	2/3	84	5,993	64,506	11,986	129,012
PHASE 4							
Municple Biulding A	4	0	0	6,161.4	66,321	24,646	265,284
Municple Biulding B	2	0	0	4,194	45,144	8,388	90,288
Municple Biulding C	1	0	0	3,658.2	39,376	3,658	39,376
Municple Biulding D	2	0	0	3,231	34,773	6,461	69,546
TOTALS	1,288		6,228			361,038	3,887,192

TOTAL RESIDENTIAL NIA AREA	1,894,983
TOTAL COMMERCIAL GEA AREA	1,992,209
GRAND TOTAL	3,887,192

Fig 0.4.1.1

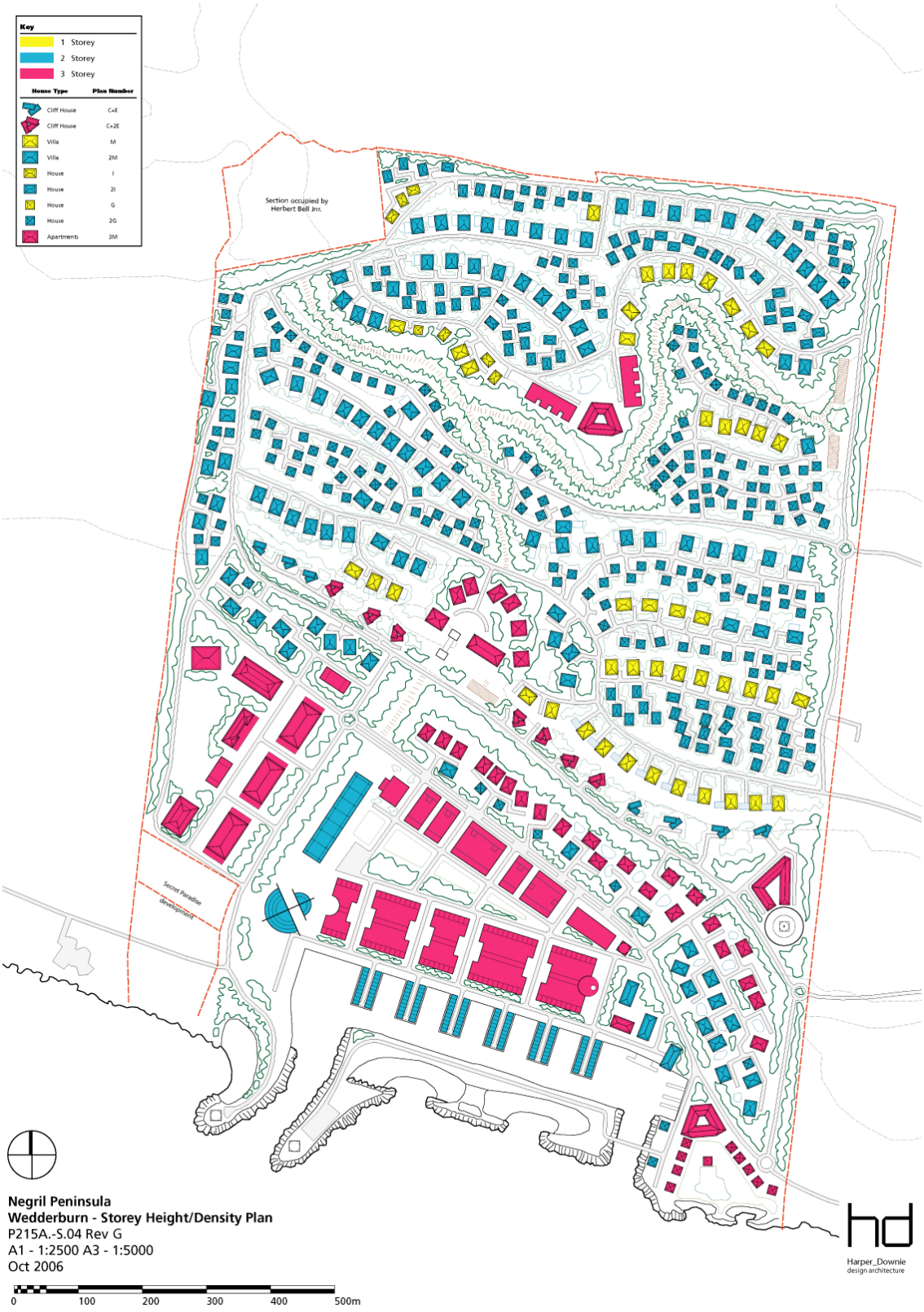

Key
1 Storey
2 Storey
3 Storey
House Type
Plan Number
Cliff House C+E
Cliff House C+2E
Villa M
Villa 2M
House I
House 2I
House G
House 2G
Apartments 3M
Section occupied by Herbert Bell Jnr.
Secret Paradise development
Negril Peninsula
Wedderburn - Storey Height/Density Plan
P215A.-S.04 Rev G
A1 - 1:2500 A3 - 1:5000
Oct 2006
0
100
200
300
400
500m
Harper_Downie
design architecture

Fig 0.4.1.2

The development will be constructed over an approximate five (5) year period, ideally as one continual operation; however it will take the form of four phases as shown in figure **0.4.1.3**

Figure **0.4.1.3**

These four phases will be stripped of vegetation in various subdivisions, thus not creating ecological problems which occur where large extents of land are stripped, such as soil erosion and landslides. These construction phases will also concentrate the construction process into smaller compact areas, which will be more manageable and less impact to the environment and the small amount of surrounding residents.

The first construction works to be commenced will be in phases 4, shown in figure 0.4.1.3 obviously though the municipal and support buildings planned for this area will be the very last to be built. This area however will be first cleared and set up for all of the necessary construction overhead preliminary items such as, compound containers, offices, toilets, mess rooms and storage handling areas. This area will be the central management control point for the whole of the proposed development. Once this is completed, work will be undertaken on phase 1, consisting of the construction of the marina itself, which will accommodate one hundred and seventy (170) keeled yachts. Five (5) new beaches, a beach hotel complex, all of the commercial/ retail buildings with the apartments which sit above them, a market square, an amphitheatre, the basement car parking, the medical/police station and one hundred and fifty nine (159) residential units, along with all the necessary infrastructure that is required.

This first phase will instantly set the scene and ambiance of the development, with phase's 2 and 3 following after on the elevated lands above this lower phase basin area.

Phase 2 will consist of a hotel complex and 393 residential units with phase 4 being a further hotel and 367 residential units.

The residential buildings will have various external elevations and the use of different materials will add variety to the number of similar layouts, thus ensuring a small and intimate residential area. The retention of various existing bush land, trees and vegetation will be enhanced throughout the development with the planting of local plants and trees that are indigenous to the area and large existing specimen trees and vegetation (especially plants used by butterflies) will be retained throughout the whole of the site, in the largest numbers possible, to retain the wildlife and ambience of the area.

For sustainability of the development the developers from the start of the project have employed architects and environmental consultants in the planning and design stages. They have created a development presently unrivalled any where in the region, with not only hotels and residential units but commercial, offices, retail outlets, restaurants, sports and leisure facilities, which is very much needed within the area.

0.4.2 Environmental Perspective

It is a requirement of the Outline Planning Application to assess the impact on the environment of the project therefore this EIA report assesses the impact of the proposed Negril Peninsula Resort on the built and natural environment of the Wedderburns area including the Physical Environment,

Biological, Marine, Water, Sewage, Potential Environmental Impact, Disaster Vulnerability, Mitigation Methods, Disaster Mitigation, Monitoring and Management.

As a part of this summary, the key conclusions of the EIA Report will be listed below for quick and easy reference.

This Environmental Impact Assessment (EIA) study has been prepared consistent with the Terms of Reference (TOR) as set out in Appendix 1.

0.4.3 EIA Conclusions

0.4.3.1 Physical Environment

The Negril Peninsula Resort Development is located beyond the Lighthouse in West End, Negril, in the parish of Westmoreland. The project site is characterized by a wide lower coastal basin. The sea at this point, is at depths adequate for the passage of medium sized ocean-going vehicles. The land stretching back towards a cliff-feature demarks the extent of the lower coastal basin.

Above the cliff escarpment, which runs east to west across the site, there is elevated terrain with terraces and escarpments, which will provide obvious zones for accommodation and tourism activities. The shoreline is primarily composed of an iron shoreline with varying size coral rocks and two small sandy areas.

The coastal basin consists of bare rocks along the shoreline and sand loam overburden of up to 1000 millimeters in other areas.

The Cliff feature on the site is very pronounced towards the center of the basin area. The cliff varies in height and steepness, growing from gentle gradients on the west side to buttresses projecting back and forward in the middle of the site and again tapers and lessens in steepness towards the eastern side of the site.
Above the escarpment, there are hard rock outcrops with areas of honeycombed Yellow Limestone and sections with sandy loam and clay soil overburden.
The site is geologically stable and suitable for development.

0.4.3.2 Flora and Fauna

Avifauna is often used as an indicator of the environmental activities associated with an area. During various surveys taken, no species which were endangered were observed. Another indicator of biological/environmental activity is the vegetation that is in place. One endangered species was seen. However nothing of biological value would be lost with a careful and planned development of the site (which is detailed later in this report).

0.4.3.3 Sewage

The non-availability of sewage disposal capacity in a municipal sewage treatment works provides the opportunity to construct a central sewage treatment system on-site, to treat the sewage to the standards as required by the monitoring agencies and discharge it in a manner acceptable to the relevant bodies.

The internal collection system will consist of pipes of 200, 250 & 300 millimeters in diameter and six (6) pumping station. This will transport the sewage to a multi-moduled treatment facility and further discharge of the treated effluent through a marine outfall to deep sea. This will be further described below.

A letter from NWC confirming they have the capacity to refine the slurry from the onsite sewage treatment works is contained in appendix XIII

The non-availability of sewage disposal capacity in a municipal sewage treatment works provides the opportunity to construct a central sewage treatment system on-site, to treat the sewage to the standards as required by the monitoring agencies and discharge it in a manner acceptable to the relevant bodies.

0.4.3.3.1 Treatment Standards

In order to be able to discharge sewage effluent into the environment, the following standards must be met and exceeded:

- Biological Oxygen Demand 20 mg/l
- Total Suspended Solids 20 mg/l

- Phosphate 4 mg/l
- Nitrate 10 mg/l
- Faecal Coli form 200 MPN
- Chlorine Residue 0.3 mg/l

0.4.3.3.2 Treatment Options

There are a wide variety of systems available to be used. All systems are rated based on the following parameters:

- Footprint
- Degree of control
- Ability to meet the set standards
- Construction cost
- Operational cost
- A minimum of two trains of treatment modules (for ease of operation and maintenance)

0.4.3.3.3 Treatment modules

The types of systems considered for use are:

- Stabilization ponds + Polishing lagoons
- Stabilization pond + Reed bed + Tile field
- Aerated lagoons + Polishing lagoons
- Activated sludge treatment
    1. Oxidation ditch + Polishing lagoon
    2. Oxidation ditch + Sand filter

3. Extended aeration + Sand filter
4. Rotating biological contactor + Sand Filter

NB

The following components are to be included regardless of the type of system selected:

- Grit chamber for grit removal
- Phosphate removal components
- Nitrate removal components
- Disinfection

0.4.3.3.3.1 Stabilization ponds, Aerated lagoons, Reed beds

These types of treatment modules have the following parameters:

- Large footprints
- High land cost
- Low levels of treatment control
- Low construction cost
- Low operation cost
- Lower skill level for operators

0.4.3.3.3.2 Tile field

- This module is usually used mainly as a disposal unit.
- The depth of ground water militates against the use of this module.

0.4.3.3.3.3 Oxidation ditch

This module has the following attributes:

- Small footprint
- Large construction cost
- Electricity usage
- Large operation expense
- Large maintenance expense
- Sludge drying and storage facility needed
- Trained operators needed
- Nitrate removal possible within the ditch

0.4.3.3.3.4 Rotating Biological Contactor

This module has the following attributes:

- Very small footprint
- May be constructed below ground level
- High capital cost
- Electricity usage
- Large operational expense
- Large maintenance expense
- Great process control
- Trained operators needed
- Nitrate removal possible within the module

0.4.3.3.3.5 Extended aeration

This module has the following attributes:

- Small footprint
- High capital cost
- High electricity usage
- Large operational expense
- Large maintenance expense
- Great process control
- Trained operators needed
- Nitrate removal possible within the module
- Very low sludge removal

0.4.3.3.4 Treatment module choice

Stabilization ponds, aerated lagoons, reed beds and tile fields will not be considered because of their large footprint.
Oxidation ditch system produces sludge in the quantities which need sludge drying and storage components. Sludge storage onsite is unacceptable because of the flies and malodors being generated
Rotating Biological Contactors require high capital input with most components being imported and as a result will not be used.
Extended aeration system will be used because of its high level of controllability, its high degree of treatment and production of small amounts of sludge which can be easily disposed of via cesspool emptying facility.

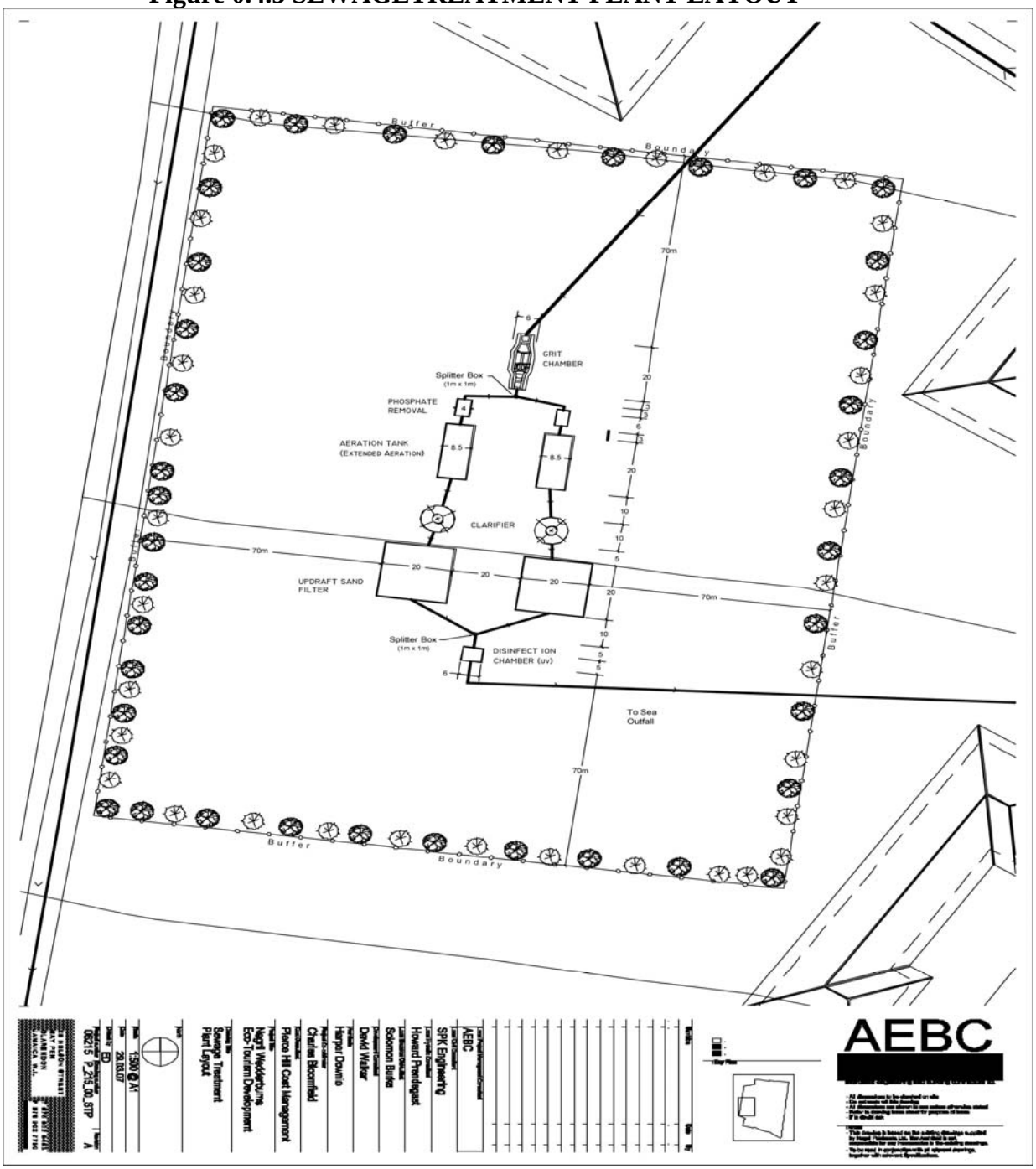
The negative aspects will include:

- High electricity usage
- Trained personnel needed

0.4.3.3.5 Treatment modules

1. Grit Chamber
2. Phosphate removal
3. Extended aeration tank
4. Secondary clarifier
5. Updraft sand filter with an additional layer of activated coal
6. Ultra Violet disinfection system
7. Sea outfall

Figure 0.4.3 SEWAGETREATMENT PLANT LAYOUT



0.4.3.3.5.1 Sea Outfall

The need to discharge the treated effluent into the sea means care must be taken to ensure the following:

- The effluent being discharged is properly treated and disinfected.
- The discharge extends approximately 600 meters from the shoreline and approximately 350 meters beyond the reefs.
- To prevent the 'blooming' of the effluent and to facilitate proper dilution of the discharged effluent, special boots will be placed on the end of the pipes.
- The pipes will be at a minimum depth of 30 meters.

0.4.3.3.6 Internal Collection Conveyance System

The internal collection system will consist of pipes of 200, 250 & 300 millimeters in diameter and six (6) pumping station. This will transport the sewage to a multi-module treatment facility and further discharge of the treated effluent through a marine outfall to deep sea. This will be further described in chapter 4 under the heading of Sewage Treatment**.**

0.4.3.4 Potable Water

This vital resource will be supplied by the National water Commission via its municipal water network. It is envisaged that there will be two connections:

1. In the vicinity of the Lighthouse via a 200 millimeter diameter pressure pipe and all the relevant appurtenances.

2. By way of a 200 millimeter diameter pressure pipe and all the relevant appurtenances from the Orange Hill Road.

The internal system will consist of three storage tanks with a total capacity of 650 000 imperial gallons and distribution pipes of sizes ranging from 75 – 200 millimeter in diameter and lateral connections.
A letter from NWC is enclosed in Appendix IX stating they can supply the development with all its water requirements

0.4.3.5 Marine and Beach Modification

The construction of the proposed marina and various beach inlets along the coast is considered to be a main centre point of the development with the offering of mooring for in excess of one hundred and seventy boats of varying sizes in the marina. This will see the dredging of part of the off-shore area to provide access along with the construction of groynes as a means of protection.
The environmental impact of such activities has been carefully examined and appropriate mitigating activities have been outlined.
In conclusion, the development of the marina will have no significantly negative or lasting consequences on the location or the environment and will provide a significant benefit.
There will be five beaches, of which the two smaller beaches would be reserved for the use of the guests of the Beach Hotel. The three larger beaches will be open to all members of the community.

The beaches will be cut into the shoreline, being constructed in such a manner, so as to encourage the depositing of sand by wave actions on the sandy area.
Some of these beaches will be protected by the groynes which are proposed for construction.
The construction of the beaches will have minimal negative impact on the environment, with the material removed being reused.
The construction of the beaches will have a positive effect on the environment and will make utile, an otherwise rocky landscape.
A copy of the completed Beach License Permit, letter to NEPA confirming notices posted and photographs of the posted public notices on the foreshore and the nearest public route way are contained in Appendix XIV.

0.4.3.6 Socio-economic Impact

The proposed development is located in an area which will have positive effects on the surrounding communities in the following ways:

- Improvement of the road and water infra structure
- Improvement of security with the construction of a Security Station
- Improvement in medical services with the construction of a medical centre
- Increase in the employment of skilled and unskilled workers during the construction period. It is estimated a generation of JA$250 million over the projected five (5) year construction period, which will go directly into the economy and the pockets of the workers of the Negril community.

- Approximately 2000 persons are estimated to be permanently employed at full activation of the project.
- Upgrade of roadways which will have a positive effect on all the residents along the Whitehall – Orange Hill corridor.
- An improvement of the water supply along the Whitehall – Orange Hill corridor.
- Increase in the need for lower to middle income housing and the satisfying of this need with the construction of additional housing on land identified.
- 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.
- 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

0.4.3.7 Potential Environmental Impact

1. There may be areas of localized flooding.
2. There is the possibility of storm surges onto the lower basin as a result of tsunamis and/or hurricanes..

0.4.3.7.1 Mitigation Measures

- The provision of a comprehensive storm water and flood control system will be implemented, with minimal run-off actually reaching the sea.
- Storm surges and tsunamis although not preventable can be mitigated against by the implementation of proper evacuation plans for the area of the lower basin unto the areas above the cliff face.
- Sewage generated will be treated at the central sewage treatment facility to be constructed on-site and further discharge of the effluent, after treatment to the standards as required by the various governmental monitoring agencies, through a marine outfall under one of the groynes for deep sea dispersal well beyond the area of the reef.
- Solid waste generated will be collected, sorted and transported the recycling centre in Negril and the municipal dump in Retirement, St. James (See Appendix X from NSWMA accepting this). The Recycling Centre in Negril, although operational will be reenergized.

0.4.3.7.2 Impact of activities on environment

All activities to be undertaken during the development and operation of the development will have some form of effect on the environment. The tables located in Chapter 8 set out most of these effects and directs to the location of the mitigating activities.

0.4.3.8 Car Parking

Serious considerations have been given to the provision of adequate car parking at the Negril Peninsula Resort, see car park schedule Appendix VII. All options of car parking have been considered and the option of basement parking has been selected for the following reasons:

0.4.3.8.1 Advantages

- Parked vehicles are out of sight, with less visual impact on the surrounding environment.
- Large open-space car parks and multi-storey car parks can attract crime and are more difficult to police than a basement car park with CCTV.
- Storm protection from flooding can be built into the design of the basement car park, to minimize the impact of adverse weather conditions.
- The stone material produced can be graded and utilized in the production of roads and other building operations, minimizing the need for large quantities of construction material having to be transported to site, through the current road network and therefore minimizing the effect of the development on the environment.
- Reduction of the impact of heavy duty vehicles on the current road network and the environment.

- As Negril Peninsula Resort becomes a destination, for certain events, a large influx of motor vehicle traffic can be expected. A basement car park of 2,161 spaces in this location will be available to deal with this traffic and minimize the effect of parking on the road network with the resultant benefit in terms of design and safety.
- Traffic management systems will be an integral part of the parking facility to control access and egress of traffic flows.
- The majority of vehicular parking is located in the shortest distance with easy access to facilities.
- Basement parking allows for better and more architecturally pleasing use of the built environment.
- A number of roads in the marina and shopping areas will be pedestrianised; the benefit will be separating pedestrian and vehicles.
- The protection of vehicles in adverse conditions.
- Reduction in construction traffic, moving material on and offsite,
- Making use of raw material, produced from construction activities for further construction.
- Vehicles in a basement car park are less likely to pose hazards to people at time of hurricanes and tsunamis.

It is likely that a basement car park will produce in the region of 152,424 cubic meters of material, made up of 15,242 cubic meters of good quality topsoil and 137,182 cubic meters of clean rock based material that will both be used on the development.

0.4.3.9 Hazard vulnerability:

The site is vulnerable to waves associated with ‘northers’ (cold fronts moving south from North America), hurricanes, storm surges, earthquakes and tsunamis. The storm surge analysis carried out for this project (2007) determined that a total water level increase of 3.5 m (11.67ft) could be expected.

0.4.3.9.1 Tropical weather systems

Tropical systems bring intense, short-medium duration rainfall events, and these may cause some degree of secondary flooding in Negril and its environs. The topography of the area precludes the possibility of major flooding.

0.4.3.9.2 “Northers”

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

0.4.3.9.3 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 0.4.3.9.1). Tropical cyclone activity has intensified over the past ten years and although 2006 was less active than predicted, it

is anticipated that this trend will continue with more frequent and intense hurricanes.

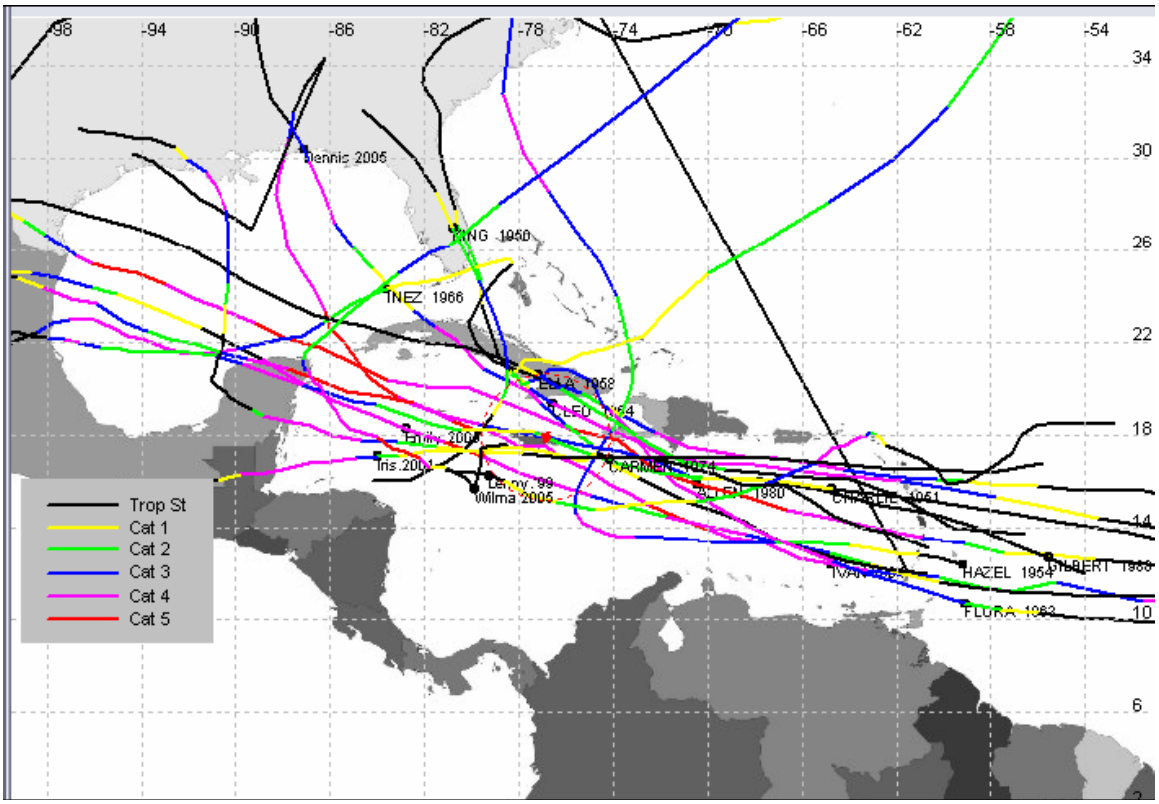


Figure 0.4.3.9.1 Hurricane tracks in the Caribbean (1950- 2005).

High velocity winds generated by hurricanes can exceed 160 miles per hour and have the capacity to cause significant damage (Table 0.4.3.9.1). West End Negril usually experiences wind from the south 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.

0.4.3.9.4 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 low lying area is therefore susceptible to inundation and accelerated erosion from increased wave action. Storm surge as a result of hurricanes several kilometers off the coast can also affect the coastline.

Table 0.4.3.9.1 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

0.4.3.9.5 Earthquake & Tsunami

Jamaica's coastline is particularly vulnerable to tsunami hazards because of its onshore and offshore geologic setting (Figure 0.4.3.9.3a). Both earthquake-initiated submarine landslides offshore the coast as well as sea floor displacement by fault movement can generate damaging tsunami along the Jamaican coast.

An unstable steep submarine slopes offshore 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 0.4.3.9.3b).

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 Negril'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 shoreline.

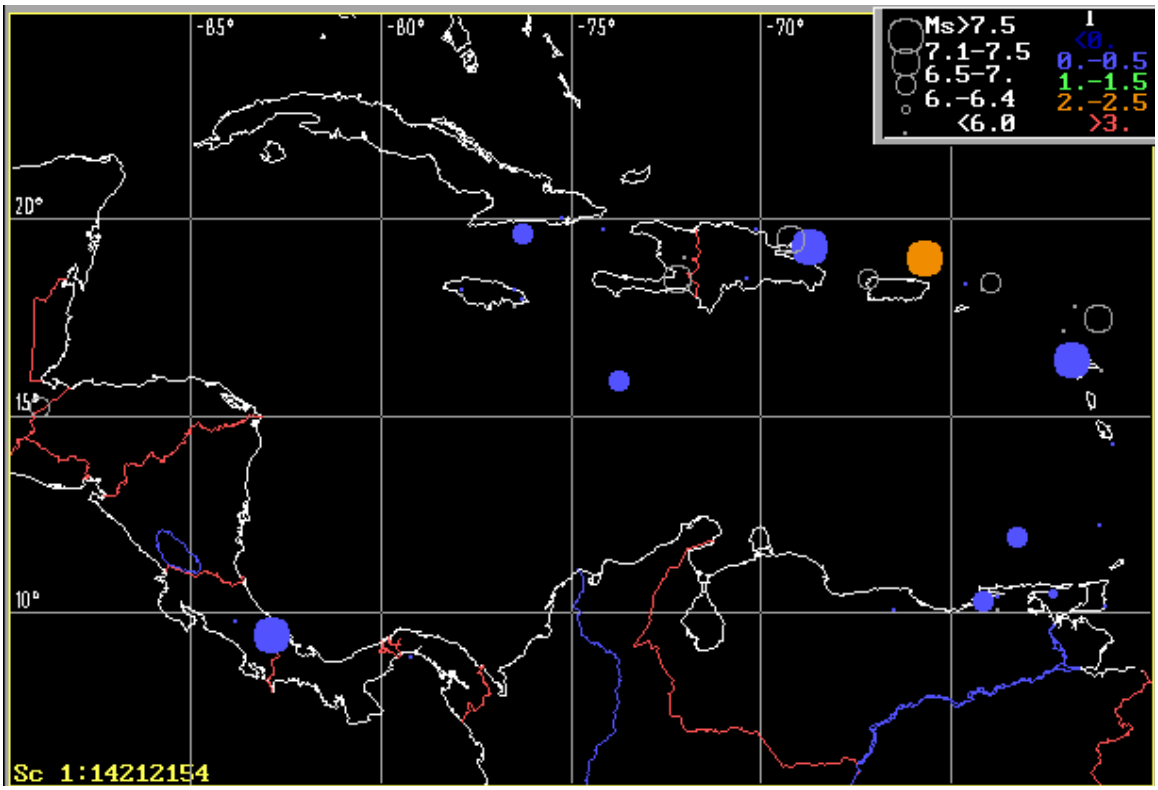
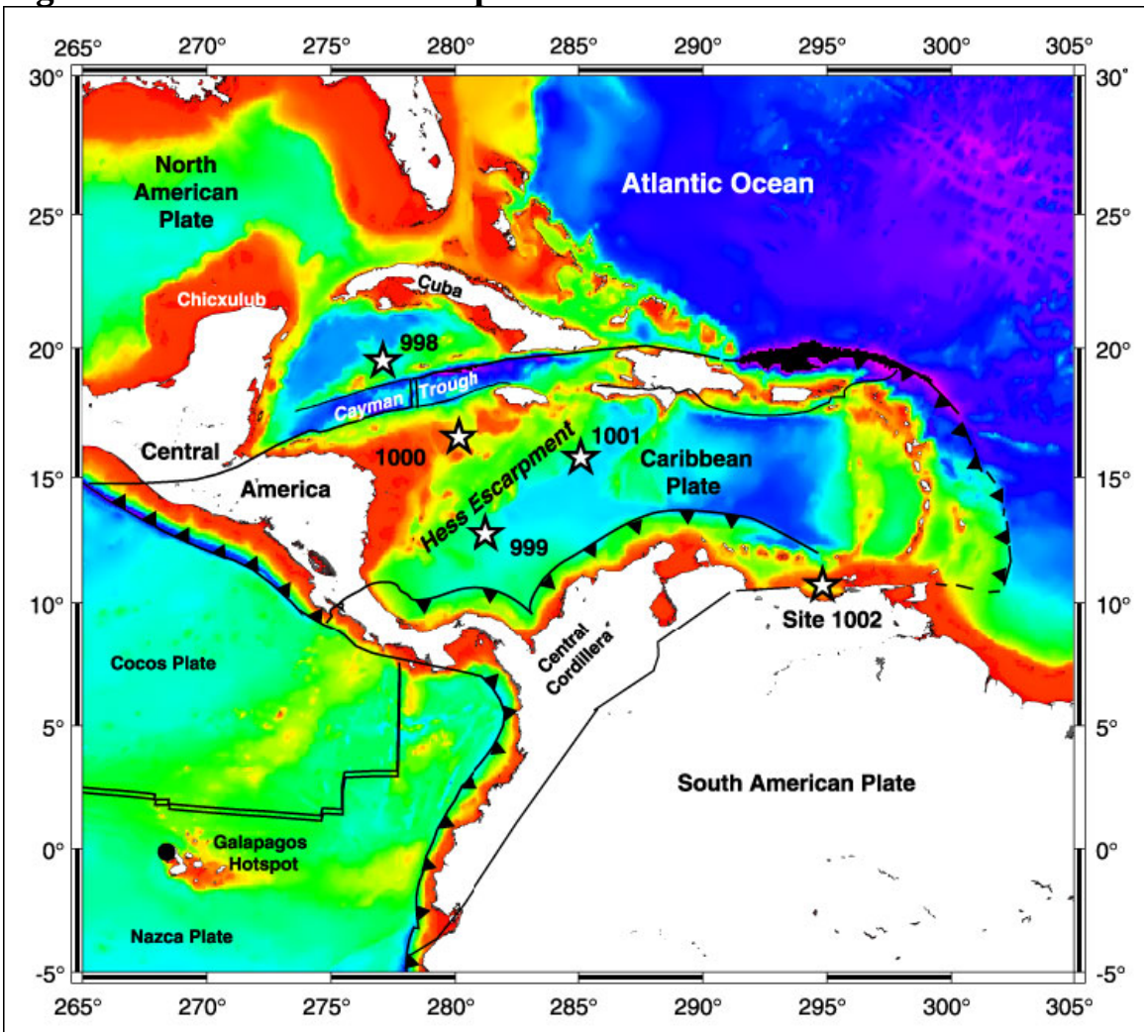


Figure 0.4.3.9.3a Historical tsunamigenic events in the Caribbean region.

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 0.4.3.9.3c).

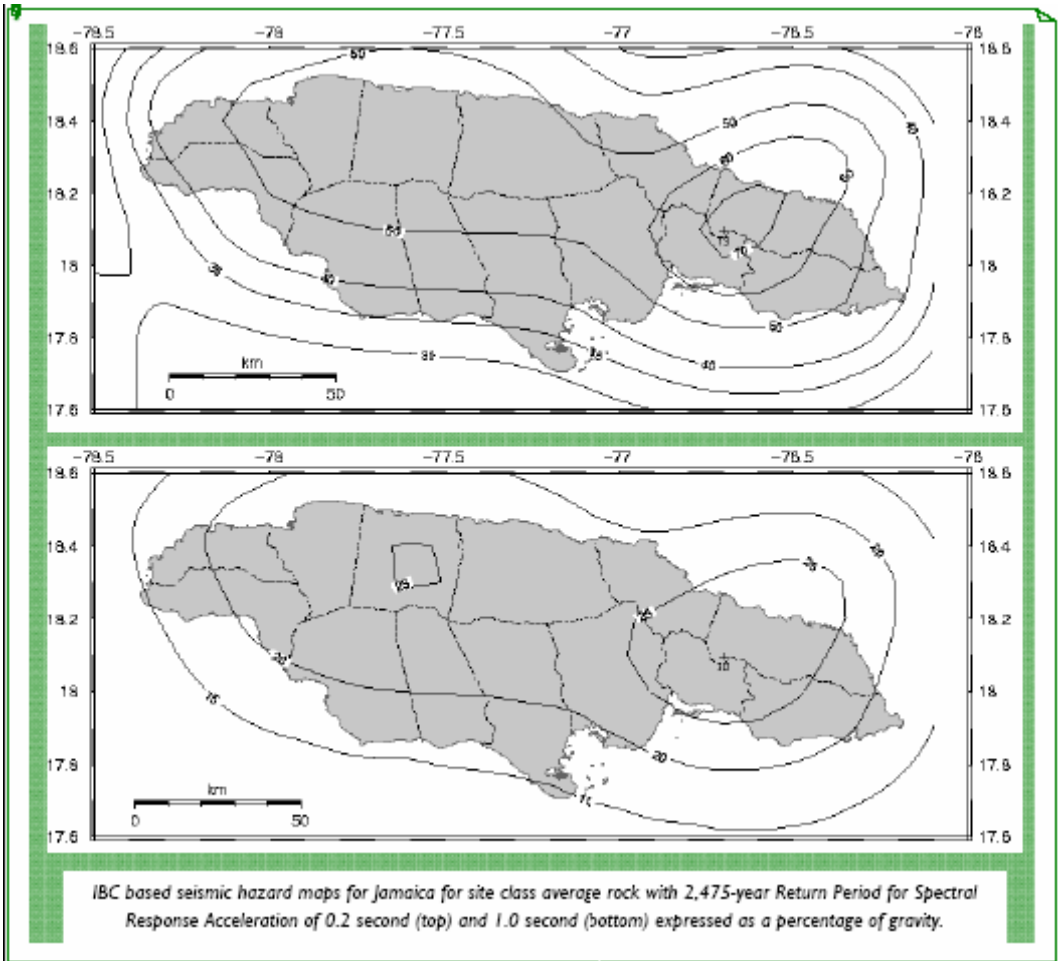
Figure 0.4.3.9.3b. Location of plate boundaries for the Caribbean.



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

0.4.3.9.6 Sea level rise

It is now fairly well established that the 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 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 Negril coastal zone and at a rate of 4.5 cm/yr, the Wedderburn coastal basin would be covered in less than 150 years.



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.

Figure 0.4.3.9.3c.

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)

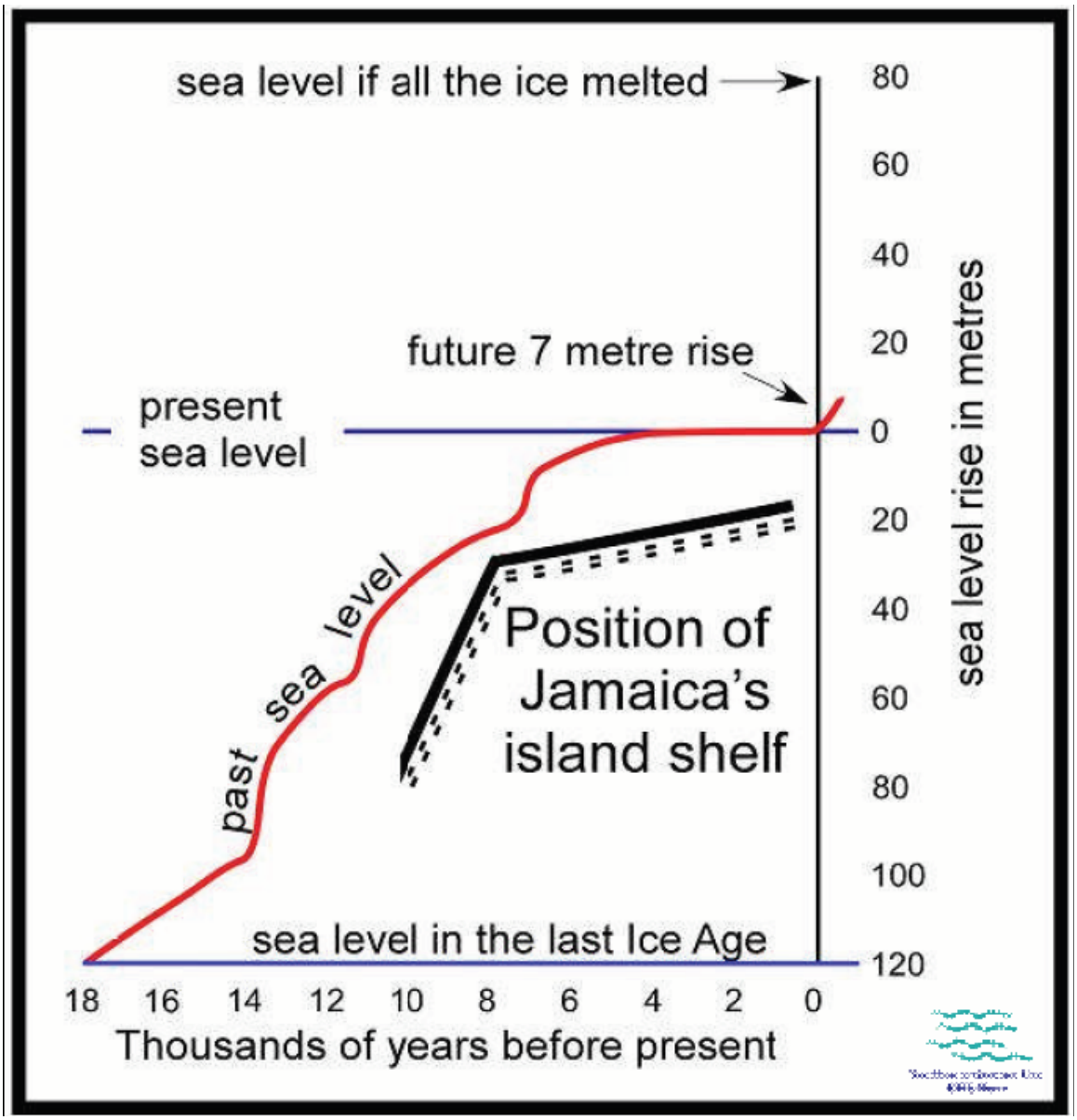


Figure 0.4.3.9.4.
A summary of the history of sea level rise into the near future.
(Source: "Will Sea Level Rise and drown Jamaica", Gleaner, November 25, 2006)

0.4.3.10 Coral Removal, Storage and Replanting

Construction of groynes as a part of the marina development will result in the need to remove and replant coral heads.
The manual option proposed for coral removal is described later in Chapter 3 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.

0.4.3.11 Groyne Construction

The construction of the groynes will be by use of large rocks and boulders put in place relatively quickly using excavators with a concrete armour over them.

0.4.3.12 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 pristine 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 in such an area so as to have minimum effect on the surrounding environment.

0.4.3.13 Land use zoning:

The project area is zoned for residential/resort use. The area is occupied in the south west by two hotels, Jackie's on the Reef and the Westender Inn and on the North east by a hotel now under construction known as Secret Paradise.

0.4.3.14 Other proposed projects nearby:

Secret Paradise development abuts the project and is under construction. Development of land in the Pitkeleny subdivision has been ongoing on the south eastern boundary of the subject site for a considerable period. Development has been predominantly high quality private residences and guest houses.

0.4.3.15 Environmentally sensitive areas:

The project area is situated within the boundaries of a Protected Area and as such great care must be exercised in carrying out any development activities in the area.

0.4.4 Project Alternatives

0.4.4.1 Eco-Tourism Resort or residential development

The development was conceptualized as a eco-tourism entity, encompassing all the positives the site has to offer. It is zoned for either tourism or residential with the principals seeking to maintain a long term interest in the development.
This being the case, residential development hold no interest to the principals, as these would be sold off and the principals would be unable to maintain a controlling interest in the site.
The economic prospects are also much greater with a greater degree of alternatives and combination available.
The concept of a "green" space could not be maintained if residential development were to take place.

0.4.4.2 'No Project' Scenario

This alternative implies that the site would be left in an undeveloped state. With no intervention, the site which has served as a cow pasture 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 the present owners of the site, it is likely that the absence of development would only mean continuation of the present use of the property, providing a pathway for persons on a southward journey and maybe a cow pasture again.

0.5 Policy, Legal and Administrative Framework

0.5.1 Applicable Environmental Legislation and Approvals

0.5.1.1 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 empowers 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 January 2007. On the basis of the review of that application, NEPA requested an environmental impact assessment of the project as communicated by letter dated 15th March 2007.

0.5.1.2 Parish Council

Under the Local Government legislation, the Westmoreland Parish Council has the legal right to examine the developments proposed for the parish, working in concert with the Town Planning Department (now part of NEPA). The Parish Council has to give approval for the construction of all developments.

It must be noted that the Parish Council's key responsibility is development control. This very important function serves not only as a guide but to shape and influence the pattern of development. As a result development proposals have to be sent to the local Parish Council for development approval.

0.5.1.3 National Water Commission.

The National Water Commission's chief portfolio responsibility in the land development process is to provide potable water and sewage services. Each proposal to develop land needs information and advice from the NWC as to the availability of the required services. The issue of sewage is important especially in the instance where the central system is being used. The NWC is also the body responsible to comment and advice (approve or disprove) sewage proposal put forward by the project proponents.

0.5.1.4 Water Resources Authority

The Water Resources Authority was established to ensure the proper use of ground and surface water. This agency comments on the proposed methods of sewage disposal in as much as it might have effects on the ground water.

0.5.1.5 Environmental Health Unit (Ministry of Health)

The Environmental Health Unit of the Ministry of Health also comments on the proposed methods of sewage disposal. The agency is concerned

about environmental degradation and human health, and ensures that sewage disposal systems are not designed to impact negatively on any of the two.

0.5.1.6 National Works Agency

The National Works Agency is concerned with the storm water drainage designs and road layout.

0.5.1.7 National Environment and Planning Agency

This Executive agency is the amalgamation of three agencies, the Town Planning Department, the Land Development and Utilization Committee and the Natural Resources and Conservation Authority. The National Environment and planning Agencies seeks to ensure that proposed developments do not have adverse negative impact on the environment. To ensure this, proposed developments are submitted to the agency for a permit and license to develop. The agencies mission is to ensure protection of the environment and the orderly development locally and nationally.

The National Resources and Conservation Authority Act (1991)

The Natural Resources and Conservation Act was enacted in 1991 and created the then governmental environmental agency, the Natural Resources and Conservation Authority.

Under this act the NRCA was mandated to effectively manage the physical and natural resources of Jamaica so as to ensure their conservation and proper use: promote public awareness of Jamaica's ecological systems and

their importance to the social and economic life of Jamaica; manage marine parks, national parks, protected areas, public recreational facilities: and advise the Minister on general policies relevant to the management, conservation and care of the environment.

0.5.1.8 The Town and Country Planning Act (1948)

This act was enacted in 1948. There have been substantial amendments to the act in 1990 to provide for effective enforcement of development controls. The major objectives of this act are to control the orderly development of the land contained within the established development order (now outdated), protecting amenities and conserving and developing the resources of the area as prescribed.
This Act also provides for the making of the Tree Preservation Orders whereby a local authority may seek to preserve trees or woodland in their area and prohibit the lopping or destruction of trees or securing the replanting of trees.

0.5.1.9 The Land Development and Utilization Act

This act deals with the use of agricultural land. This act tries to prevent landowner and the state from having good agriculture land idle. It aims to have good agricultural land kept in production.

0.5.1.10 Water Resources Act (1995)

The Water Resources Act was enacted in 1995 to regulate and manage the abstraction and allocation of water resources. The act also governs the preservation of water quality and the conservation of such resources. The Authority is required to gather information on the quality and quantity of water in the above ground and underground resources.

0.5.1.11 The Housing Act (1963)

Under the provision of this act, the Minister is designated "**Corporate Sole**" and thus has the power of perpetual succession with the capacity to acquire, hold and dispose of land or properties of whatever kind. The Minister after considering the housing conditions and needs of an area may cause the area to be declared as a housing area. After nine months of the coming into force of such an order, the Minister shall cause to be developed a housing scheme in the area. However the Minister before approving a scheme must provide notice to the public, which must be gazzetted, consider all objection and representation made with respect to the scheme and afford opportunities for the objections to be heard.
The Act also provides for the Minister to (order the) layout and construction of public street or roads and open space on land, erect dwellings and convert buildings on the land into dwellings and execute such works…. As may be necessary for the perfecting of such a (housing) scheme.

0.5.1.12 The Public Health Act (1974)

The Public Health Act falls under the ambit of the Ministry of Health.

Provisions are also made under this act for the functioning of the Environmental Health Unit of the Ministry of Health. The Environmental Health Unit functions through the Public Health Act to monitor and control pollution from point sources. The Central Health Committee will administer action against any breaches of this act.

0.5.1.13 The Litter Act (1986)

This Act seeks to control the disposal of refuse in undesignated areas, to include public spaces as described under section 2(c) of this act, which include public gardens, parks or open spaces or "any place of general resort to which the public, or are permitted to have access with or without payment of any fees"….. Or, 'any other place in the public air to which the public has access without payment of any fees'. As such, disposal of refuse in the area during any phase of the development would constitute an offence under this act.

0.5.1.14 Beach Control Act (1956)

This legislation was passed to ensure the proper management of Jamaica's coastal and marine resources by a system of licensing 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. These applications have already been made and copies of them can be seen in Appendix 12 along with photographs of the posted Public Notices on site.

0.5.1.15 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.

0.5.1.16 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.

0.5.1.17 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.

0.5.1.18 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 intends to collect and convey sewage to a treatment facility onsite, and then the treated effluent is to be discharged through a marine outfall and dispersal at an appropriate depth.

0.5.1.19 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
- Negligent use or management of a fire which could result in damage to property (Section 13a);

0.5.1.20 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 licensed quarries.

0.5.1.21 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.

0.5.1.22 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.

0.5.1.23 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.

0.5.1.24 Tourist Board (Water Sports) Regulations (1985)

These regulations govern the operation and conduct of water sports.

0.5.1.25 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"

0.5.2 ENVIRONMENTAL POLICIES

0.5.2.1 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.

0.5.2.2 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.

CHAPTER 1

1 THE PHYSICAL ENVIRONMENT

1.0 Description of surrounding Environment

1.1 Location

The Negril Peninsula Resort is sited on the Western Coast of Jamaica within the Negril region of Westmoreland. It is located in a South Easterly direction beyond the Negril Lighthouse, in West End, Negril. It is located between the Secret Paradise Hotel Development on the West, Jackie's on the Reef on the East. The Caribbean Sea is to the South and a number of landowners, with mainly uninhabited and heavily vegetated properties to the North. See location map in Appendix II

1.2 Physical description of the Site

1.2.1 Topography

The Wedderburns site is characterized by a wide lower coastal basin. The sea at this point, is at depths adequate for the passage of medium sized

ocean-going vessels. The land stretching back towards a cliff-feature demarks the extent of the lower coastal basin.
Above the cliff escarpment which runs east to west across the site, there is elevated terrain with terraces and escarpments, which will provide obvious zones for residential and tourism activities. The shoreline is primarily composed of an iron shoreline with varying size coral rocks and two small sandy areas.

The Cliff feature on the site is very pronounced towards the central area of the site. The cliff varies in height and steepness growing from gentle gradients on the west side to buttresses projecting back and forth in the middle of the site and again tapering in steepness towards the eastern side of the site.

1.2.2 Surface Soil

The surface soil underlying the development consist predominantly of Bonnygate Stony Loam, with isolated pockets of Chudleigh Clay loam at the upper extremities of the development and areas of Crane sand along portion of the coastal boundaries.

1.2.3 Drainage

The area has been divided into three main drainage basins:
Upper Shelf
Lower Shelf

Coastal Basin

The drainage path of both upper shelves fall naturally into the lower coastal basin, where along the base of the escarpment below the lower shelf there exist naturally occurring soak away areas adequate for a large percentage of storm water flows from the elevated shelves. There are also a number of sinkholes on the elevated shelves which will also assist in percolation.

Honey combed rock formation on the Coastal Basin will aid in the percolation and the storm water reaching coastal areas will be greatly reduced.

1.3 Geology

1.3.1 Lithology

- There is Iron Rock formation along the Coastal boundaries.
- The remainder of the area under consideration consists of a Montpelier formation which is mainly yellow limestone rocks as the under base rock formation.

1.3.2 Hydrogeology

The area surrounding the development site is classified as an Aquiclude. The upper regions are classified as a limestone aquiclude, while the lower reaches; including the coastal basin is classified as a coastal aquiclude.

This hydro geological formation helps to preclude pollution of the underground water resources because of the impermeable and semi-permeable nature of the underlying rock sub base.

There are no water extraction points (wells) in the project area.
The existing vegetation, fauna, hydrology, drainage, climate and socio-cultural characteristics are described later in this document.

1.4 Description of proposed development

Negril Peninsula Resorts Limited is proposing an Eco-tourism development on approximately one hundred and forty six hectares of land in the West End region of Negril. The subdivision will provide approximately six thousand two hundred and twenty eight (6,228) habitable rooms divided into three thousand four Hundred and ninety seven (3,903) for direct tourism and two thousand three hundred and twenty five (2,325) for non direct tourism. This will include houses on single lots, duplexes and apartments.

The coastal shoreline of approximately nine hundred and fifty five meters, fronted by the Caribbean Sea at the southwest is projected to accommodate a medium-sized harbour marina to accommodate keeled yachts and medium-sized ocean-going vessels.

The honeycombed limestone shoreline will be transformed, with the creation of five sandy beaches.

The areas adjoining the proposed development consist of a new tourism development known as Secret Paradise on the Western boundary nearest to the sea and on the Eastern boundaries there are domestic residents and two hotels.

Most of the Northern and Eastern borders are uninhabited and are fairly heavily vegetated.

1.4.1 Technical Specifications

The technical specification and demands for the project will be as follows:

- 2,925M^3 per day of potable water will be supplied by the National Water Commission.
- Three storage tanks of total capacity equivalent to one day supply will be constructed.
- 2,925M^3 per day of raw sewage will be discharged, conveyed, treated and discharged from a onsite facility.
- 10.5 tonnes of solid waste will be generated onsite, of which 10% or 1.05 tonnes will be recycled and the remainder carted away for disposal at the appropriate land fill site.
- Estimated electricity consumption during resort operation = 3.5 MW.
- Supply to be provided by JPS and a number of diesel-powered stand-by generators will also be installed. Various energy saving methods are to be implemented inclusive of a heavy emphasis on solar energy.

- Project life cycle = ~50 years

1.4.2 Existing Infrastructure

1.4.2.1 Electricity

Adequate electrical supply (3 phase) is available along the West end Road and as such, supply will not be a problem for the development. The electricity supply will be upgrade to meet the peak demand.
See Appendix XI for letter of confirmation from JPS

1.4.2.2 Telephone

Access to land lines in this area is limited, but the magnitude of mobile service providers, now in the market place, will ensure that the development will be able to access adequately, local and international acceptable levels of service in all areas of telephone communications.

1.4.2.3 Roads

Access to the site can now be achieved from two main directions:

- Along the seacoast via the West End Road
- Along the Easterly boundaries of the property, via the Orange Hill Road.

The possibility of activating an abandoned parochial road, which begins on the Orange Hill /Mount Airy Road and runs in proximity to the North Western Boundary, will be further explored.
The main access will be along the Orange Hill Road and will require work to be undertaken on the roadway to upgrade it. This road should be properly prepared and surfaced nearer to the end of the construction period.
See Appendix 14 for letter of confirmation from NWA

1.4.2.4 Water Supply

The National Water Commission will be requested to supply water to the development via two routes, a 200 mm ø Ductile Iron pipe which is located in the region of the Negril Lighthouse and via the existing supply from the Orange Hill area. Conveyance's will be laid using Schedule 40 PVC pressure pipes from the positions mentioned above to the development via approximately 2,640 m of pipeline. An internal distributing system will uses Schedule 40 PVC pressure pipes of sizes ranging from 50 – 200 mm and laterals will range from 13 -100 mm.

Total Demand	2,925,000 l/d
	650,000 IGPD

See Appendix 10 for letter of confirmation from NWC.

1.4.2.4.1 Distribution System (on-site)

This system will consist of the following components:

- Distribution mains of diameters varying in size from 200 mm to 50 mm diameter.
- Lateral connections for buildings varying in size from 25 mm to 100 mm diameter.
- All mains will be of PVC Schedule 40 Pressure Pipes except for any specially identified areas where Ductile Iron Pipes will be used.
- One (1) storage tanks of capacities 500,000 Imperial Gallons and two (2) of capacity 250,000 Imperial Gallons.
- Approximately 31 fire hydrants
- Approximately 7 PRVs located at the
- Valve boxes and Valves at intersections and areas of crucial control.

1.4.2.4.2 Supply System (off-site)

This will consist of the following components:

- 200 mm diameter PVC Schedule 40 Pressure Pipes
- PRVs
- Fire hydrants.

1.4.2.5 Sewage Collection, Conveyance, Treatment and Disposal Service

The National Water Commission's municipal sewage treatment ponds are not adequate to accept the flows of 37 l/s. A sewage treatment facility will be constructed to treat and dispose of the treated effluent via a marine outfall.

Total discharge	650,000 IGPD
	2 925 000 l/d
	≈ 34 l/s

1.4.2.5.1 Collection System (On-site)

- Street sewers will be constructed using 200 mm ø Schedule PVC 35 pipes.
- There will be six (6) Pumping/Relift stations on site.
- The stations will be equipped with submersible pumps and electrical standby systems.
- Trunk Sewers will be of 250 mm ø Schedule 35 PVC pipes.
- Street manholes will be of 1400 mm ø concrete pre-cast with heavy duty manhole frames, covers and step irons.
- Manholes in path ways and grass verges will have medium and lift duty frames and covers.
- There are approximately 793 man holes and the attendant appurtenances.
- There are approximately 8,830 m of 200 mm ø Schedule 35 PVC pipes.
- There are approximately 4,760 m of 250 mm ø Schedule 35 PVC pipes.

1.4.2.6 Health and Safety

The safety of the inhabitants of the adjoining community and the workers who will be employed during the period of infrastructure construction,

must be taken into consideration. All health and safety hazards, dust, noise and industrial accidents must be mitigated against, to ensure as little disturbance as possible to surrounding inhabitants and that no time is lost by means of work time accidents.

1.4.2.7 Aesthetics

The development by the nature of it being an eco-tourism venture will blend into the environment and add an element of beautification to the area.
Adequate parks and open spaces have been incorporated into the development.

1.4.2.8 Attitudes

Negril provides a magnet for those seeking employment over the parishes of Westmoreland and Hanover and from even further beyond. The increase in both residents and the labour force demands an increase in the opportunities for employment and other socio-economic activities.

The Negril Peninsular development will provide for some of these demands and also create other areas of employment, which are not yet apparent to the general populous.
Residents, commercial interests and commuting workers, when questioned during a survey of approximately 37 respondents during the period of the 30th -31st of October 2006, generally welcomed the concept of an eco-

tourism venture in the area. Most questioned the adequacy of the road network but, stated that other social amenities were considered adequate.

1.4.2.9 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).
5. NEPA'S Licence to construct and permit to operate a sewage treatment facility.

1.4.2.10 Significant environmental issues:

1.4.2.10.1 Construction phase

– Negative impacts

- Loss of land use options
- Loss of terrestrial habitat & biodiversity
- Materials stockpiling & storage – coastal contamination
- Land surcharge – drainage modification
- Timber scaffolding & form support – forest depletion

- On-site concrete batching plant operation - dust & toxic effluents
- 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

- Positive Impacts

- Replanting & landscaping
- Employment/Income generation
- Construction phase – positive impacts
- Employment – socio-economic benefit
- Replanting & landscaping – habitat recreation

1.4.2.10.2 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
- Misuse of reef resources – poor SCUBA/snorkling practices
- Mosquito fogging
- Induced housing demand – uncontrolled settlement/squatting

-Positive impacts

- Employment & staff training – socio-economic benefit
- Landscape & grounds maintenance
- Public beach facility management
- Diversity of entertainment
- Introduction of new skills and professions (associated with the marina)
- Increase in the provision of public services with the introduction of municipal and medical services.

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 following on pages 72 73 74 and 75 provides a summary of the environmental impacts.
The EIA report includes environmental specifications for the construction works and whereas a general plan for environmental monitoring as been formulated, an outline plan for environmental monitoring of the construction phase, cannot be finalized until the final details for construction are defined and NEPA's permit conditions are known.

ENVIRONMENTAL IMPACT	IMPACT TYPE								MITIGATION		
	POSITIVE		NEGATIVE								
CONSTRUCTION PHASE IMPACT	Significant	Not significant	Significant	Not significant	Short term	Long Term	Irreversible	Comulative	No mitigation required	Mitigation required	Reference to mitigation section
Loss of land use option			X			x	x		x		
Loss of terrestrial habitat and biodiversity			X		x	x		x		x	
Soil erosion - Marine turbidity			X	x	x			x		x	
Loss of recreational amenities - pre-empted use				x	x					x	
Piling and building foundation				x	x					x	
Earth material sourcing - illegal quarrying				x	x					x	
Material transportation - dusting and spillage				x	x					x	
Material stockpiling and storage - coastal contamination			x		x					x	
Construction work induced traffic - congestion				x	x					x	
Land surcharge - drainage modification			x							x	
Concrete batching plant operation - dust & effluent			x		x					x	
Timber scaffolding and form support -p forest depletion			x							x	
Construction of solid waste storage and disposal			x		x					x	
Dusting - air quality degradation			x		x					x	
Construction work noise - public health				x	x					x	

Sewage and litter - public health and contamination			x	x	x					x	
Impervious surfacing and paving - increased runoff			x	x						x	
ENVIRONMENTAL IMPACT	**IMPACT TYPE**								**MITIGATION**		
	POSITIVE		**NEGATIVE**								
CONSTRUCTION PHASE IMPACT (cont)	**Significant**	**Not significant**	**Significant**	**Not significant**	**Short term**	**Long Term**	**Irreversible**	**Cumulative**	**No mitigation required**	**Mitigation required**	**Reference to mitigation section**
Installation/upgrading of utilities - soil erosion				x	x					x	
Construction works water demand - supply deletion			x		x					x	
Replanting and landscaping - habitat enhancement										x	
Employment - socio economic benefits					x						
Road side vending - eye sore & litter				x	x					x	
Visual intrusion on seascape				x							
Coastal excavation and construction works			x							x	
Sourcing rocks, beach fill and sand - coastal works			x		x					x	
Material stockpiling - coastal works			x		x					x	
Employment - income generation					x					x	
Fuel and chemical storage – spillage			x		x					x	
Solid waste management			x		x					x	

Equipment and vehicle maintenance - soil contamination			x		x					x	

ENVIRONMENTAL IMPACT	IMPACT TYPE								MITIGATION		
	POSITIVE		NEGATIVE								
IMPACT	Significant	Not significant	Significant	Not significant	Short term	Long Term	Irreversible	Cumulative	No mitigation required	Mitigation required	Reference to mitigation section
OPERATIONAL PHASE IMPACT										x	
Employment/staff training	x		x			x		x	x		
Water demand - source depletion			x			x		x		x	
Energy demand - fossil fuel combustion			x			x		x		x	
Sewage collection and disposal			x			x		x		x	
Solid waste management and disposal			x			x		x		x	
Surface runoff and disposal - erosion & contamination				x		x				x	
Vehicular traffic - congestion				x		x		x	x	x	
Night time entertainment - noise				x		x				x	
SCUBA and snorkeling - misuse of reef resources			x			x		x		x	
Landscape and ground maintenance	x		x			x		x		x	

Mosquito fogging			x			x				x	
Public beach facility management	x		x			x			x		
Induced housing demand and squatting			x			x		x		x	

CHAPTER 2

2.0 TERRESTRIAL ECOLOGICAL ASSESSMENTS

2.1 Faunal and Floristic Assessment and Floristic Assessment

2.1.1 Methodology:

This ecological assessment was conducted primarily through qualitative field surveys supported by literature research and ground-truthing. Field surveys methods were applied in three ecological zones identified below along with an extensive photo- inventory of the area. This was complimented and verified with the field guides: Jamaican's Manual of Dendrology, published by Forestry Department, and The World of Tropical Flowers published by Windward.

Plate 1: Sections of the Negril Peninsula Resort development (looking south)

The following activities were used to characterize the ecology of the area.

1. Aerial photographs and land use maps to identify species communities and distribution.
2. Ground truthing was used to verify vegetation type distribution and classification of the various plant communities.
3. Literature research of information related to geographical influence to generate species inventories.
4. Identification of animals through field guides, vocalization, and actual sightings.

This survey was conducted over a period of seven days to facilitate the different phases of the study. Here the aerial photo graphs were used to determine ecological boundaries and to show the different terrain of the property.

Line transects were the primary method used to conduct the vegetation study. In addition to these, the physical walking of the property by the specialized team was done so as to identify and classify species communities and the level of diversity within each community. The idea that the distribution of vegetation types are influenced generally by factors such as , soil type, elevation, moisture and average temperature of the area, gave credence to the walking traverses.

Verification was sought from Dr. George Proctor one of Jamaica's renowned Botanist and a Specialist in identification of endangered plant species (after whom a plant found on the property is named, the Agave oberlii).

The fauna survey was undertaken by two persons; an observer and a recorder and it was limited to birds and butterflies. It also gives consideration to other fauna which may be present or which may visit the area for breeding purposes.

The proposed subdivision site is characterized by three distinct divisions based on elevations. These were:

- Coastal Basin
- Lower shelf

- Upper shelf

2.1.2 Coastal basin

This degraded area is relatively flat, consisting of sandy infertile soil. Tree species throughout this area are sparsely populated, with ground cover dominated by shrubs. The distribution of the vegetation types are influenced generally by several factors, some of which are, soil type, coastal influence, moisture levels of rainfall and temperature.

Plate 2: Shrub dominated coastal plain

2.1.3 Lower shelf

This section of the site shows moderate anthropogenic intrusions resulting from deforestation and forest fire. The define honey comb rock formation is a major feature of this area. The vegetation is typical of that of dry areas with secondary growth and to some extent free draining soils showing past evidence of sea cover.

Plate 3: Rock outcrops along the Hill slopes

2.1.4 Upper shelf

The limestone forest areas are dominated by the honey comb rock forest floor, trees are densely populated, dominated by species of Red Birch (*Bursera simaruba*) and Dogwood (*Piscidia piscipula*). The canopy is continuous in most areas and the under storey was quite open in some instances, with low light penetration and primarily had saplings of the larger species.

2.1.5 Vegetation Survey:

Plate 4: Property shows secondary re- growth

Some of these areas were mostly overgrown with weeds. Species such as Cashaw macca (*Prosopis juliflora)*, fern (*Polypodium sp*.),and Bull hoof (*Bauhinia divaricata*) ,Logwood (*Haematoxylum campechianum)*, Bastad ceder (*Guazuma ulmifolia)* and Red birch (*Bursera simaruba)* were common interspersed by wicker three species of orchids , one species of cactus two species of palm . In some instances, recent logging was evident.

2.1.6 Vegetation that occupies sections of the limestone areas

A Few openings were observed in the canopy probably due to the effects of Hurricanes Ivan (2004), Dennis (2005) and Emily (2005) or logging. Epiphytes and climbers were well represented.

Leaf litter was poor in the areas visited and decomposition rates appeared slow. The substrate was predominantly the honey comb rock. Termite mounds could be seen in several areas. Termites act as an important

nutrient recycler by digesting cellulose of dead or fallen trees which have become an important element in the functioning of this type of microclimate.

Plate 6: Vegetation found on the main plateau

Plate 6: Vegetation found on the main plateau (continued)

Table 2.1: **Vegetation typically found on the proposed subdivision – Negril Peninsula Resort site**

Common names	Scientific names	Family
Dogwood	*Piscidia piscipula*	Leguminoceae
Lucky nut	Thevetia peruviana	Apocynaceae
Duppy thatch	*Agave oberlii*	Agavaceae
Dogwood	*Piscidia piscipula*	Leguminoceae
Fig	*Ficus membranacea*	Moraceae
Cotton Tree	*Ceiba pentandra*	Bombacaceae
Basterd Cedar	*Guazuma ulmifolia*	Sterculiaceae
Guango	*Samanea saman*	Leguminoceae
Cashaw macca	*Prosopis julifolia*	Leguminoceae
Fiddle wood	*Citharexylum cauatum*	Verbenaceae
Log wood	*Haematoxylum campechianum*	Leguminoceae
Bull Hoof	*Bauchina divaricata*	Leguminoceae
Prickley Yellow	*Zanthoxylum martinicense*	Rutaceae
Sweet wood	*Licaria triandra*	Lauruceae
Wild tamarind	*Phecellobium arboreum*	Leguminoceae
Spray orchid	*Doritaenopsis dorette*	
Pretty pineapple	*Billbergia pyramidalis*	Bromeliaceae

Common names	Scientific names	Family
Giantwild pine wild pine	*Hohenbergia spinulosa* *H. urbaniana*	
Wicker		
Yellow sanders	*Zanthoxylum flavum*	Rutaceae
Guinea grass	*Panicum maximum*	Poaceae
Cerceae		
Caster oil	*Ricinus communis*	Euphorbiaceae
Black jointer	*Piper amalago*	Piperaceae
Broom weed	*Sida acula*	Malvaceae
Broom weed	*Rivina humilis*	Phylolaccaceae
Sweet wood	*Licaria triandra*	Lauraceae

2.2 FAUNAL SURVEY:

The primary focus of the faunal studies was on the avifauna in the area and for the other species noted such as insects, reptiles and amphibians. Analysis of avifauna species was conducted in relation to habitat types as outlined above in the vegetation analysis.

2.2.1 Avifauna:

Many bird species are dependent on the forest and as such are affected when sections are opened up. Species such as Jamaican Vireo, Jamaican owl, Hopping dick fall into this category. Some species showed increased numbers in residential and agricultural areas, such as; Cattle Egret, Yellow-Faced Grassquit, Jamaican Black Bird, Bald Pate, Antie Katie.

Turkey Vulture and John Chewitte are common species found throughout the site.

Yellow-faced Grassquit and Turkey Vultures are common species found throughout the site. The secondary scrub was found to be the principal habitat for several species including; Mourning and Ground Dove`s, Antillean Palm Swift and the Grasshopper Sparrow to name a few. Literature sources confirmed that major nesting periods are between January and May each year, thus during such months more birds should be more evident in the area.

Table 2.2 .**Avifauna of the West End region of Negril – Negril Peninsula Resort site**

FAMILY	SCIENTIFIC NAMES	COMMON NAMES	STATUS/RANK
Accipitridae	*Buteo jamaicensis*	Red-tailed Hawk	endemic
Apodidae	*Tachornis phoeicobia*	Antillean Palm Swift	
Ardeidae	*Bubulcus ibis*	Cattle Egret	
Caprimulgidae	*Chordeiles gundlachii*	Antillean Nighthawk	Summer migrant
Cathartidae	*Cathartes aura*	Turkey Buzzard	
Coerebinae	*Coereba flaveola*	Bananaquit	endemic
Cucilidae	*Crotophaga anis*	Smooth-billed Ani	
Coccyzidae	*Coccyzus minor*	Mangrove Cuckoo	
Columbidae	*Columba leucocephala*	White-crowned Pigeon	
Columbidae	*Columbina passerine*	Common Ground Dove	
Columbidae	*Geotrygon versicolor*	Crested Quail Dove	endemic
Columbidae	*Zenaida asiatica*	White-winged Dove	endemic
Columbidae	*Leptotila jamaicensis*	Caribbean Dove	
Columbidae	*Zenaida aurita*	Zenaida Dove	endemic
Columbidae	*Zenaida macroura*	Mourning Dove	
Emberizinae	*Ammodramus savannarum*	Grasshopper Sparrow	
Emberizinae	*Loxipasser anoxanthus*	Yellow-shouldered Grassquit	endemic
Emberizinae	*Tiaris bicolor*	Black-faced Grassquit	
Emberizinae	*Tiaris olivacea*	Yellow-faced Grassquit	
Falconidae	*Falco sparverius*	American Kestrel	
Fringillidae	*Loxigilla violacea*	Antillean Bullfinch	

FAMILY	SCIENTIFIC NAMES	COMMON NAMES	STATUS/RANK
Hirundinidae	*Hirundo fulva*	Cave Swallow	
Icteridae	*Quiscalus niger*	Greater Antillean Grackle	
Icteridae	*Icterus leucopteryx*	Jamaican oriole	
Icteridae	*Molothrus bonariensis*	Shiny Cowbird	
Mimidae	*Mimus polyglottos*	Northern Mockingbird	
Picidae	*Melanerpes radiolatus***	Jamaican Woodpecker	endemic
Psittacidae	*Aratinga nana***	Olive -throated Parakeet	endemic
Strigidae	*Pseudoscops grammicus*	Jamaican Owl	
Thraupinae	*Euphonia jamaica***	Jamaican Euphonia	endemic
Thraupinae	*Euneornis campestris*	Orangequit	endemic
Thraupinae	*Spindalis nigricephala*	Jamaican Stripe-headed Tanager	endemic
Trochilidae	*Anthracothorax mango*	Jamaican Mango	endemic
Trochilidae	*Mellisuga minima*	Vervain	
Trochilidae	*Trochilus polytmus polytmus***	Red-billed Streamertail	endemic
Turdidae	*Turdus jamaicensis***	White-chinned Thrush	endemic
Tyrannidae	*Myiarchus barbirostris***	Sad Flycatcher	endemic
Tyrannidae	*Myiarchus validus***	Rufous-tailed Flycatcher	endemic
Tyrannidae	*Myiarchus stolidus*	Stolid Flycatcher	
Tyrannidae	*Myiopagis cotta*	Jamaican Elarnia	endemic
Tyrannidae	*Tyrannus dominicensis*	Gray Kingbird	Summer migrant
Tytonidae	*Tyto alba*	Common Barn Owl	
Vireonidae	*Vireo altiloquus*	Black-whiskered Vireo	Summer migrant
Vireonidae	*Vireo modestus*	Jamaican Vireo	endemic
WINTER MIGRANTS SPECIES OBSERVED IN WEST END OF NEGRIL			
Coccyzidae	*Coccyzus americanus*	Yellow-billed Cuckoo	
Parulidae	*Dendroica caerulescens*	Black-throated Blue Warbler	
Parulidae	*Dendroica coronata*	Yellow-rumped Warbler	
Parulidae	*Dendroica discolor*	Prairie Warbler	
Parulidae	*Dendroica dominica*	Palm Warbler	
Parulidae	*Dendroica tigrina*	Cape May Warbler	
Parulidae	*Geothlypis trichas*	Common Yellowthroat	

FAMILY	SCIENTIFIC NAMES	COMMON NAMES	STATUS/RANK
Parulidae	*Mniotilta varia*	Black and White Warbler	
Parulidae	*Parula Americana*	Northern Parula	
Parulidae	*Seiurus aurocapillus*	Ovenbird	
Parulidae	*Setophaga ruticilla*	American Redstart	

2.2.2 Other Fauna:

Insects were fairly well represented, with butterflies, moths, bees and wasps being the most obvious of the group. Lepidoptera (butterflies etc.) were represented with at least 5 different species noted. More importantly is the ecological functions of these insects where they act as pollinators. Other insect species included ants, beetles and bugs.

Table 2.3: **Invertebrates known to and observed in the study area of Negril Peninsula Resort site.**

FAMILY NAMES	SCIENTIFIC NAMES	COMMON NAMES	STATUS/ RANK
ORDER: LEPIDOPTERA [Moths & Butterflies]			
Arctiidae	*Ammalo helops*		
	Calidota strigosa		
	Eunomia rubripunctata		Endemic
	Cosmosoma achemon		
	Cosmosoma auge		
	Cosmosoma fenestrata		
	Horama grotei		Endemic
	Empyreuma anassa		Endemic

FAMILY NAMES	SCIENTIFIC NAMES	COMMON NAMES	STATUS/ RANK
	Phoenicoprocta jamaicensis		Endemic
	Composia credula		Rare
	Correbidia sp.		Rare
Hyponomeutidae	*Atteva auria*		
Pyralidae	*Diaphina hyalinata*		
	Epipagis huronalis		
	Anania florella		
Sphingidae	*Enyo biosduvali*		
	Erinnyis alope		
Geometridae	*Nepheloleuca foridata*		
ORDER: ODONATA [Dragonflies and Damselflies]			
Aeshnidae	*Coryphaeschana adnexa*	Needle case	
Libellulidae	*Erythemis simplicollis*		
	Erythemis plebeja	Needle case	
	Tramea abdomiinalis	Needle case	
	Tramea insulris	Needle case	
	Tramea binotata	Needle case	
	Erythrodiplax aunrata	Needle case	
	Erythrodiplax bernice	Needle case	
	Dthemis rufinervis	Needle case	
	Macrothemis celeno	Needle case	
	Lepthemis vesiculosa	Needle case	
	Anax junius	Needle case	
	Micrathytyria didyma	Needle case	
	Pantala flavescens	Needle case	
Zygoptera (Damsel flies)	*Unidentified sp.*	Needle case	
ORDER: MANTODEA [Praying Mantis]			
	Stagmomatis domingensis	Praying mantis	
ORDER: ISOPTERA [Termites]			
	Nasutitermes Nigricepes	Termite; Duck ants; white ants	
	Procyptotermes cornicepes	Termite; Duck ants; white ants	
ORDER: ORTHOPTERA [Grasshopers & Crickets]			

FAMILY NAMES	SCIENTIFIC NAMES	COMMON NAMES	STATUS/ RANK
Gryllidae	*Halpithus sp*	Cricket	
Acrididae	*Orphullela punctata*	Small Grasshopper	
	Neoconocephalus affinis	Grasshopper	
	Stilpnochlora laurifolium	Grasshopper	
Noctuidae	*Ascalapha odorata*	Black Witch, Duppy Bat	
	Melipotis sp.		
	Sylectra ericata		
	Leucania juncicola		
	Thysania xenobia		
	Cinccia sp.		
ORDER: DERMAPTERA [Earwigs]			
	Euborellia annulipes	Earwig	
	Cabidora rip aria	Earwig	
ORDER: HOMOPTERA [Plant bugs]			
Membracidae	*Tyolzygnus fasciatus*		
Cidadidellidae	*Poeciloscata laticepes*		
ORDER: HEMIPTERA [True bugs]			
Gerridae	*Gerris sp.*		
Pentatomidae (Stink bugs)	*Loxa viridis*	Stink Bug	
	Nezara viridula	Stink Bug	
	Proxy victor	Stink Bug	
	Euschistatus bifibulous	Stink Bug	
	Alcaeorrhyndicus grandis	Stink Bug	
	Proscys victor	Stink Bug	
Cydinidae	*Tominotus communis*		
Rediviidae		Stick insect	
Pyrrhocoridae (Stainers**)**	*Dysdercus jamaicensis*	Police man bug; Love bug	
	Oncopertus Sanderchatus		
	Oncopertus pictus		
ORDER: NEUROPTERA [Lace wings & ant lions]			
Chrysopidae	*Chrysopa bicornea*	Ant lion; Nanny Goat	
Myrmelontidae	*Hesperoleon sp.*	Green lace wing	
ORDER: DIPTERA [Flies]			
Tipulidae	*Limonira sp.*	Daddy long leg; crane fly	
Syrphidae (Flower	*Ornidia obesa*		
	Copestylum inatoma		

FAMILY NAMES	SCIENTIFIC NAMES	COMMON NAMES	STATUS/ RANK
flies)	*Copestylum Tamaulipanaum*		
	Pseudodorus clavatus		
	Toxomerus pulchallus		
Bombylidae	*Paecillathrax lucifer*	Bee fly	
Stratyomyidae (Soldier flies)	*Hermatia illuscells*	Soldier fly	
Assilidae	*Leptogaster jamaicensis*	Robber fly; bee fly	
	Cerotainia jamaicensis	Robber fly; bee fly	
	Ommatis alexanderi	Robber fly; bee fly	
Tephritidae	*Anastrepha sp*	Fruit fly	
Stphylinidae	*Carpelimus petomus*		
	Carpelimus sp.		
Tenebrionidae	*Tarpela metabilis*		
ORDER: COLEOPTERA [Beetles]			
Cincindellide	*Cicindela carthagena jamaicana*		
Coccinellidae	*Chalieorus cacti*	Lady bird beetle	
	Cycloneda sauguinea	Lady bird beetle	
Scolytidae	*Xyleborus sp.*	Shotgun borers	
Chrysomelidae	*Coptocyia jamakana*		
	Metriona flavolineata		
	Diabrotica bivittata		
	Disonycha laevigate		
	Homophoeta albicellis		
	Cerotoma ruficornis		
Cerambycidae	*Eburia postica*		
	Oreodera sp.		
	Chlorida festiva		
	Elaphidon spinicorne		
	Neoptychodes trilineta		
	Neoclytus longipes		
	Neocl ytus sp.		
Scarabeeidae (Scarab beetle)	*Paragymentis lanius*		
	Ligyrus fossor		
	Macraspis tetradactyla		
	Strategus sp.	News bug	

FAMILY NAMES	SCIENTIFIC NAMES	COMMON NAMES	STATUS/ RANK
	Oniticellus cubiensis	Dung beetle	
	Phanaeus vindex		
Dyticidae	*Unidentified sp.*		
ORDER: HYMENOPTERA [Ants, Wasps & Bees]			
Scolidae	*Compsomeris dorsata*		
	Campsomeris attrata		
Ichneumonidae	*Icheumonus sp.*	Night wasp	
Apidae	*Euglossa jamaicensis*		
	Centris sp.		
	Apis mellifera	Honey bee	
	Exomolapsis sp.		
Megachilidae	*Megachile concina*	Leaf cutter bee	
	Megachile poyei	Leaf cutter bee	
Sphecidae	*Sceliphron asimile*	Mud wasp	
	Zeta abdominalae	Mud wasp	
	Pachydynerus nasidens	Mud wasp	
Vespidae	*Polistes crinitus*	Red wasp	
	Polistes hunteri	Red wasp	
	Polistes major	Big red wasp	
Chalcidae	*Spilochalsis sp.*		
Formicidae	*Paratrechina Longicornis*		
	Crematogaster sp.	Black ant	
	Pheidole sp.	Biting ant	
	Camponutus sp.	Carpenter ant; Big red ant	
	Trachymymex jamaicensis	Gardening ant	Endemic
ORDER: COLLEMBOLA [Springtails]			
	Unidentified sp.	Springtail	
SPIDERS			
	Peucetia sp.	Anancy Spiders	
	Argiope aurunita	Anancy Spiders	
	Micrathena sp.	Anancy Spiders	
	Phalaugium sp.	Anancy Spiders	
MILLIPEDES			
	Julida sp.	Forty leg	
ORDER: IXODES [Ticks]			
	Boophilous microplus	Cattle tick	
ORDER: ISOPODA			

FAMILY NAMES	SCIENTIFIC NAMES	COMMON NAMES	STATUS/ RANK
	Unidentified sp.	Woodlouse	
ORDER: OLIGOCHAETA [Earth Worms]			
	Pheretima sp.	Earthworm	
	Proto scolex sp.	Earthworm	
SNAILS			
	Thelidomus aspreera		
	Sagda jayana		
	Sagda anodon		
	Sagda torrefactor		
	Plectocycoltus jamaicensis		
	Lucidella granulose		
	Lucidella anroela		
	Lucidella sp.		
	Urocoptis aspera		
	Urocoptis brevis		
	Urocoptis sp.		
	Orthalicus undatus		
	Eutrochatella sp.		
	Pleurodonte autalucena		
	Tudora jayana		
	Tudora tectilabris		
	Tudora banksiana		
	Tudora sp.		
	Dentelaria sp.		

2.3 Amphibians, Reptiles and Mammals:

Reptiles and amphibians were not noted to be major residence of the area during the surveys; however, the presence of the large amount of bromeliads would indicate that they are very much present in the study area. About half of a hectare of land in the upper most part of the study area is covered with these species of plants and is known to be suitable

habitats for the terrestrial animals and also source of water for a large host of animals.

On the coastal basin where the area was obviously degraded, there is a high possibility of land crabs inhabiting this zone. Close inspection only revealed burrows that could have been used by the mongoose which is one of the obvious invasive species of mammals in the area or land crabs.

2.4 Ecological Analysis:

2.4.1 Soil fertility:

It is well established that the presence of trees contribute significantly to soil amelioration. Trees provide a number of functions; physically, they prevent soil erosion by protecting the soil from direct rainfall through interception with their canopies and they improve soil stability through their root systems. Chemically, they improve soil quality by additions of organic matter (leaf litter, decomposing branches and root exudates) and through leaching from stem and leaves. The species of the Leguminaceae family may play a greater role in this regard. These plants are nitrogen fixing trees, and large specimens are frequent in several areas.

2.4.2 Habitats:

Several plant species provide valuable habitats for animal species. The Yellow Sanda trees provide feeding and nesting grounds for bird species.

In addition to creating microhabitats, plants such as bromeliads and other epiphytes support the breeding species of tree frogs and lizards. The agaves are unique plants to the area, which also adds horticultural value to an area and should be preserved either by in-situ or ex-situ conservation. The large population of the bromeliads in the forest area provides very important ecosystems and habitats in such locale and should, as much as possible, be preserved.

2.4.3 Plant dispersal:

Several of the plant species have specialized relationships with birds to ensure pollination and seed dispersal. One such case occurs with bromeliads being pollinated by *Trochilus polytmus,* Red billed streamer tail. If plant removal is to be under taken, the feeding trees that play their role in the chain of interdependency among the various species should be replanted or be protected as much as possible.

2.5 Impacts & Mitigation

The study reflects the presence of at least one invasive species, the mongoose and the high level of interdependency among species of the different communities. It is advisable that the removal of plants on which some animals depend, be planned so as to prevent the elimination of one species, while allowing an erotic growth in an invasive species creating an imbalance in the equilibrium of the various ecosystem.

2.6 Summary:

The survey and literature review for the biological survey of the Negril Peninsula Resort site and environs has revealed that the presence of several important plant and animal species, however, no rare or endangered species were observed. A comparison of potential species (likely to occur) diversity in the various study areas indicated good representation when matched against national levels. To this end, land clearance is acceptable but, it is recommended that the natural feeding trees for birds should be retained as much as possible and trees of ecological importance should be clearly labeled.

Plate 7: Feeding trees for birds

Where possible, if important species are found, they should be removed for preservation and horticultural society groups should be involved to protect the two orchid species identified.

CHAPTER 3
MARINE AND SHORLINE ASSESSMENT REPORT

3.1 Introduction:

A major component of the Negril Peninsula Resort development is a Marina proposed for the coastal component of the development, along with five semi-enclosed beach coves and protective groynes.

The descriptions of these development components are listed as follows in the sequence that each will be implemented:

1. The excavation and construction of a marina facility of dimensions 650 meters long, 77 meters wide and 7 meters deep. Excavation will be facilitated through the use of land-based earth moving equipment and will be preceded by the removal and stockpiling of topsoil.
2. Construction of two groynes of average dimensions 30 meters by 155 meters.
3. The excavation of a marine access channel to the marina facility, the dimensions of which are a variable width of between 36 to 65 meters and a depth of 7 meters.
4. The excavation and construction of 5 pocket beaches along with protective structures.

Excavations on land will be up to 12 metres below existing ground level and dredging depths up to 7 metres will be required to form the marina access channel.

The basin could be excavated from land side down to sea level using land based machinery with the dredging operation following excavating the channel and remainder of the basin from the sea side

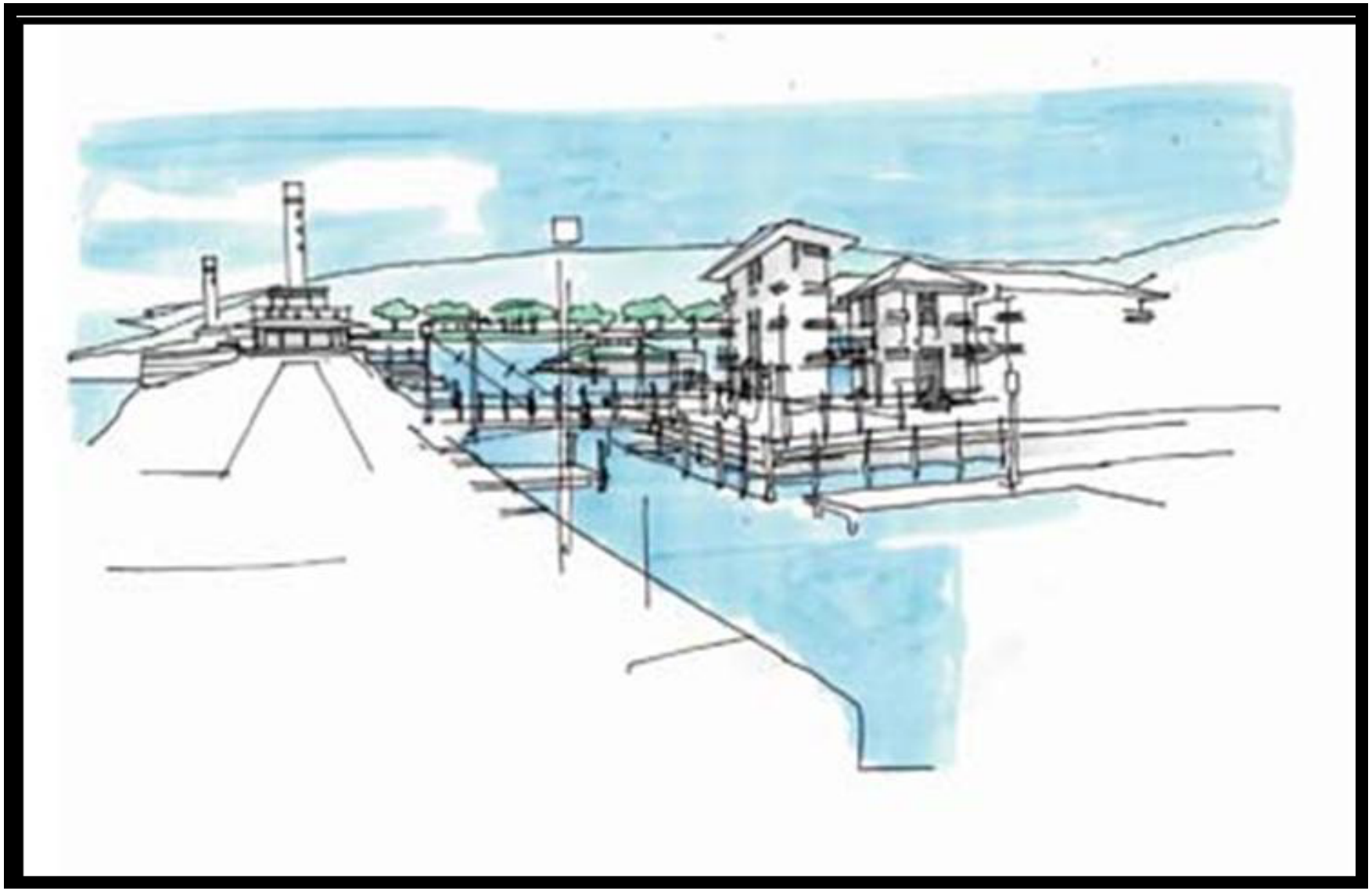
The groynes will be formed from compacted marl and protected with igneous rock or concrete armour over a geo-textile layer.

The walls to the basin will be formed from the land side using a Diaphragm wall or contiguous bored pile wall construction following the excavation of capping rock to sea level. The wall will be toed into the rock at around -30 feet and excavation of the basin below sea level will be carried out by barge following construction of the entrance channel.

Of the four items mentioned above, both the groyne construction and the excavation of the marine access channel will entail disturbances to the seafloor. The remainder will be constructed on land, with accesses to the sea being provided after construction.

Once completed, the marina facility will take an appearance approximating that outlined in **Figure 1**.

FIG 1
CONCEPT DRAWING OF MARINA ONCE COMPLETE



3.2 Study Area Demarcation:

The lay of the land upon which the proposed marina, beach and land-based development is to be implemented is outlined on the aerial photograph illustrated in **Figure 2**. The general layout of the development is illustrated by **Figure 3**, which is an overlay of the development plan on a 1991 aerial photograph of the location. Finally, the specific layout of the coastal and marine works is defined on **Figure 4**.

The landward limit of the rapid assessment area was defined by using the eastern and western boundaries of the property at the point where they intersect the coastline.

The seaward limit of the assessment area was defined through the interpretation of significant seafloor features, as defined during the aerial photo assessment.

3.3 Benthic Assessment

3.3.1 Introduction

The physical impacts envisaged as a result of the construction of the marina component of the development were assessed as follows:

1. Physical impact of the construction of the two groynes to protect the access channel to the marina on sensitive marine components.
2. Physical impact of any dredging work required to create access to the marina on sensitive marine components

FIG 2
AERIAL PHOTOGRAPH OF THE PROPOSED DEVELOPMENT AND ITS ADJOINING COASTAL COMPONENTS

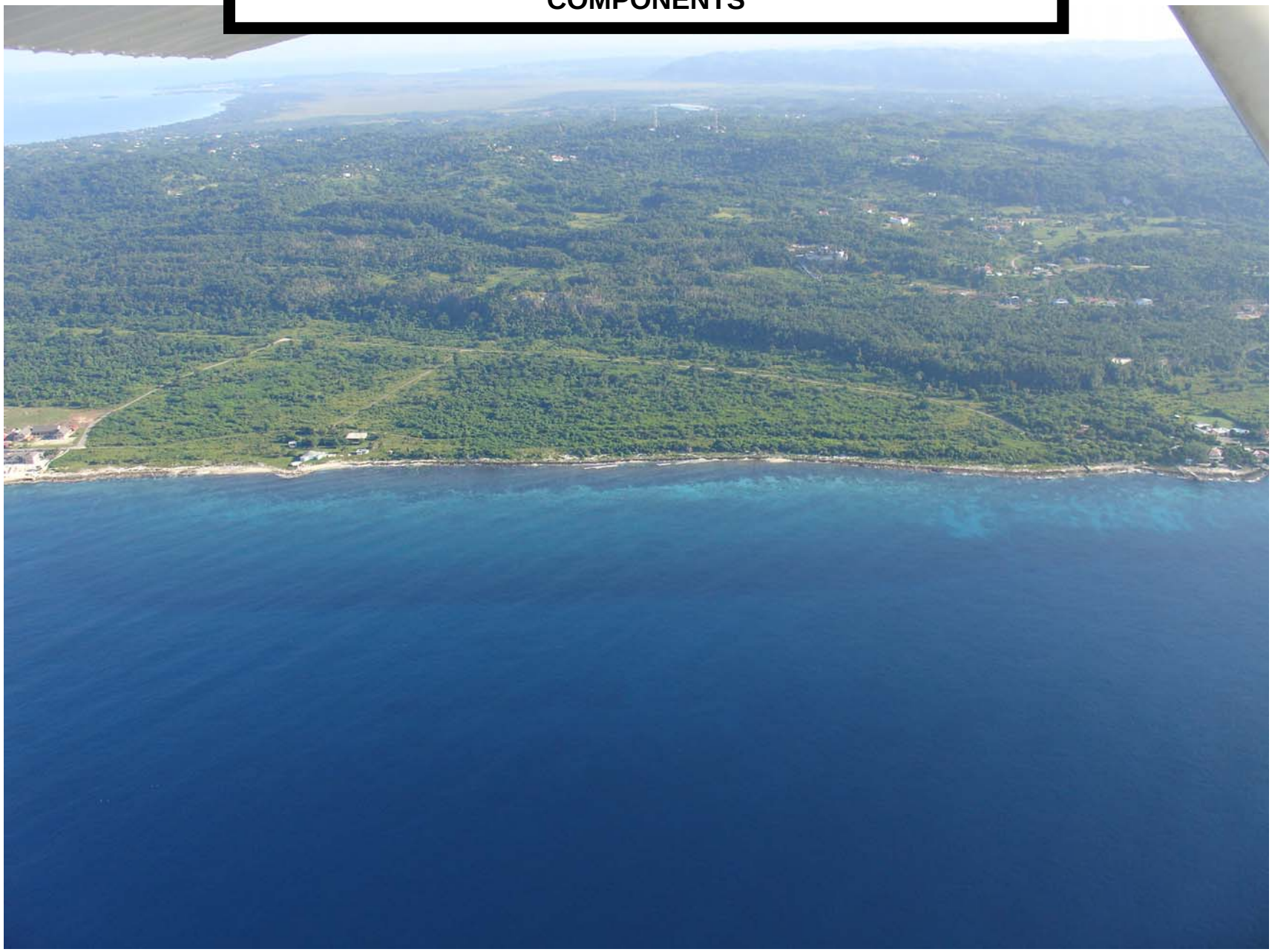
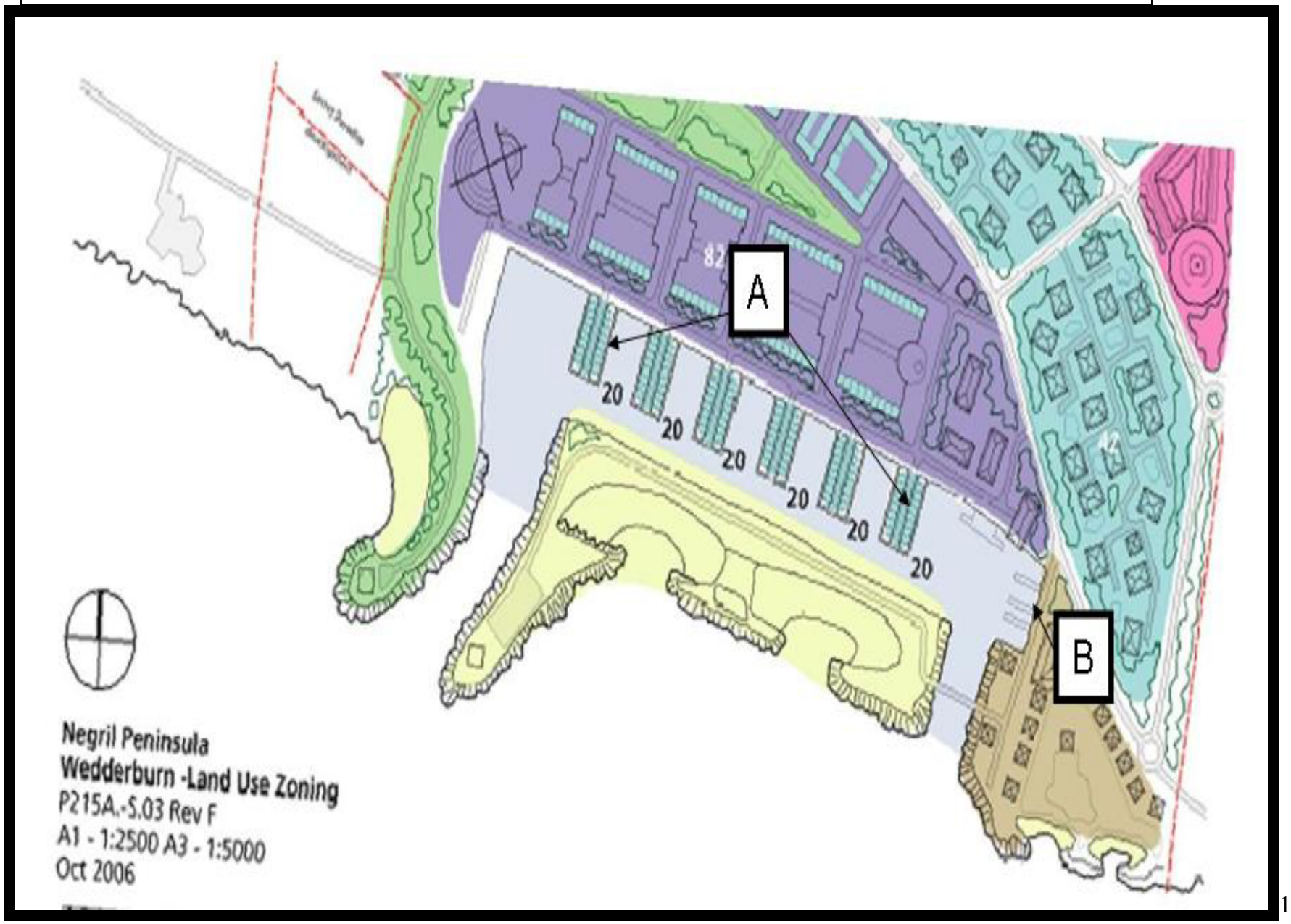


FIG 3
ILLUSTRATION OF PROPOSED DEVELOPMENT LAYOUT

FIG. 4 CLOSE UP OF MARINA WORKS DESIGNED TO ACCOMMODATE SMALL VESSELS IN PARALLEL SLIPS (A) AND LARGE VESSELS AT INDIVIDUAL JETTIES



3. Physical impact of any shoreline removal to facilitate sea circulation to the proposed coves
4. Turbidity impacts restricting light penetration to light dependent marine organisms.
5. Sedimentation (physical smothering) impacts on any sensitive marine lifeforms that may exist adjoining the proposed works.

An assessment of the benthic resources immediately adjoining the proposed development site was therefore seen as being necessary in order to determine the resources that could be affected by the impacts stated.

3.3.2 Benthic Assessment Methods

With a total coastal frontage of nearly a kilometer, a number of approaches were taken to ensure adequate area coverage:

3.3.2.1 Aerial Assessments

Aerial and satellite image interpretation and mapping was initially conducted using a combination of the following:

1. Aerial photographs taken in 1991 by the Survey Department,
2. 2000 Landsat TM imagery obtained from the National Oceanic and Atmospheric Administration (NOAA),

3. (circa) 2000 IKONOS images obtained from Google Earth
4. Obliquely oriented[1] aerial photographs of the site taken in 2007 by the author with a digital camera.

The objective of this mapping effort was to identify benthic features that could be interpreted from these images using photogrammetry[2] to remotely identify and determine the spatial distribution of shoreline and marine seafloor characteristics, which can be discerned with these methods. These characteristics relate to colour, 3-dimensional form and texture patterns, which can be used by a suitably trained and experienced remote sensing technician to identify the various types of bottom substrates, benthic features[3] and coastal formations existing within and surrounding Jamaica's waters.

Such photo-interpretation would lead to the determination of the spatial extent of benthic substrate features, specifically sand and hard bottom. These substrates are often indicative of habitats for various attached and mobile marine lifeforms and would, by deduction, hint to the spatial extent of these live components.

Image interpretations were rendered on aerial images scaled to represent the same dimensions as the design plans for the development. This was done through the use of a Geographical Information System [4] software (Mapmaker Pro)

[1] Oblique aerial photographs are those that are taken at any angle other than vertically downwards
[2] Photogrammetry is the science of using aerial photographs and other remote sensing imagery to obtain measurements of natural and human-made features on the earth www.Physical Geography.net
[3] organisms attached permanently to the seafloor
[4] GIS utilizes software to layer various geographical information onto one another, facilitating interpretations.

3.3.2.2 Coastal / Marine Assessment Method Description - Ground Verification:

After the process of aerial assessments was completed, ground truthing was conducted to verify interpretations made during aerial photo assessments and to provide general information on the status of natural resources that may exist within the immediate study area.

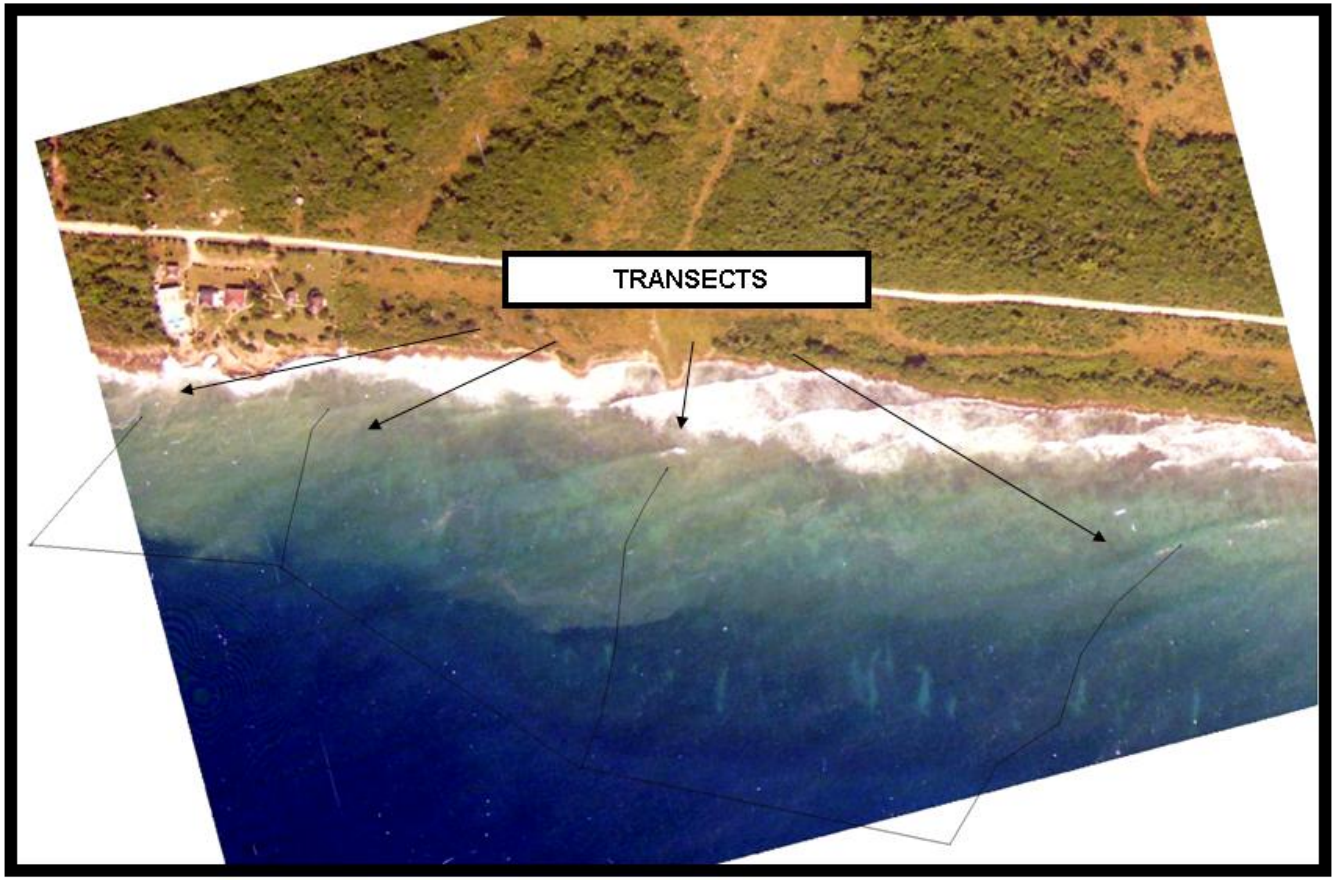
For the coastal features examined, a simple walking traverse of the shoreline was conducted along the entire coastline of the proposed development in order to visually confirm the features interpreted on the aerial images. The services of a glass bottom boat were obtained in order to facilitate a broad and rapid visual survey of the seafloor features adjoining the site.

The adjoining marine environment encompasses an area of dimensions 1400 meters x 200 meters or 28 hectares. The use of the glass bottom boat was seen as ideal because it allowed for a visual understanding of the seafloor conditions to be obtained within a short space of time.

A 'comb tooth' transect[5] layout pattern (**see fig 5**) was used for the purpose of the survey, with one long transect being run parallel to the shoreline at a

[5] A transect is a line deployed over a study area representing a measured sample of that area. A comb tooth transect pattern starts from a main transect, with perpendicular transects being run from this base. definition).

FIG 5
ILLUSTRATION OF "COMB TOOTH" TRANSECTS CONDUCTED WITH GLASS BOTTOM BOAT



distance of approximately 200 meters offshore and with transects being branched off, running perpendicularly towards the shore.

Observations were made from the glass viewer on the boat and any significant changes in seafloor composition or character were recorded in note form. Additionally, the locations of these changes were obtained through the use of a hand held global positioning system (GPS[6]). Additionally, broad interpretations of the health of the reef area, as defined by estimates of coral percentage cover were assessed by visual interpretation methods. Finally, the contour of the seafloor was determined by interpolating between spot depths obtained through the use of a portable depth sounder during the visual survey, with positions being fixed with a GPS.

More detailed assessments of the seafloor bound by the footprint of the proposed groynes and marine access channel were done using transects deployed within these areas to guide the positioning of photoquadrats[7] taken with an underwater still camera.

Percentage cover of corals in relation to algae was used as the basis for reef health, since there is a loosely established relationship between the ratio of corals to algae on a reef and its overall health. This ratio was interpreted from work done by Hughes 1991[8], which identified Jamaican north coast reefs as having 54% area cover of corals and 4% area cover of algae in the

[6] A satellite based positioning and navigating tool implemented by the US Military, but accessible by the civilian public. The system involves the use of a hand held receiver, which interprets signals transmitted by a system of 24 satellites set in a geostationary orbit around the earth.

[7] Vertically oriented photographs of features, used for the purpose of estimating percentage cover of various features, such as corals.

[8] www.agrra.org/reports/jamaica2.htmlAgrra report summary

1970s. Owing to the effects of eutrophication[9] due to development, the influence of a pan-Caribbean die-off of the Black Spiny urchin in 1983 (at the time, the dominant herbivore on coral reefs) and the impacts of Hurricanes Allen (1980) and Gilbert (1998), this ratio changed to 5% coral cover and 95% algae cover in the 1990s. These two ratios were used as a general indication of reefs of good health (1970s) and reefs of poor health (1990s).

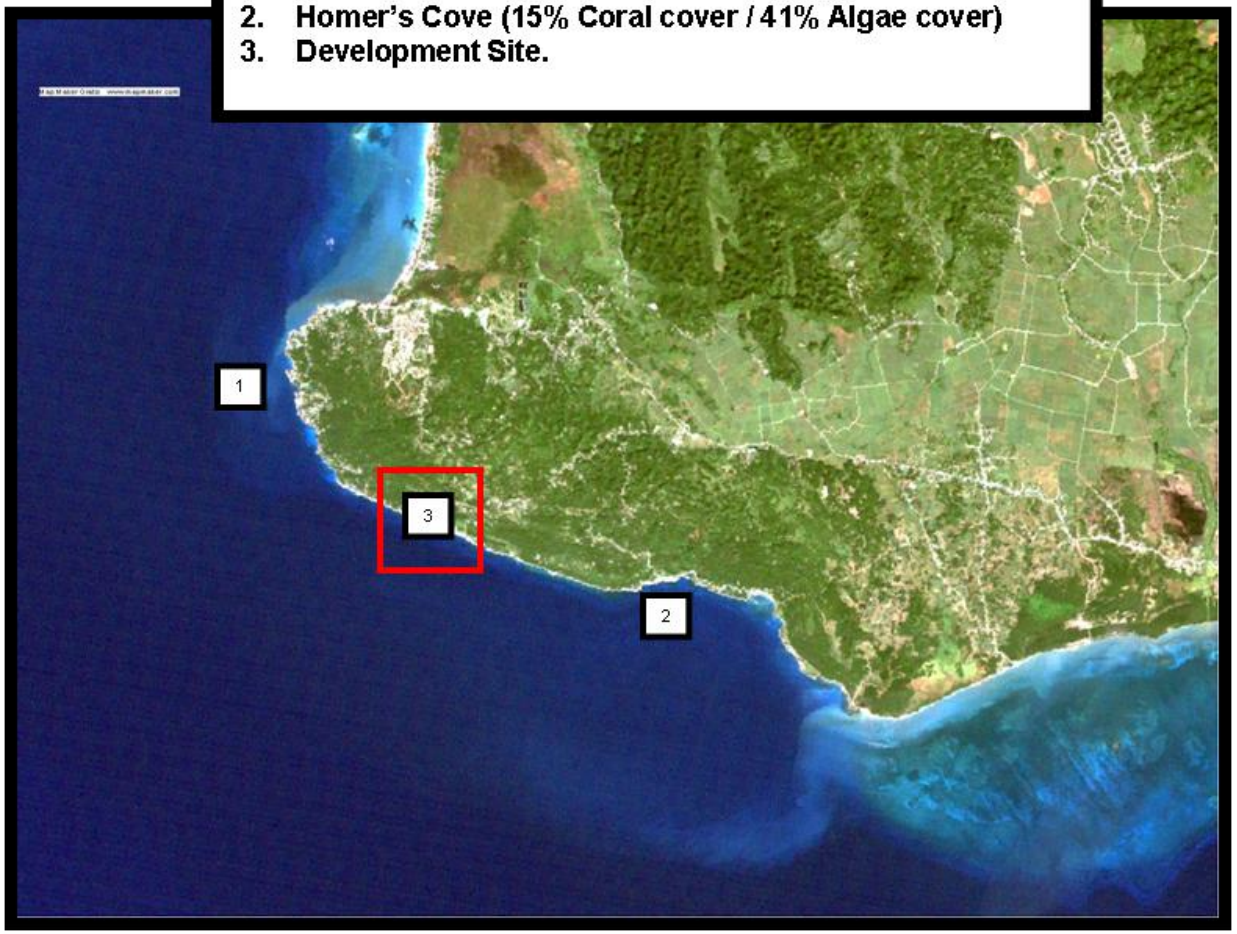
Information on coral reef health, monitored during surveys conducted by the Atlantic Gulf Rapid Reef Assessment (AGRRA) project conducted in 2000[10] at Drumville Cove to the west of the site and Homers Cove (**see locations on fig 6**) to the east were interpreted as indicative of reef conditions experienced at the beginning of this decade and would hint to the health of the reef prior to the impact of Hurricanes Ivan in 2004 and Emily in 2005.

Estimates of numbers and types of fish observed at the site were obtained using both the transect and roving fish count methods defined for AGRRA[11]. Fish examined were also based on the AGRRA method, with emphasis being placed on herbivorous and commercially important fish. Estimates obtained for the fish counts conducted for the project were

[9] The impact of nutrient pollution on the marine environment resulting in the overgrowth of attached and free-floating plant life.
[10] www.agrra.org/ARB_volume/JamaicaReport.pdf
[11] www.agrra.org/method/methodhome.html

FIG 6
ILLUSTRATION OF LOCATION OF AGRRA ASSESSMENT SITES NEAR TO THE PROPOSED DEVELOPMENT SITE

1. **Drumville Cove (8% Coral cover / 67Algae cover %)**
2. **Homer's Cove (15% Coral cover / 41% Algae cover)**
3. **Development Site.**



compared with information obtained during the AGRRA 2000 survey for both Drumville Cove and Homers Cove.

Once the aerial and ground assessment work was done, the information obtained was processed through the use of a Geographical Information System software (GIS) to layer the information together and to facilitate a visual rendition of the information obtained.

3.4 Observations:

3.4.1 Coastline

The coastline within the development borders could be described as a raised reef dominated by honeycomb limestone with sand pockets and topsoil interspersed over its extent. The waterline had expressions of honeycomb limestone, sand, coral rubble and coral boulders distributed along the entire length of the property's shoreline (**Fig 7-9**)

The sand and rubble and boulders observed had apparently been deposited at the location by either a single or multiple tropical cyclone events.

Interviews conducted with persons traversing the area revealed that Hurricanes Ivan and Emily had created particularly severe sea conditions at the site, with Hurricane Ivan being the more severe of the two events.

Coastline vegetation could be described as shrubs, grasses and runners adapted to the type of saline and ground conditions that would be expected at the location. It was, however, evident that major vegetation removal

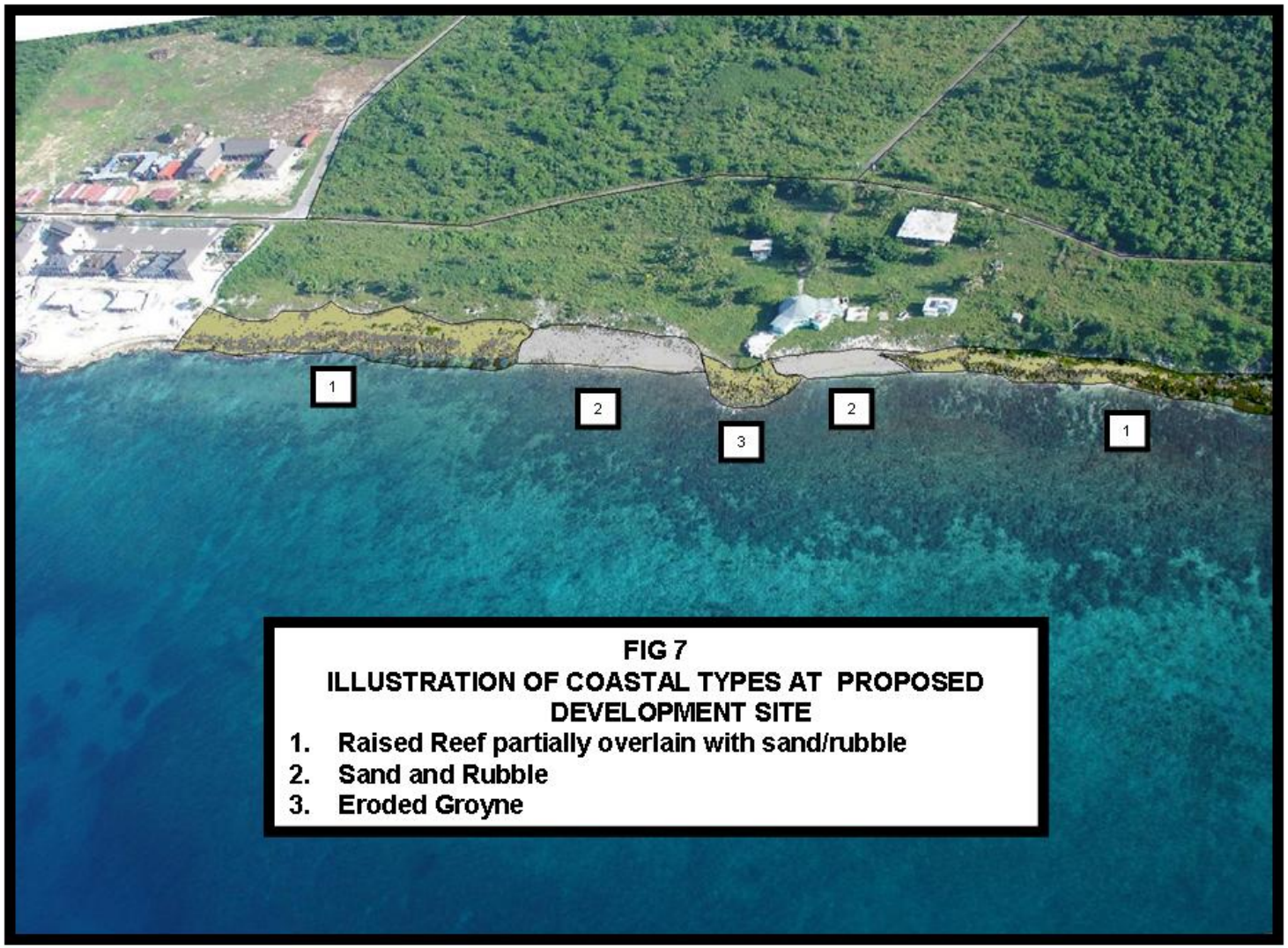


FIG 7
ILLUSTRATION OF COASTAL TYPES AT PROPOSED DEVELOPMENT SITE

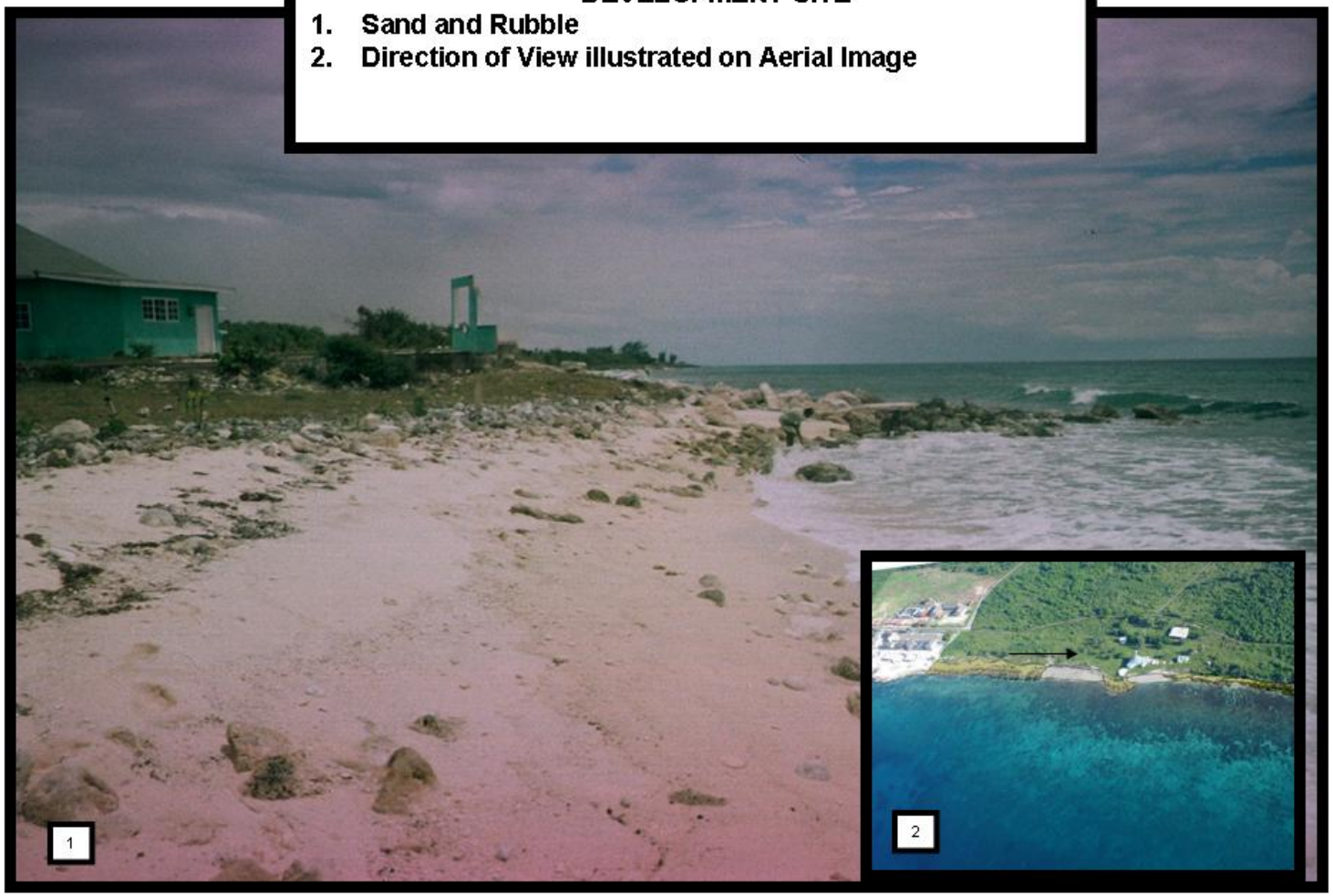
1. Raised Reef partially overlain with sand/rubble
2. Sand and Rubble
3. Eroded Groyne

FIG 8
ILLUSTRATION OF COASTAL TYPES AT PROPOSED DEVELOPMENT SITE

1. Raised Reef partially overlain with sand/rubble
2. Direction of View illustrated on Aerial Image

FIG 9
ILLUSTRATION OF COASTAL TYPES AT PROPOSED DEVELOPMENT SITE

1. Sand and Rubble
2. Direction of View illustrated on Aerial Image



had been conducted at the site over the years, with systematic cutting of larger shrubs and small trees being done by unknown persons, apparently to keep the land clear for possible development. This was evident on the 1991 Survey Department aerial photographs examined and more so on examination of Google Earth images taken after 2000 (**Fig 10**). An evaluation of these vegetation changes will ultimately aid in the determination of storm surge run-up distances (to be reported on in the chapter to follow).

3.4.2 Marine

The form, colour and texture patterns observed during aerial photo analysis lead to the conclusion that there were both hard and soft substrate areas within the study area). The spatial distribution of these substrates defined an area characteristic of a fringing coral reef. By deduction (due to locations adjoining the fringing reef) and colour, the soft substrate area was inferred to be composed of sediments of a marine origin.

Figure 11 outlines the spatial separation between hard and soft substrate areas deduced to be within the study area.

FIG 11
ILLUSTRATION OF BENTHIC SUBSTRATE SPATIAL EXTENT AT PROPOSED DEVELOPMENT SITE

KEY

1. **Hard Bottom**
2. **Soft Bottom (Sand)**

3.4.2.1 Marine Assessment Ground Truthing – Photogrammetry Interpretations and Glass Bottom Boat Observations:

The area identified as being of a hard bottom character in **Figure 11** was confirmed during the visual surveys as being a fringing reef with a sandy plain existing immediately to seaward of the deepest section of this reef.

The reef area had been determined by aerial photo interpretation to be approximately 200 meters in width and this was also confirmed through measurements made with the hand held GPS unit. The reef was comprised of a hard coralline[12] substrate of low to moderate rugosity dominated the area[13]. The coral framework had apparently experienced extensive physical impact from wave action since, for the most part, only the dead coral skeleton bases remained. This inference was also arrived at due to a noticeable absence of branching corals, such as Elkhorn and Staghorn corals which would normally be found in these depths and which would have been affected by wave action.

There were, however, existing growths of encrusting massive or boulder shaped corals observed, particularly what were believed to be Mountainous

[12] Coralline substrates are mainly comprised of Calcium Carbonate-based reef frameworks created by the skeletons of corals deposited over thousands of years of existence….
[13]rugosity being defined as the level of complexity that a reef has, for example, the extent to which a reef area has holes, crevasses and overhangs within its substrate: Friedlander Allan & Parrish James 1998. Habitat characteristics affecting fish assemblages on a Hawaiian coral reef. Journal of Experimental Biology and Ecology 224:1-30.

Star Coral and Mustard coral (**see fig 13 and 13A**), particularly in water depths between 2 - 7 meters.

Algae were also observed colonizing the seafloor. Much of the hard bottom was covered with Turf algae[14], with scattered tufts of fleshy algae also being observed. What was noticeable was the marked absence of fleshy algae on the shallower portions of the reef. This suggested that the area was either;

- a. devoid of nutrients to support excessive plant growth,
- b. scoured by sediment-borne currents during recent storms
- c. influenced by strong herbivory[15], or
- d. combinations of the first 3 factors.

The reef area extended down to depths of between 9.4 to 11.7 meters, where it then plunged steeply to approximately 20 meters, contacting a marine sandy plain approximately 200 meters offshore.

While the distance of the island shelf was not directly measured using GPS, it was interpreted from satellite imagery to be approximately 500 meters from the shoreline at the location of the proposed development site. It is likely, therefore, that the sandy plain contacting the near shore fringing reef would extend to deep water reefs bordering the island shelf.

One of the limitations of conducting marine observations from a surface source, such as a glass bottom boat is that observations made can only be

[14] Marine plants that create a fine carpet over any exposed hard surface on the reef face.
[15] Definition for herbivory

regarded as general, since the recorder is not within the environment to make close-up observations. Additionally, the outboard engine on the boat may scare away mobile reef animals, particularly, if observations are being made in shallow water. This may lead to a false belief that the reef is devoid of such animals.

Having said the above, it was noted that there were few observations of fish made during the survey, particularly in the shallower portions of the reef (i.e. 5 meters and shallower). Where mobile organisms were concerned, reef fish were the most obvious with three varieties being observed.

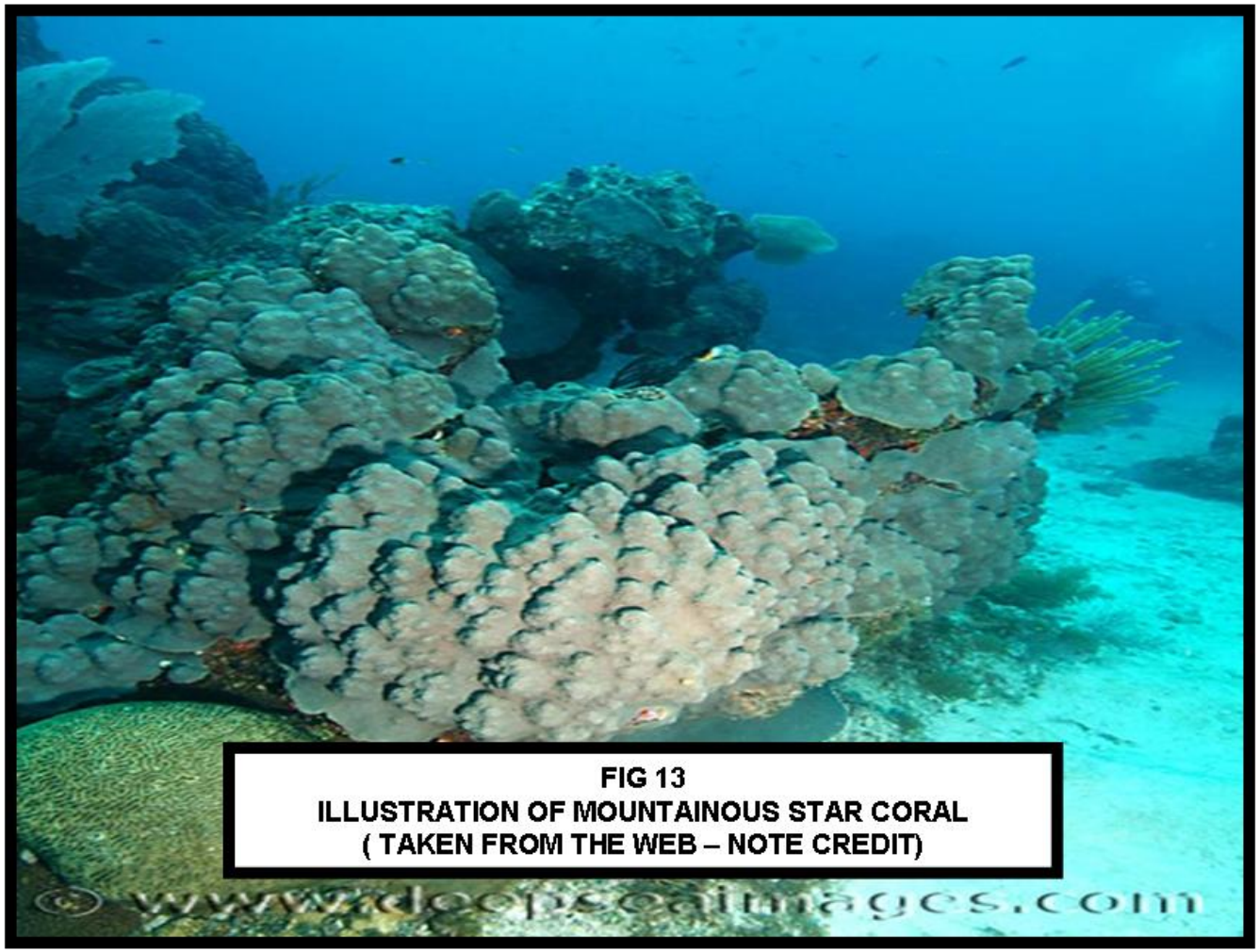


FIG 13
ILLUSTRATION OF MOUNTAINOUS STAR CORAL
(TAKEN FROM THE WEB – NOTE CREDIT)

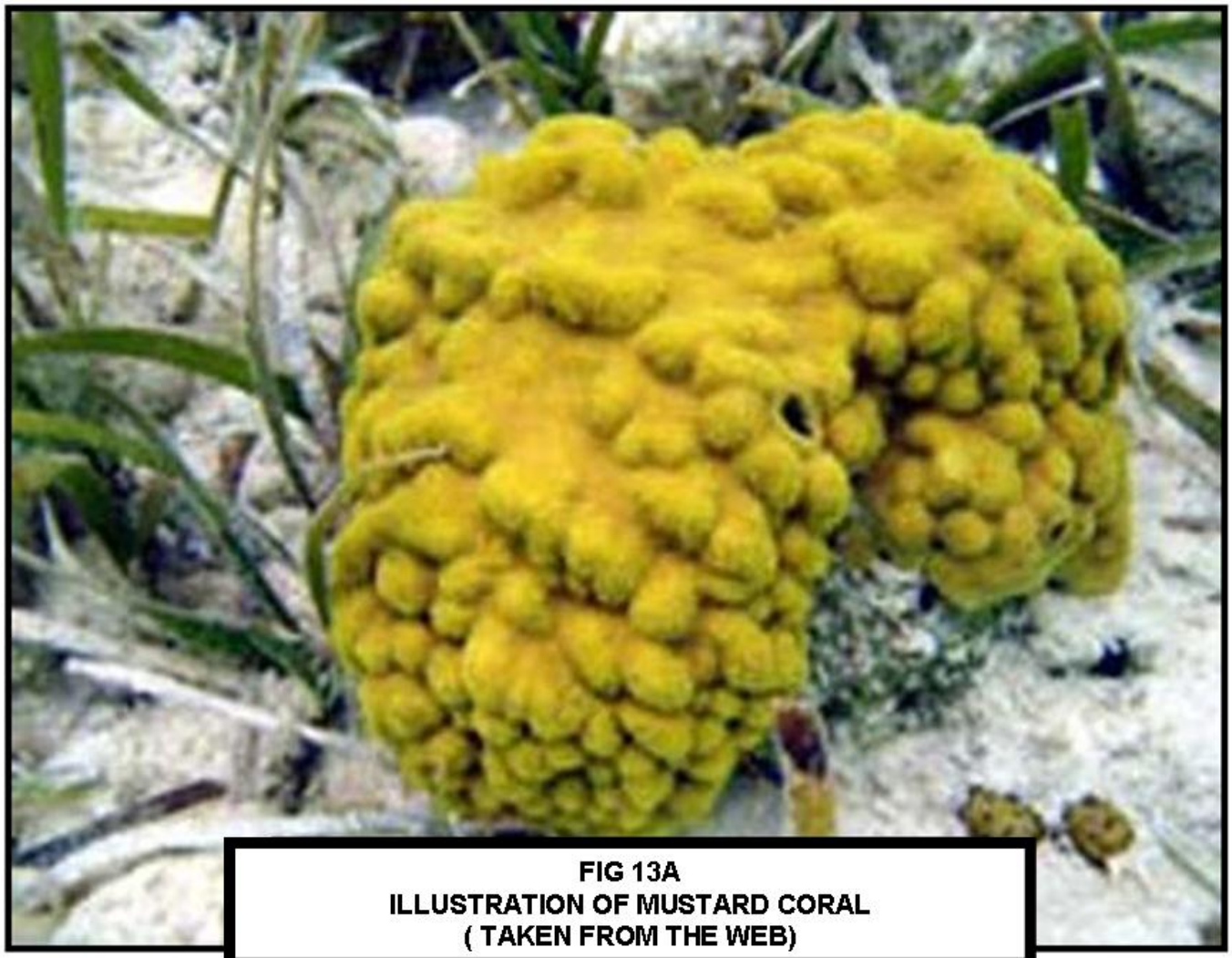


FIG 13A
ILLUSTRATION OF MUSTARD CORAL
(TAKEN FROM THE WEB)

Total numbers of fish individuals observed during the entire survey were low, being less than 20, with the exception of a school of herring-like fish, numbering in excess of 100 individuals. Fish sizes were generally less than 10 cm in length and were mainly identified as reef herbivores[16], such as Doctor Fish, Damsel Fish and Sergeant Major Fish (**see fig 14 for illustrations**).

Sea urchins concluded the list of mobile marine organisms observed. Total numbers observed were also low with 18 individuals being observed. Two species could be distinguished (**see figs 15 and 15A for illustrations**), namely the Black Spiny Urchin and the Sea Egg. It is known that Sea Urchins are the major controllers of plant growth on Jamaican reefs.[17] However, with the few numbers observed, it is unlikely that they played a significant role in the apparent reduction of and the presence of these urchins may be linked to the absence of fleshy algae in shallower portions of the fringing reef.

Seafloor surface area covered by algal and coral (indicators of reef health) were determined from visual estimates made from the glass bottom boat in the field.

[16] Plant eaters
[17] Nancy Knowlton 2001. Sea urchin recovery from mass mortality: New hope for Caribbean coral reefs? PNAS Vol 98: 4822-4824

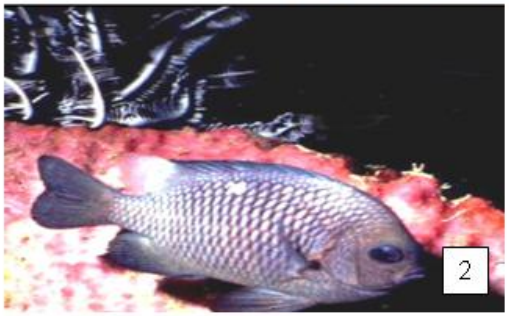


FIG 14
ILLUSTRATION OF FISHES OBSERVED DURING THE GLASS BOTTOM BOAT SURVEYS
(TAKEN FROM THE WEB)

1. **DOCTOR FISH**
2. **DAMSEL FISH**
3. **SERGEANT MAJOR FISH**
4. **Parrot Fish**

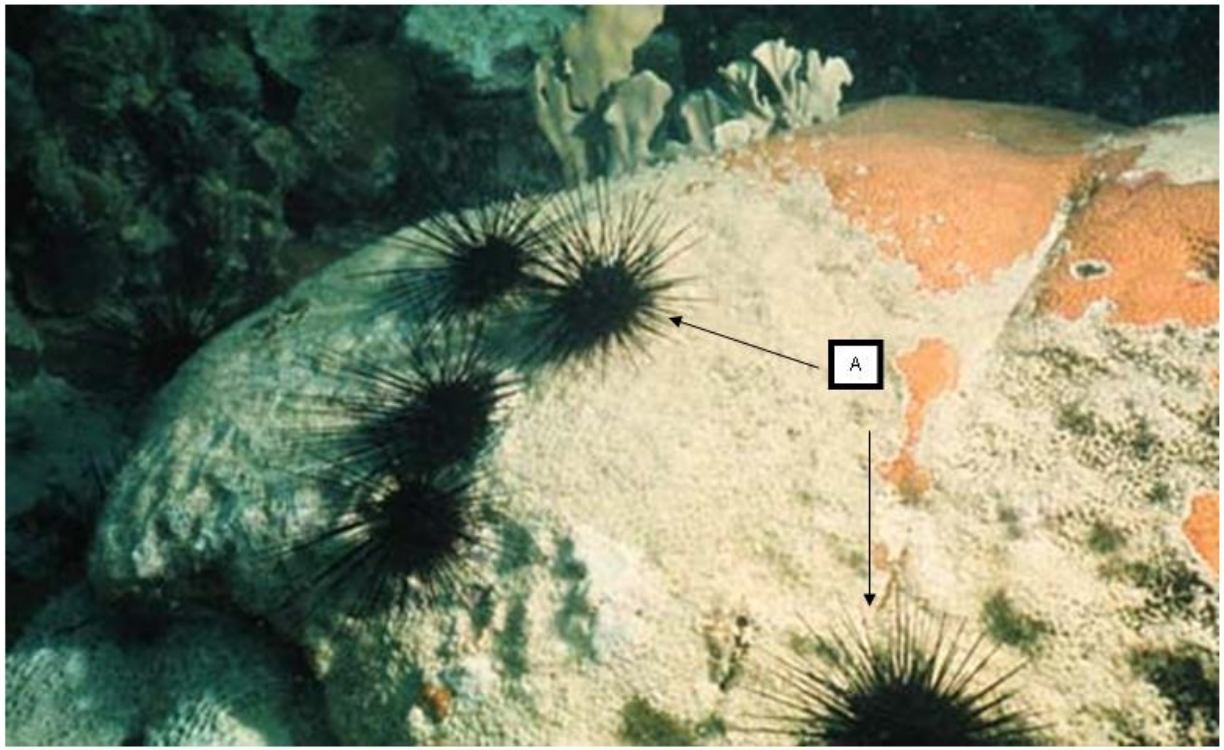


FIG 15
ILLUSTRATION OF THE BLACK SPINY URCHIN (A)
(TAKEN FROM THE WEB)

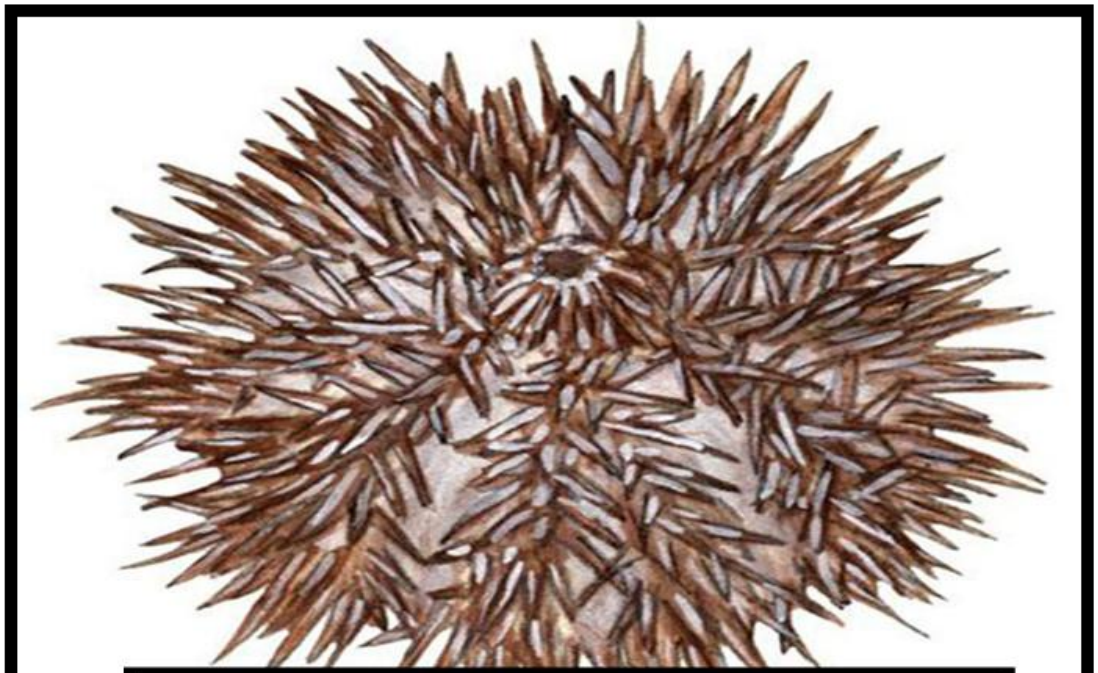


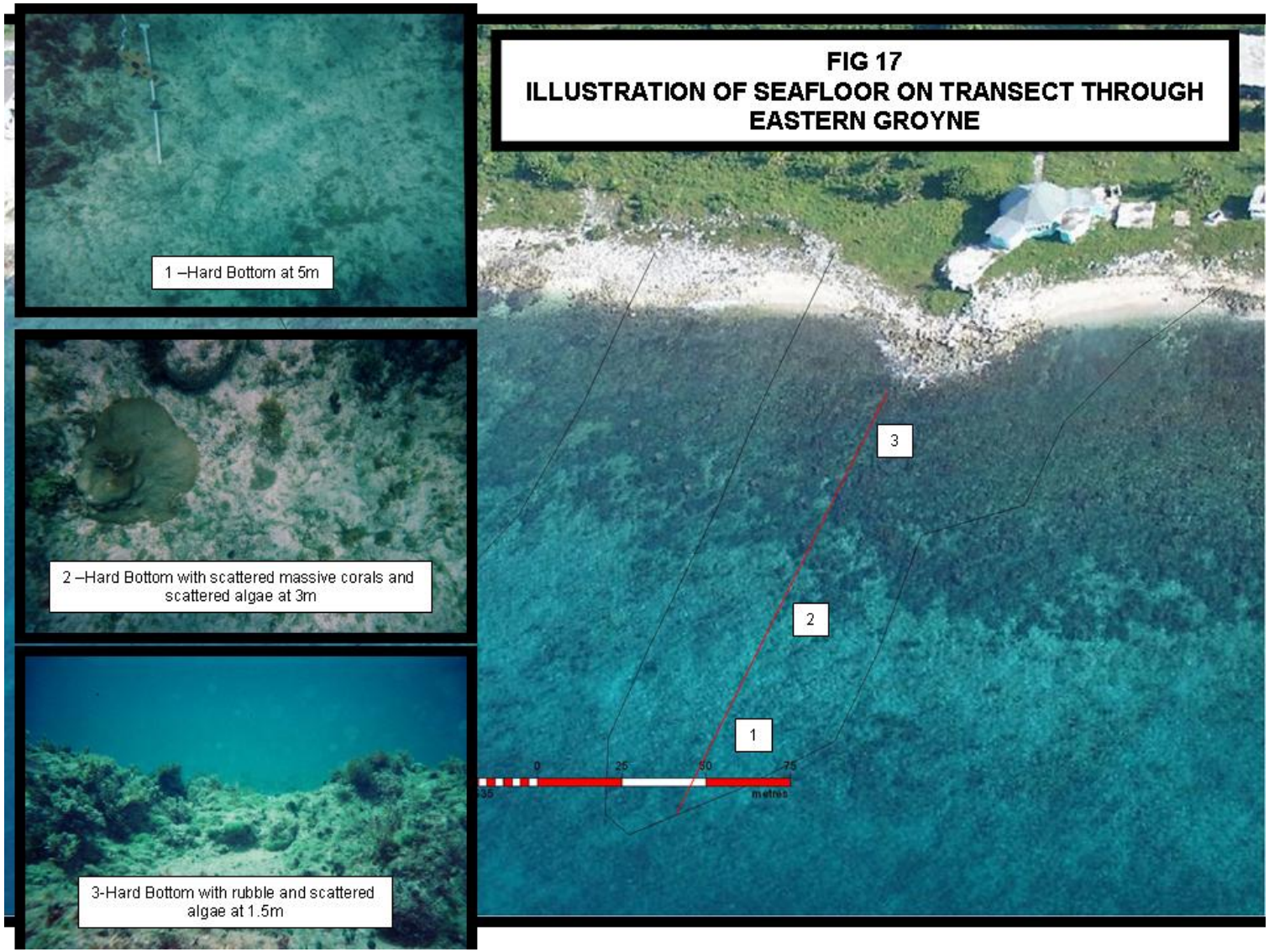
FIG 15A
ILLUSTRATION OF SEA EGG URCHIN
(TAKEN FROM THE WEB)

Note that these estimates would be very conservative, owing to the imprecision inherent in making such observations from a surface platform. Thus, the estimates given below were only made for water depths down to 5 meters deep. Within the depth range cited above, it was estimated that the reef had low live coral cover, less than 5 percent. Algae cover, inclusive of turf and fleshy algae, was estimated at 95%, with turf algae dominating.

3.4.2.2 Marine Assessment Ground Truthing – Groyne and Marine **Channel**

Underwater surveys conducted within the footprint of the proposed offshore structures (**aligned according to transects outlined on Figure 16**) confirmed observations made from the glass bottom boat. Details on the character of the seafloor and its lifeforms are outlined on **Figures 17-19**. Additionally it was determined that much of the seafloor within the shoreline and a distance of 50 meters offshore (maximum depth of 1.5 meters) was littered with football sized coral rubble. This suggested that at least one severe wave event scoured the seafloor of coral and other

FIG 16
ILLUSTRATION OF PHOTO AND AGRRA FISH TRANSECTS THROUGH GROYNE FOOTPRINTS


1 –Hard Bottom at 5m
2 –Hard Bottom with scattered massive corals and scattered algae at 3m
3-Hard Bottom with rubble and scattered algae at 1.5m
FIG 17
ILLUSTRATION OF SEAFLOOR ON TRANSECT THROUGH EASTERN GROYNE
3
2
1
0
25
50
75
-35
metres

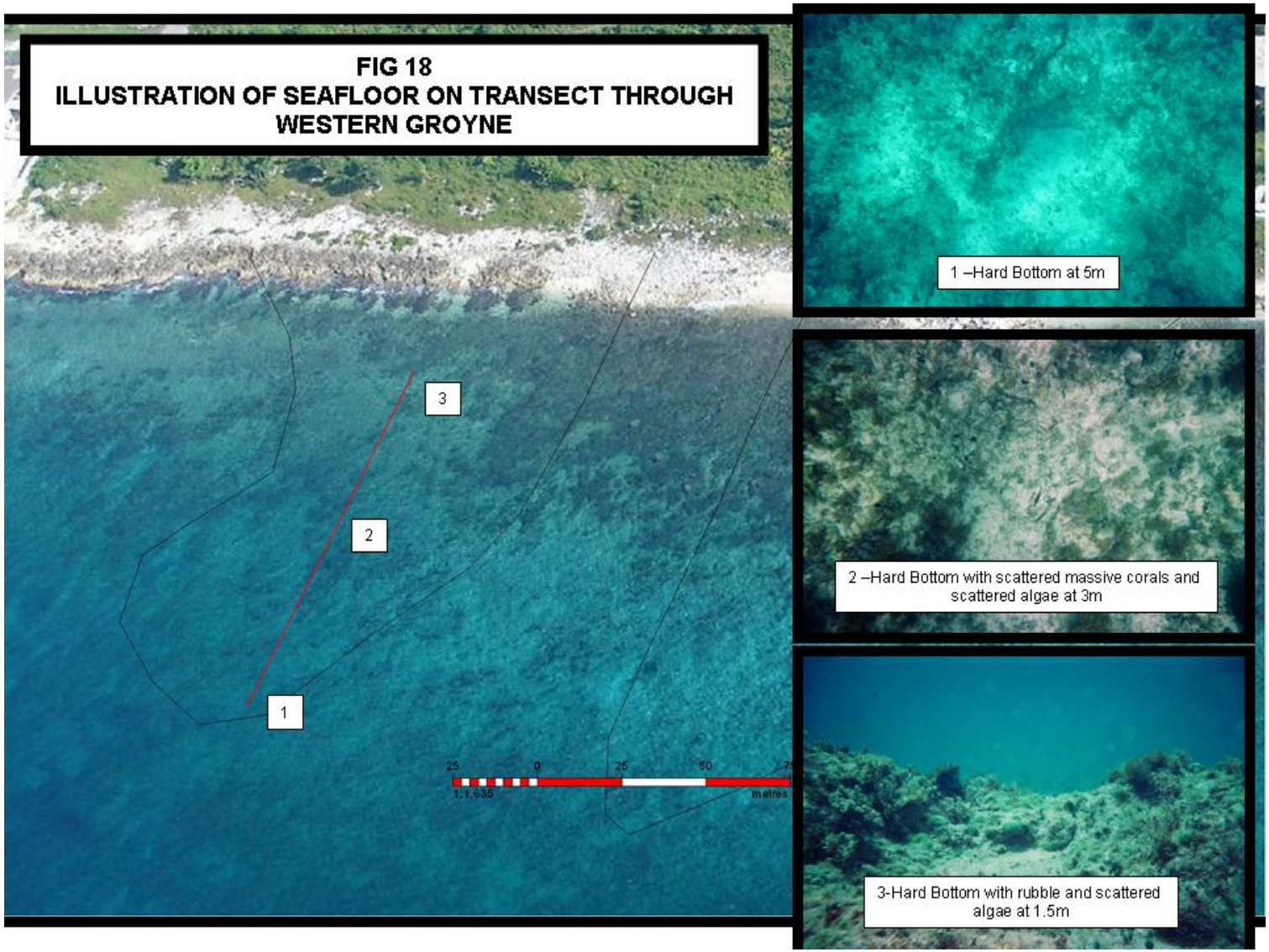
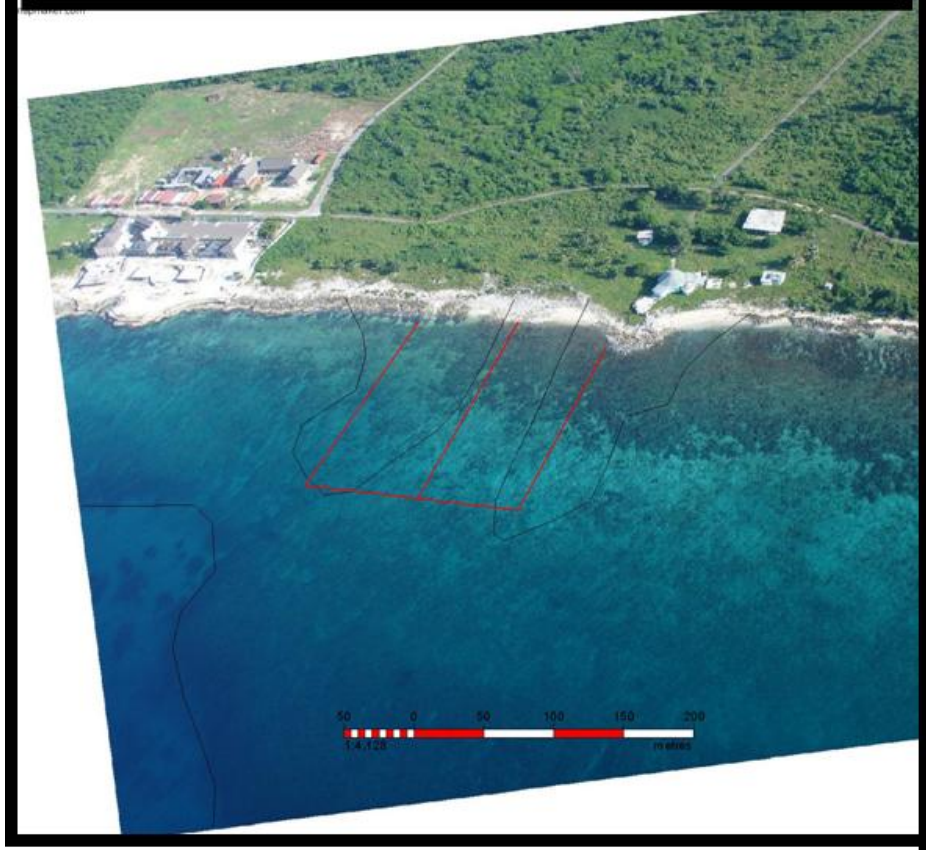


FIG 18
ILLUSTRATION OF SEAFLOOR ON TRANSECT THROUGH WESTERN GROYNE
3
2
1
25
0
25
50
1:1,635
metres
1 –Hard Bottom at 5m
2 –Hard Bottom with scattered massive corals and scattered algae at 3m
3-Hard Bottom with rubble and scattered algae at 1.5m

FIG 19
ILLUSTRATION OF FISH OBSERVED ON TRANSECT THROUGH BOTH GROYNES



material and distributed it adjoining the shoreline. Boring urchins (**see Figure 20 for illustrations**) colonized hard substrates found within this shallow zone.

Some coral recruitment was evident in the survey area, with observations of juvenile Smooth Startlet Coral recruits being made **(see figure 21**).

Fish data, as surveyed in the field (**see survey transects on figure 16**) were summarized as outlined in **Figure 22**. The AGRRA method for fish census is biased towards fish types that are direct herbivores and those that are of commercial value. While they were not censuses in the transect surveys, the roving surveys revealed that the most commonly observed fish types within the survey area were juvenile Damsel and Sergeant Major Damsel fishes and juvenile Wrasses (illustrated on **Figure 23A-C**).

3.5 Seafloor Topography

Depth contours interpolated from spot depths taken during the glass bottom boat survey have been outlined on **Figure 24**, while cross sections illustrating the shape of the seafloor, have been outlined on **Figure 25**. This information suggests that the footprint of the proposed groynes and marine access channel lie within water depths of 0 to 7.4 meters.

Measurements of the area of the footprint of the groynes and channel area combined were estimated with GIS at 3.2 hectares. The surface area of the channel was estimated at 0.98 hectares. With a channel design depth of 7 meters and a volumetric shape approximating a triangular wedge (deduced

FIG 20
ILLUSTRATION OF ROCK BORING URCHIN OBSERVED AT THE NEARSHORE ENVIRONMENT AT DEVELOPMENT SITE

TAKEN FROM THE WEB

FIG 21
ILLUSTRATION OF JUVENILE SMOOTH STARLET CORAL

ITAKEN FROM THE WEB

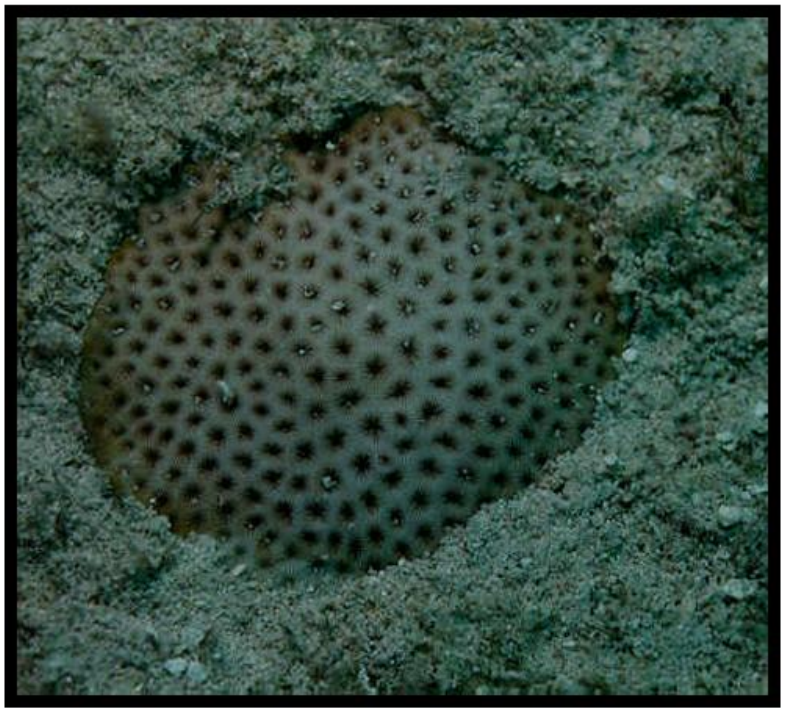


FIG 22
AGRRA Data for Transects conducted in proposed footprint of groynes for Marina.
Total Survey Area 778m²

(RESULTS FOR DRUMVILLE COVE IN RED AND HOMER'S COVE IN BLUE

Doctor/Surgeon Fish		Parrot Fish		Grunts		Snappers		Groupers	
#/100 m²	Length	#/100 m²	Length	#/100m²	Length	#/100 m²	Length	#/100 m²	Length
16	<10cm	13	<10cm	0	-	0	-	0	-
3	8.2	10.8	13	3	15.3	0	-	3.5	15.5
9.7	5.4	22	12.9	0.5	20.5	0	-	1	15.5

FIG 23A
PHOTOGRAPH SHOWING ACTUAL FISH OBSERVED ON AGRRA TRANSECT AT DEVELOPMENT SITE

1. Sergeant Major Damselfish
2. Doctor Fish
3. Parrot Fish
4. Bluehead Wrasse (female)

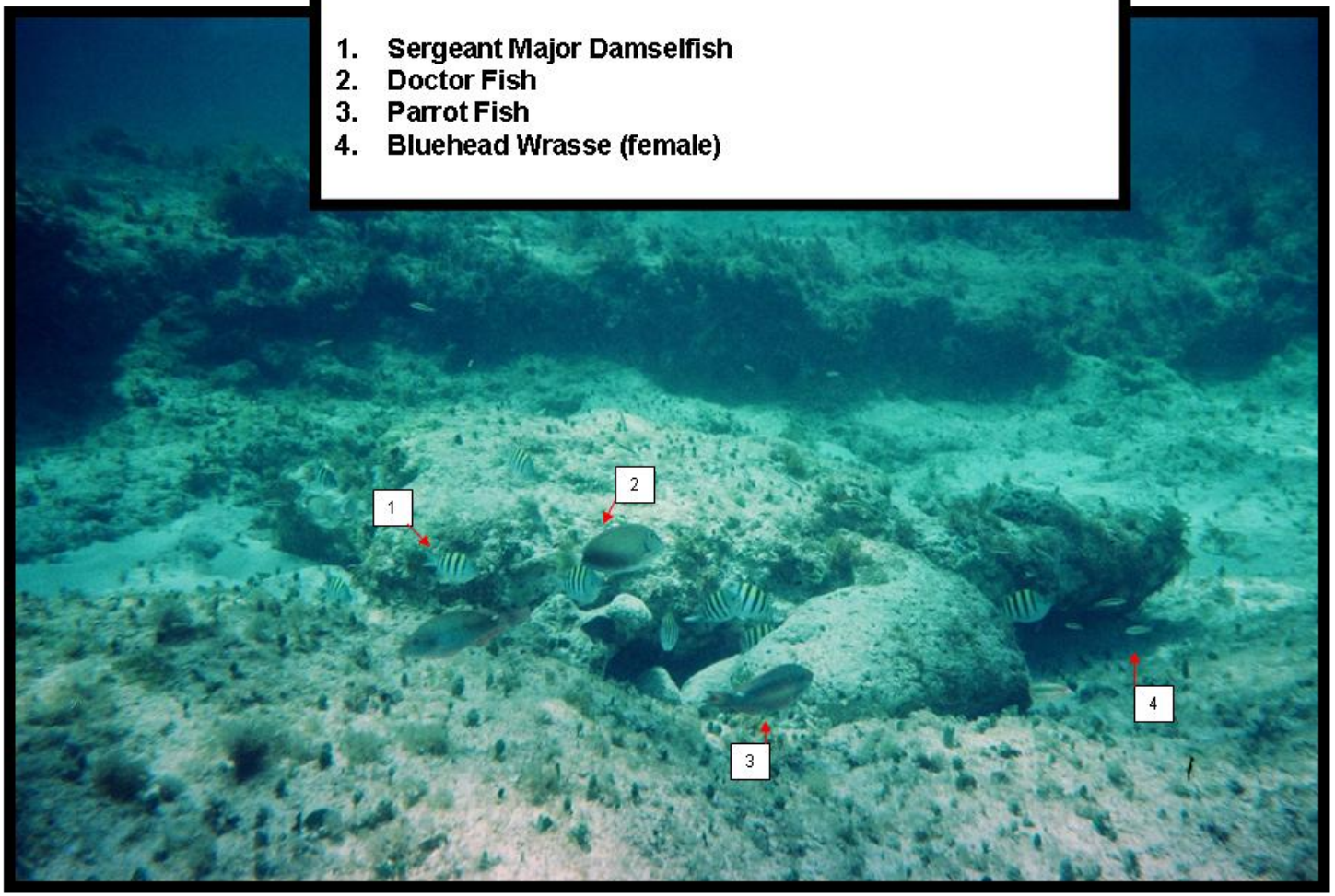


FIG 23B
PHOTOGRAPH SHOWING ACTUAL FISH OBSERVED ON AGRRA TRANSECT AT DEVELOPMENT SITE

1. **Sergeant Major Damselfish**

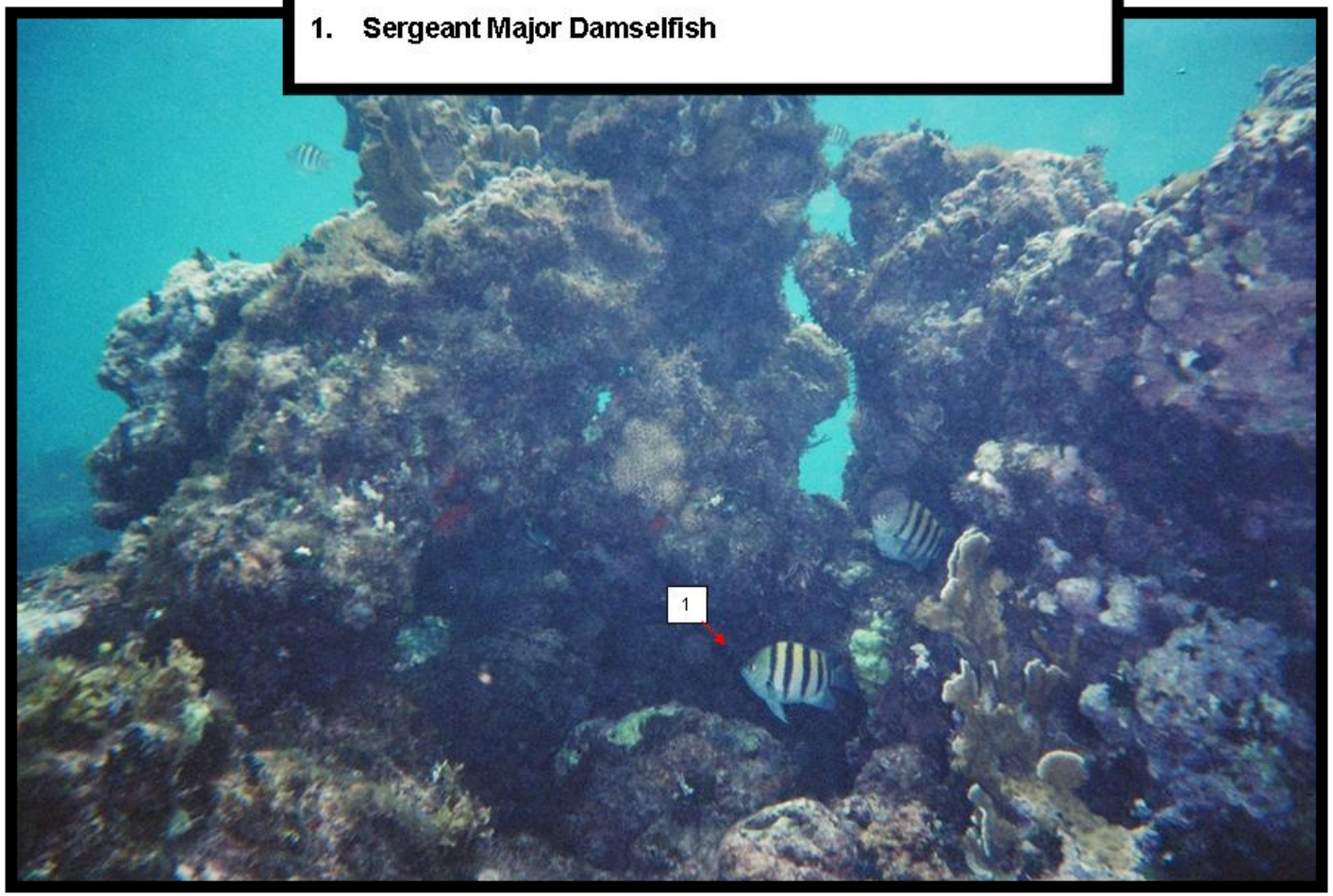


FIG 23C
PHOTOGRAPH SHOWING ACTUAL FISH OBSERVED ON AGRRA TRANSECT AT DEVELOPMENT SITE

1. Sergeant Major
2. Damsel Fish
3. Wrasse

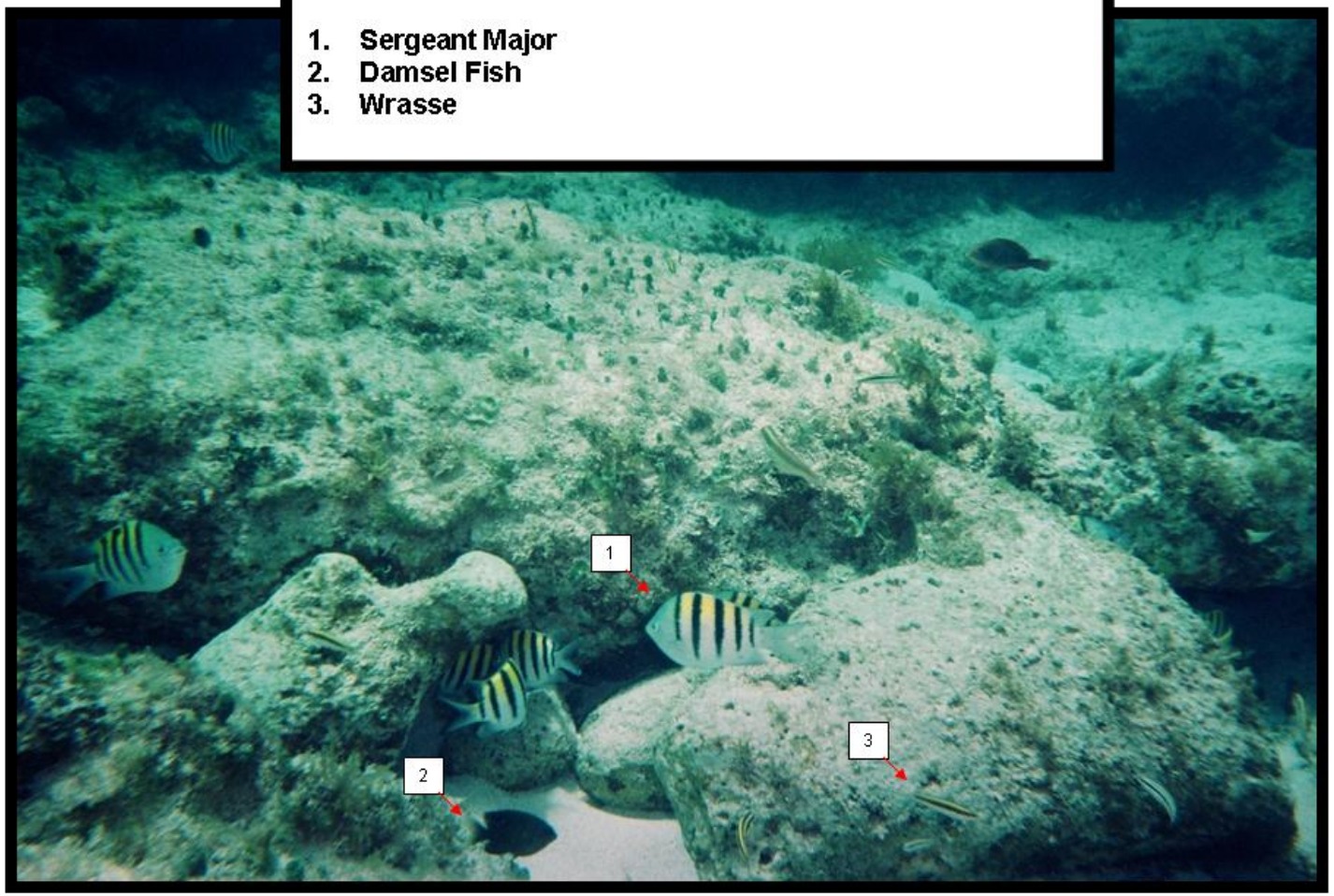


FIG 24
ILLUSTRATION OF SPOT DEPTHS AND APPROXIMATE INTERPOLATED DEPTH CONTOURS FOR THE SEAFLOOR AT THE DEVELOPMENT SITE

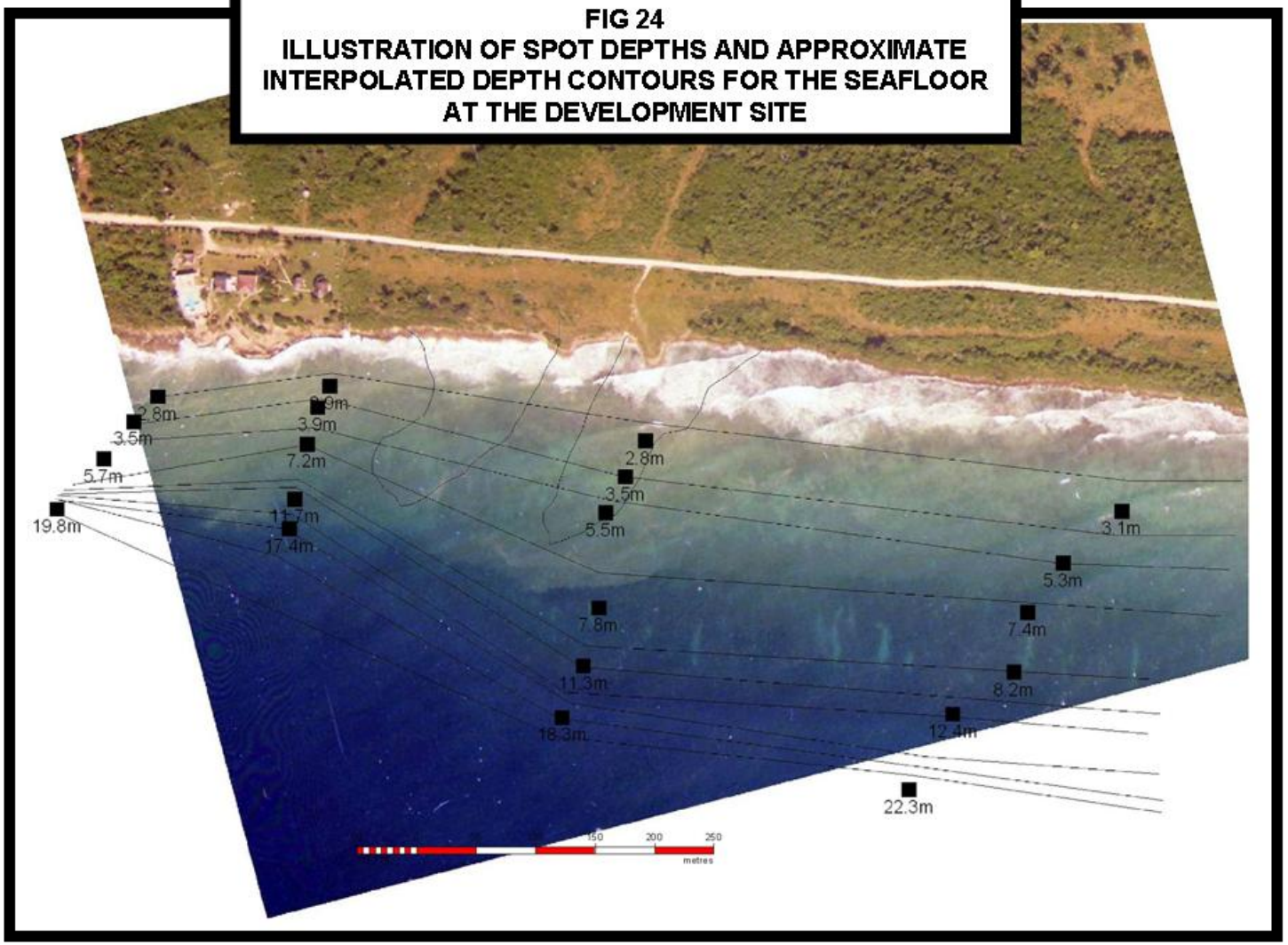
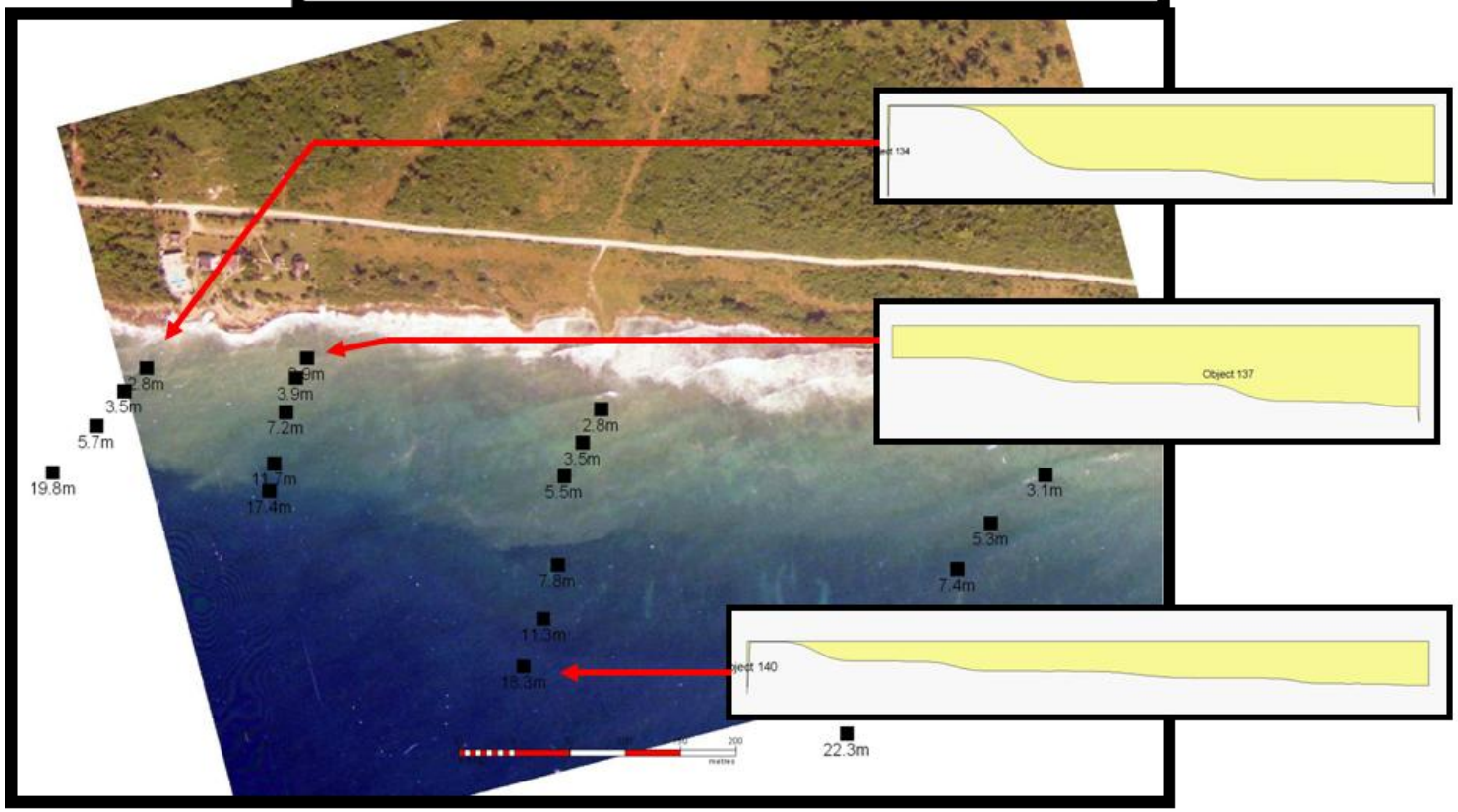


FIG 25
ILLUSTRATION OF SPOT DEPTHS AND CROSSECTIONS FOR THE SEAFLOOR AT THE DEVELOPMENT SITE



from **Figure 25**), the volume of material to be dredged from the seafloor was estimated at 18,365 cubic meters.

3.6 Conclusions Reef Resources Status:

The percentage cover results observed for the study area are indicative of a reef undergoing severe coral stress. The main sources of stress at this location were not immediately evident; however, there were strong signs of coastal wave impacts onshore, which were probably caused by Hurricane Ivan in 2004 and Emily in 2005. It is possible that the reef may have been significantly damaged by these tropical disturbances.

Fish populations observed on the reef also indicated conditions of stress, with none of the top reef predators and very few herbivores being observed. This is possibly indicative of chronic over fishing, which may have been further exacerbated by reef damage due to tropical disturbances.

Comparing both benthic and fish population results with the AGRRA results obtained for both Drumville and Homer's cove sites lead to the opinion that the Negril Peninsula Resort site was "worse for wear" where its fisheries resources were concerned. However, it must be noted that the 2000 AGRRA sites were surveyed in water depths deeper than that surveyed for the proposed development site. Additionally, the development site was surveyed after two particularly severe weather events had impacted the site.

Having declared that the reef was stressed, it was encouraging to observe the new coral growths in the shallower portions of the reef area. It is anticipated that, by association and extension, that this was a condition of regrowth that extended to the entire fringing reef system.

3.7 Implications for Development – Impacts:

It is envisaged that, while the combined excavation works associated with the construction of the marina and pocket beaches is extensive (in excess of 450,000 m^3 of material to be removed), the overall physical impact on the marine impact will be negligible, **provided that** the works are indeed conducted behind the shoreline. It is, however, foreseen that short term turbidity or sedimentation impacts to the marine environment could occur once the accesses to the marine environment are constructed and if control of the movement of seawater into the excavated areas is not carefully regulated[18].

It was noted that the marina construction proposal calls for the construction of two large groynes seaward of the shoreline and that dredging will be required to facilitate vessel drafts of 17 ft (5meters). The total area of footprint is estimated at 3.2 hectares and surveys conducted within the footprint of the proposed groynes and the proposed access channel. However, the numbers of coral individuals observed within the designated

[18] Having said the above, an assessment of the terrestrial environmental components of the development and the possible impacts that the marina and beach construction works could have on terrestrial flora and fauna was outside of the scope of this assessment report. Such an evaluation will have to be made within the context of a terrestrial assessment, with identifications of possible impacts being made.

development area have lead to the opinion that marine excavation works can be done within this reef area.

3.8 Possible Mitigations:

A listing of possible mitigations that should be implemented at the marina and beach development site has been outlined below:

3.8.1 Seafloor Resource Impacts due to Groyne Construction / Dredging:

The methods of coral removal and relocation adopted for the Port Authority's Rackhams Cay dredging exercise conducted in 2001 can be implemented to safeguard the health of any live coral or other benthic resources found within the footprints of the groynes and access channel areas.

This will entail the following:

1. Mapping, quantification and tagging of all significantly sized marine benthic items[19] found within an area of concern defined around the proposed marina groyne and dredging works location. This area encompasses approximately 3.2 hectares of seafloor.

2. The identification of locations to which these resources can be relocated. It is fortunate that the reef system on which the

[19] For the Rackhams Cay relocation effort, the decision made was that all massive (boulder) corals of a minimum diameter of 10 cm would be removed and relocated. Corals were defined as the priority benthic resource to be removed, along with any mobile benthic organisms, such as Urchins that were in the area.

construction works is proposed extends to the east and west of the development area and is additionally within the same depth range. Relocation of coral items can be effected within close range of the area to be developed, preferably at an up-current location to prevent any turbidity or sedimentation impacts from affecting the newly relocated items.

3. The utilization of the same methods for removing, transporting and replanting benthic items prior to construction, as outlined by the regulating Agency for the Rackhams Cay project. These have been documented within the EIA prepared for the project and include:

    - The use of power tools to cut the resources away from the reef substrate, leaving a buffer of a minimum of 10 cm from the live component to facilitate handling.
    - The transportation of the items in containers underwater, preventing excessive exposure to the sun and drying.
    - The replanting of the item on an equivalent hard substrate with the use of either marine cement or epoxy – ensuring that spacing equivalent to that existing at the site of removal is maintained.
    - The preparation of the cut faces of the access channel in such a fashion that it will provide additional substrate surface area for recolonization by corals, for example, through the addition of artificial reef structures (see Artificial Reefs Inc[20].)

[20] www.artificialreefs.com

4. The use of silt curtains and the timing of coastal works with periods of calm sea conditions will be critical.

3.8.2 Seafloor Resource Impacts due to Marina / Beach Construction:

Mitigations are listed below:

1. Excavation impacts on the waterline will have to be guaranteed, through an adherence to a construction setback from the foreshore. GIS measurements suggest that a 10 meter excavation setback from the foreshore could be feasible. This setback would exempt the access ways to be ultimately built to facilitate boat access and flushing to the facilities being created.
2. Excavation and full construction works will have to be achieved prior to the creation of openings in the foreshore to allow seawater entry.
3. Controlled flooding of the excavated areas must be implemented to allow for the introduction of water without sediment outflow. It therefore means that the process of creating sea accesses must be done at a pace that will allow for the settling of sediments suspended by the filling of the excavated areas.

4. Further to point 3, the use of silt curtains and the timing of coastal works with periods of calm sea conditions will be critical.

CHAPTER 3

3.9 Storm Surge Assessment Report

3.9.1 Introduction

The shoreline of the Negril area was impacted significantly by the passage of Hurricanes Ivan (2004) and Emily (2005). Technical assessments conducted by NEPA in 2005 after the onset of Hurricane Ivan suggested that storm waves extended inland for distances in excess of 30 meters at locations along the Long Bay waterfront[1]. Additionally, wave impact resulted in considerable sand movement from the beaches at both Long and Bloody Bays in Negril.

The Jamaican planning guidelines for coastal development speak to distances from the shoreline from which buildings should be set back. These setbacks would assist in ensuring the structural integrity of coastal buildings in the event of hurricane generated waves and are based on shoreline steepness, with setbacks of 7.6 meters for shorelines of a 1:1 slope[2] or steeper, 15.2 meters for shorelines of a 1:4-1:20 slope and 30.5 meters for shorelines of 1; 20 and gentler[3].

[1] Pers Comms Ainsley Henry and Sean Green, IWCZM Branch NEPA.
[2] Slope steepness can be represented as angles relative to the horizontal, or as in this case, height increased per horizontal distance traveled. Hence, a 1:20 slope would mean one that increases in height by one unit for every 20 units of distance traveled.
[3] Adapted from www.oas.org/cdmp/document/kma/mobay/mobaysum.htm

It is worthy to note that an alternative approach to the use of setbacks was adopted for a large hotel development at Glistening Waters in Falmouth, Trelawney. This development was proposed for a peninsula of land that would have been inundated with storm waves from hurricanes of strengths weaker than that experienced during Hurricane Ivan, or during the landmark hurricane event for the north coast, Hurricane Allen[4]. Approval was granted for the implementation of the development with coastal facing structures being elevated on pilings above the predicted storm surge heights for a category 5 Hurricane (3.5 meters).

With both setback techniques in mind, information was collected for the Negril Peninsula Resort shoreline, with a view to determining the following:

1. The shoreline slope character, to determine the Planning setback limit that would be stipulated for the site.
2. The extent to which storm surge run-up from either or both Hurricanes Ivan and Emily extended inland at the development site.
3. The rendering of setbacks and run-up distances for points 1-2 on aerial images of the development site to facilitate comparisons.

(as illustrated on Figure 26)

The information outlined in 1-3 above would then be used to guide the positioning of buildings relative to the shoreline and to guide the design of coastal buildings to mitigate against possible surge damage.

[4] Both hurricanes were Category 5 systems while passing offshore the island.

3.9.2 Shoreline Slope Character Determination

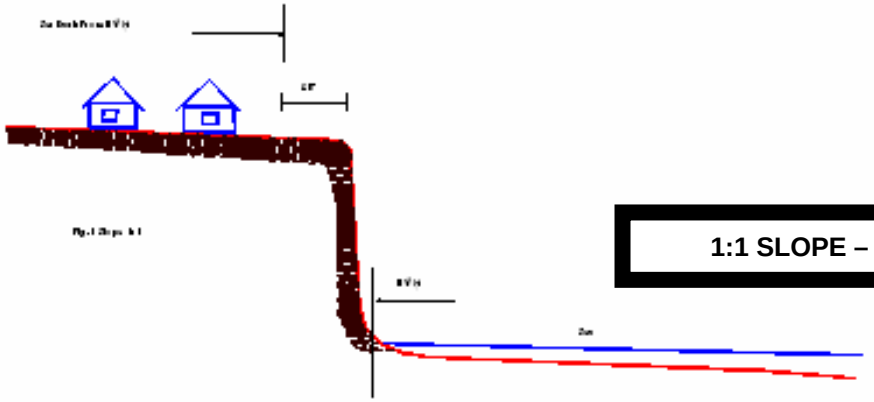
3.9.2.1 Shoreline Character - General Description

The shoreline bordering the Negril Peninsula Resort development site was characterized as a raised reef structure and had a uniform elevation and slope (as **illustrated on Figure 8 previously**). This raised reef structure was overtopped in areas with coral rubble and sand pockets.

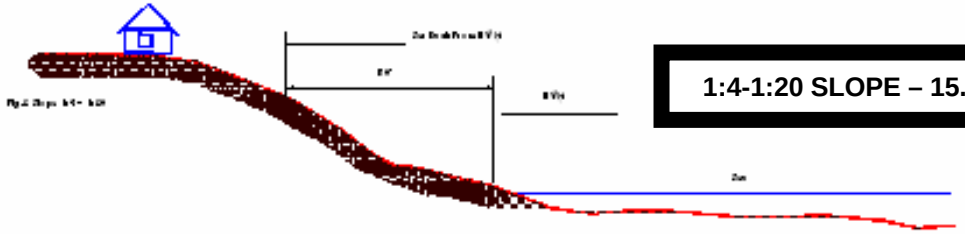
There were two areas of beach on the property, which (it is assumed) were created from the removal of pre-existing raised reef structure to create areas favorable for the run-up of waves, with subsequent sand deposition (**see figure 27**). This condition was further enhanced by the presence of two groynes that had been constructed at the site, apparently to create sand retention conditions for the created beaches (**see figure 27**). It will be apparent that the groynes outlined on **figure 27** (circa 2000) is not on the more recent image in **figure 28** (November 2007), which shows what appears to be the wave-impacted remnants of one of these groynes.

FIG 26
TOWN PLANNING DEPARTMENT COASTAL SETBACK GUIDELINES

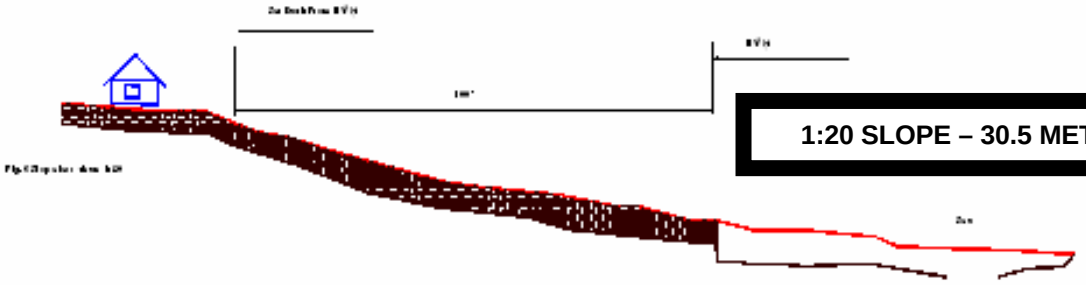
ADAPTED FROM www.oas.org/cdmp/document/kma/mobay/mobaysum.htm



1:1 SLOPE – 7.6 METERS



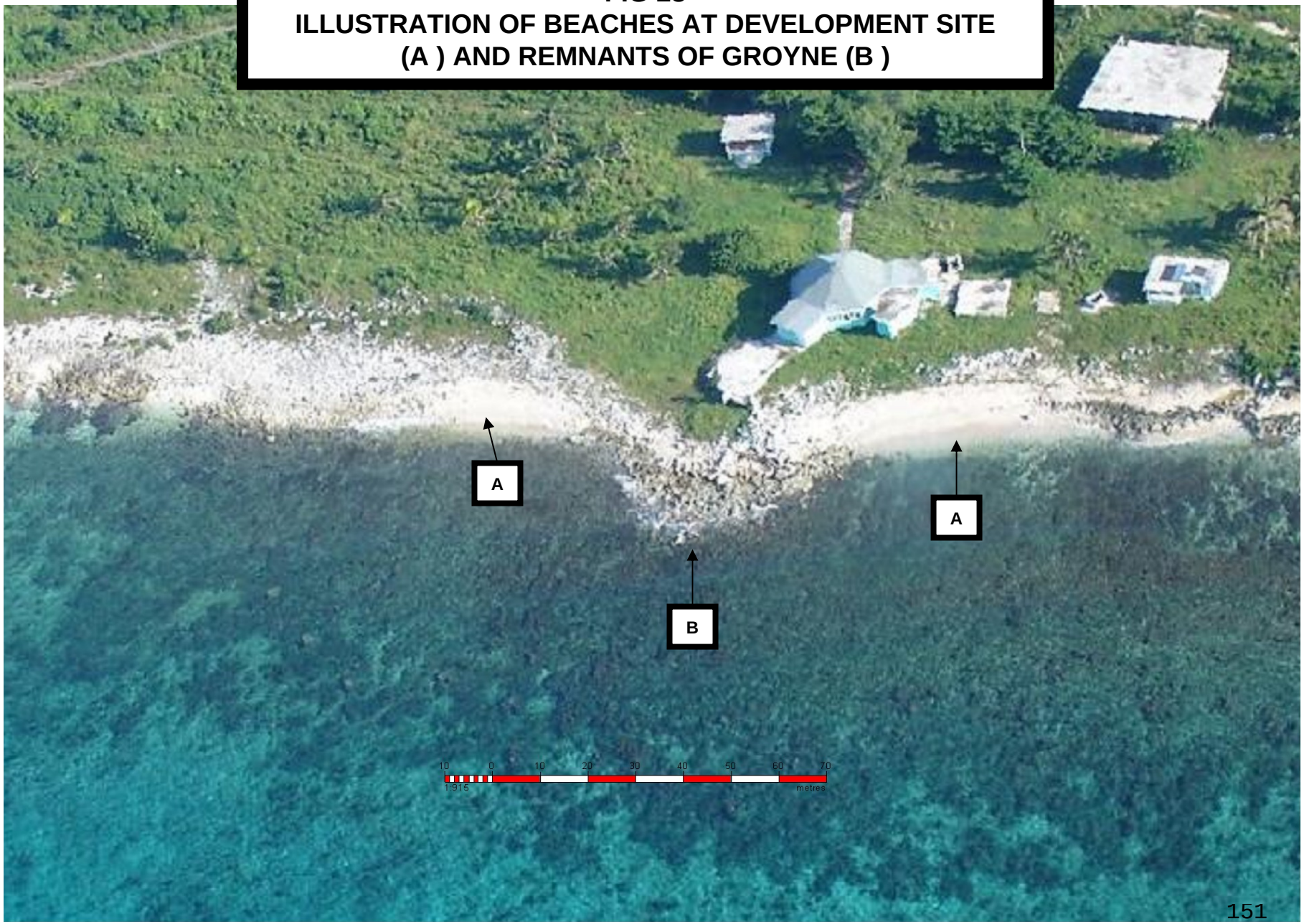
1:4-1:20 SLOPE – 15.2 METERS



1:20 SLOPE – 30.5 METERS

FIG 27
ILLUSTRATION OF GROYNE PREVIOUSLY EXISTING AT THE DEVELOPMENT SITE (A) AND BEACHES APARENTLY CREATED THROUGH THE REMOVAL OF BEACH ROCK (B)

FIG 28
ILLUSTRATION OF BEACHES AT DEVELOPMENT SITE (A) AND REMNANTS OF GROYNE (B)



3.9.3 Slope Characterization – Methods Used

The shape and elevation of the Negril Peninsula Resort shoreline was determined at five roughly equidistant locations by measuring changes in shoreline slope angle. These changes were measured with a Clinometer[5], with the distances between the observed changes being measured with a metric measuring tape (see **Figure 29**). Both angles and distances were then plotted to outline a profile of the shoreline, as illustrated on **Figure 30**.

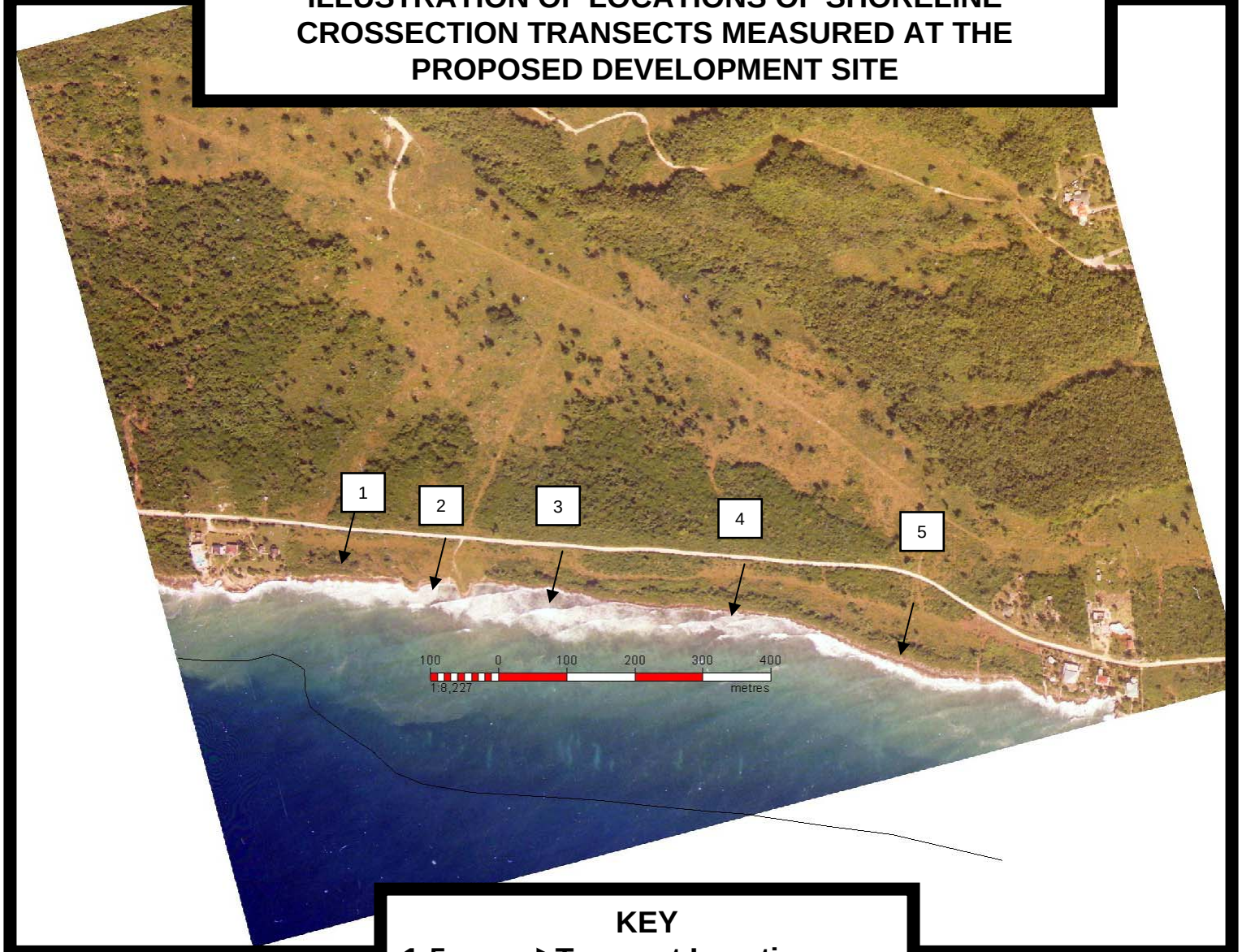
Measurements and angles were obtained with the waterline[6] as the base reference for the profile. From this reference, the height of the various reference points could be ascertained, given the expected height of tide above or below mean sea level at the time of the survey.

With the survey information plotted, the overall slope angle of the shoreline could then be determined and compared with the setbacks outlined in the Town Planning regulations (note **Figure 26**) to determine the planning setback that would be relevant for the location. The plotting of these setback distances on geo-referenced aerial images of the site was then effected through the use of GIS.

[5] A Clinometer is a device that measures angles above (positive angle) and below (negative angle) a horizontal reference. The horizontal reference is established at the height of the observer's eye above ground, with observations being made on a measuring staff at the same height at the observer's eye height.

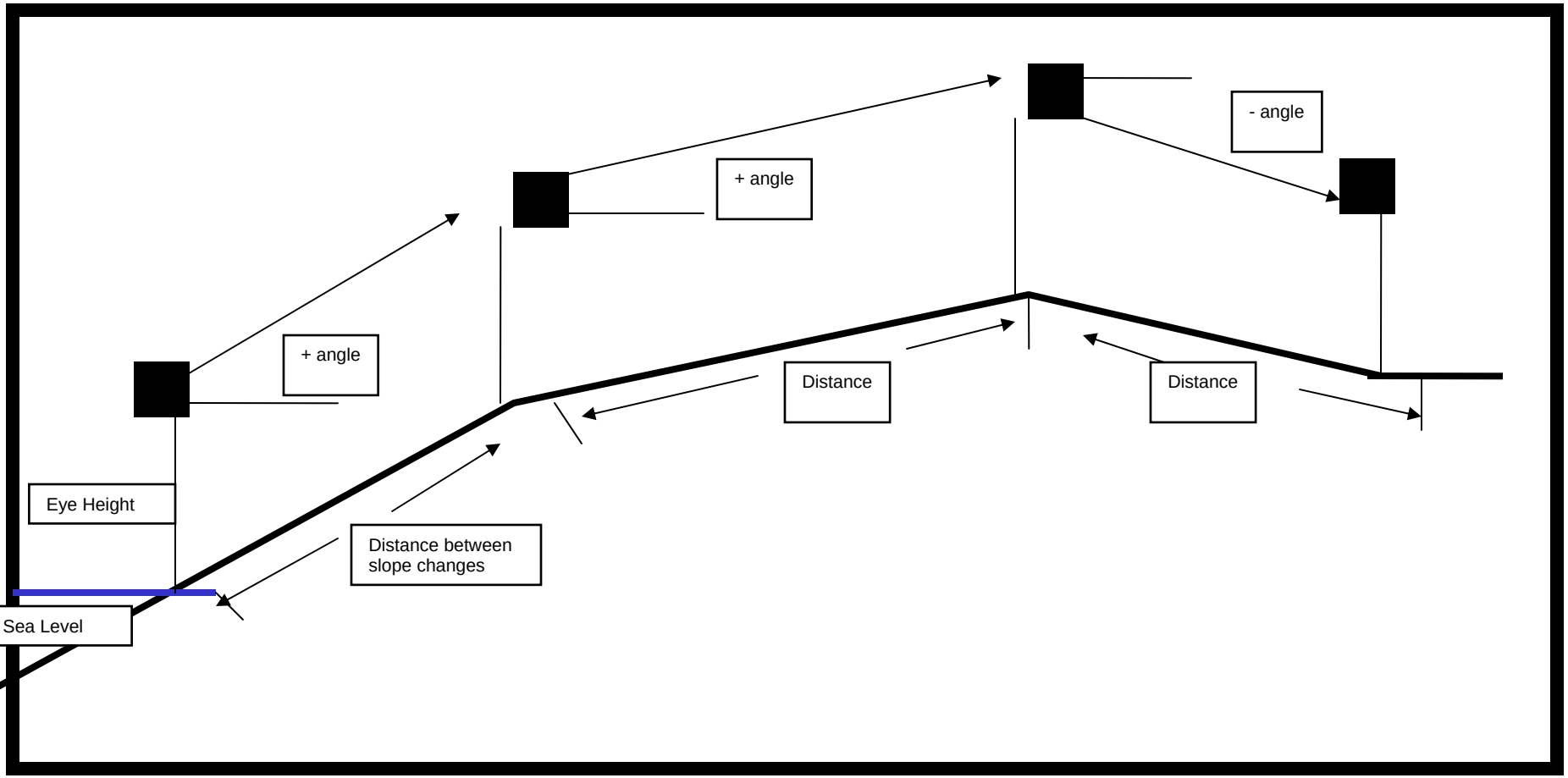
[6] The point of furthest seaward retreat of shoreline waves

FIG 29
ILLUSTRATION OF LOCATIONS OF SHORELINE CROSSECTION TRANSECTS MEASURED AT THE PROPOSED DEVELOPMENT SITE



KEY
1-5 → Transect Locations

FIG 30
ILLUSTRATION OF METHOD FOR MEASURING SHORELINE CROSSECTION



3.9.4 Storm Surge Wave Run-up Distance Determination – Methods Used.

Coral rubble was used as a prominent visual cue for the extent to which storm surge run-up progressed inland. The inland limits of these observed signs of storm surge run-up were initially identified on the low altitude oblique aerial photographs taken of the shoreline in 2007 (see photo sequence on **Figures 31A-E**). Field confirmation and mapping of the locations of these cues was then done using GPS, with the positions then being plotted on geo-referenced aerial photographs.

FIG 31A
ILLUSTRATION OF NEAR-SHORE WAVE RUN-UP EVIDENCE ON 2007 OBLIQUE AIR PHOTOS(RUBBLE AND SAND DEPOSITS WHITE IN APPEARANCE, LIMIT IN RED)

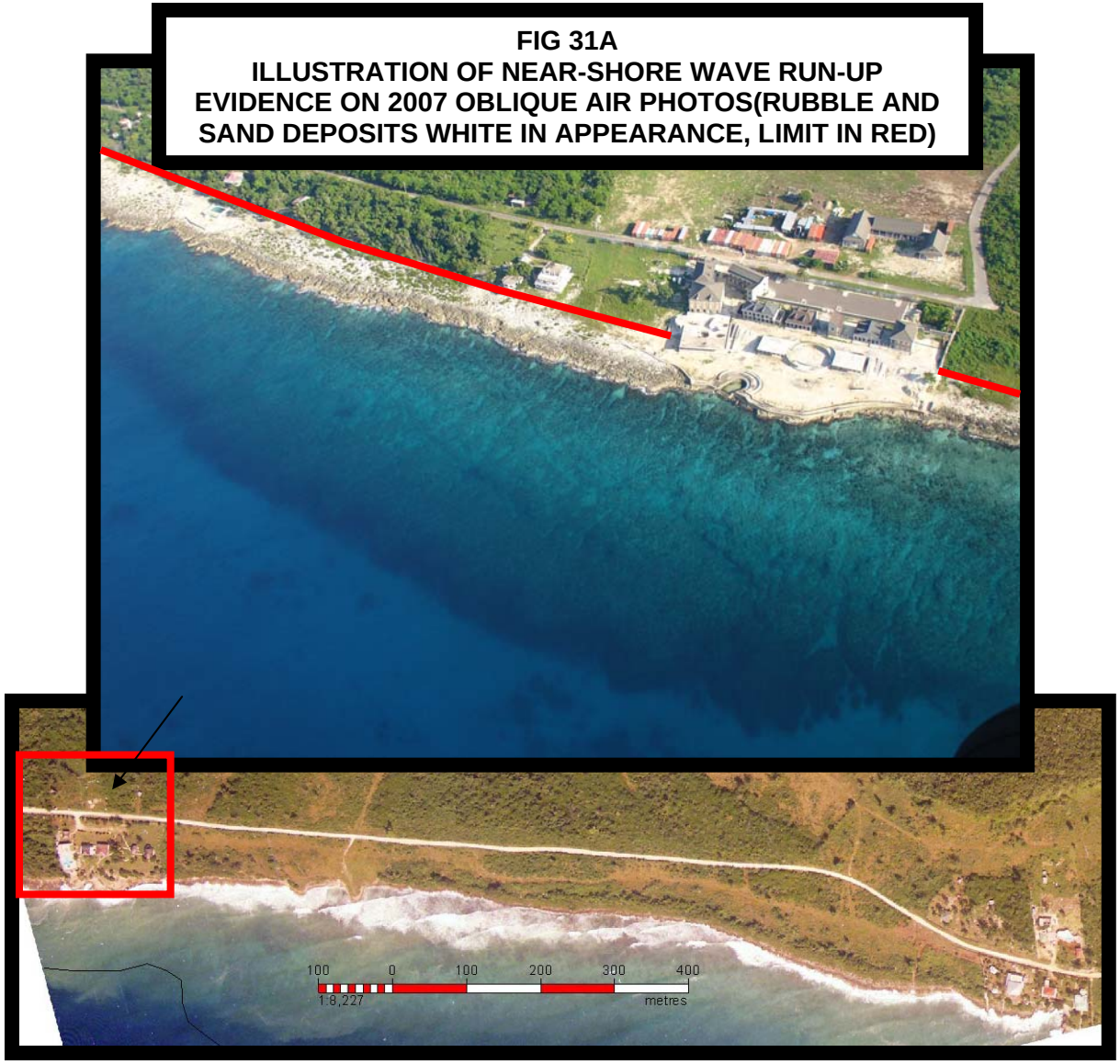


FIG 31B
ILLUSTRATION OF NEAR-SHORE WAVE RUN-UP EVIDENCE ON 2007 OBLIQUE AIR PHOTOS(RUBBLE AND SAND DEPOSITS WHITE IN APPEARANCE, LIMIT IN RED)

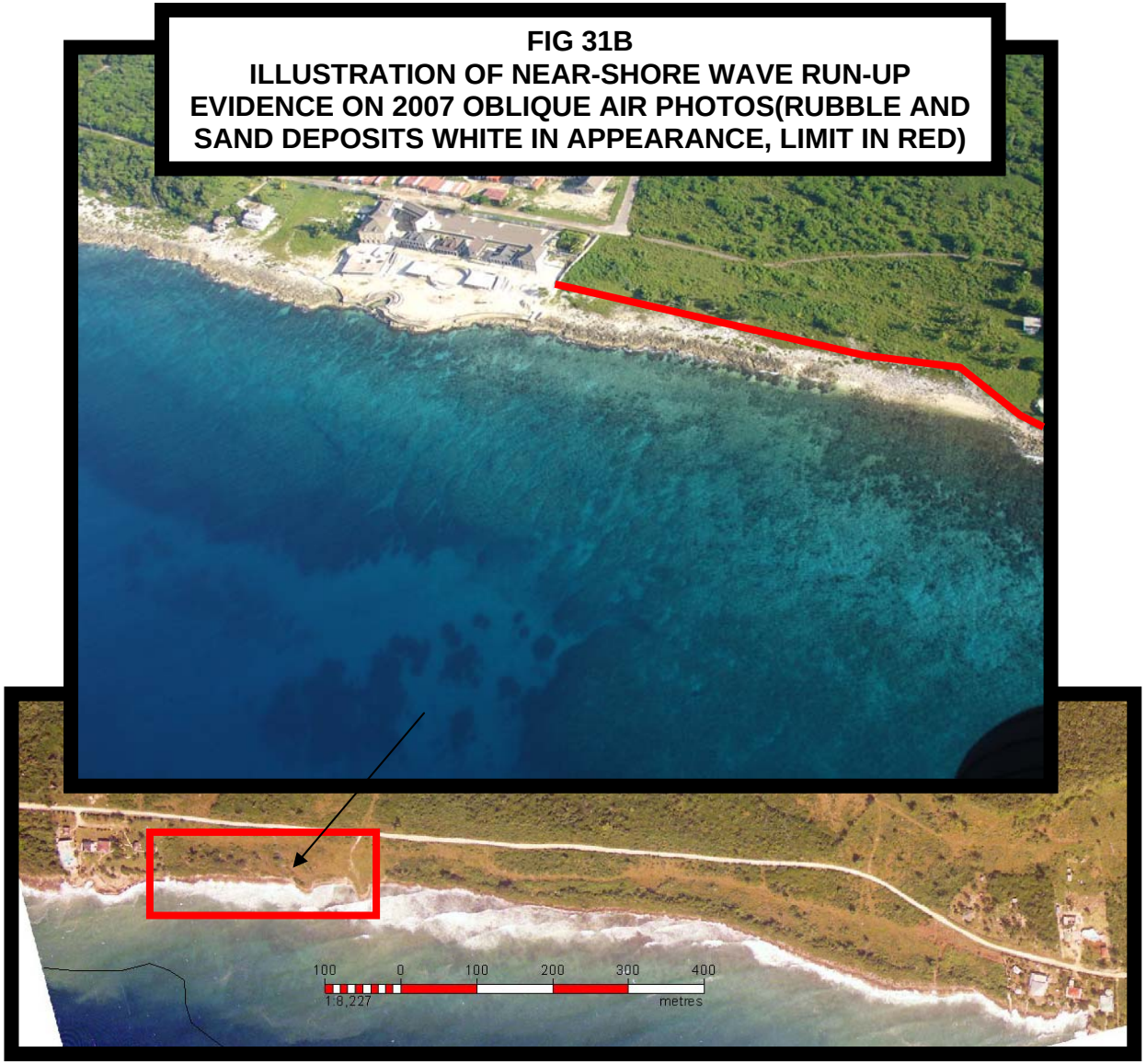


FIG 31C
ILLUSTRATION OF NEAR-SHORE WAVE RUN-UP EVIDENCE ON 2007 OBLIQUE AIR PHOTOS(RUBBLE AND SAND DEPOSITS WHITE IN APPEARANCE, LIMIT IN RED)

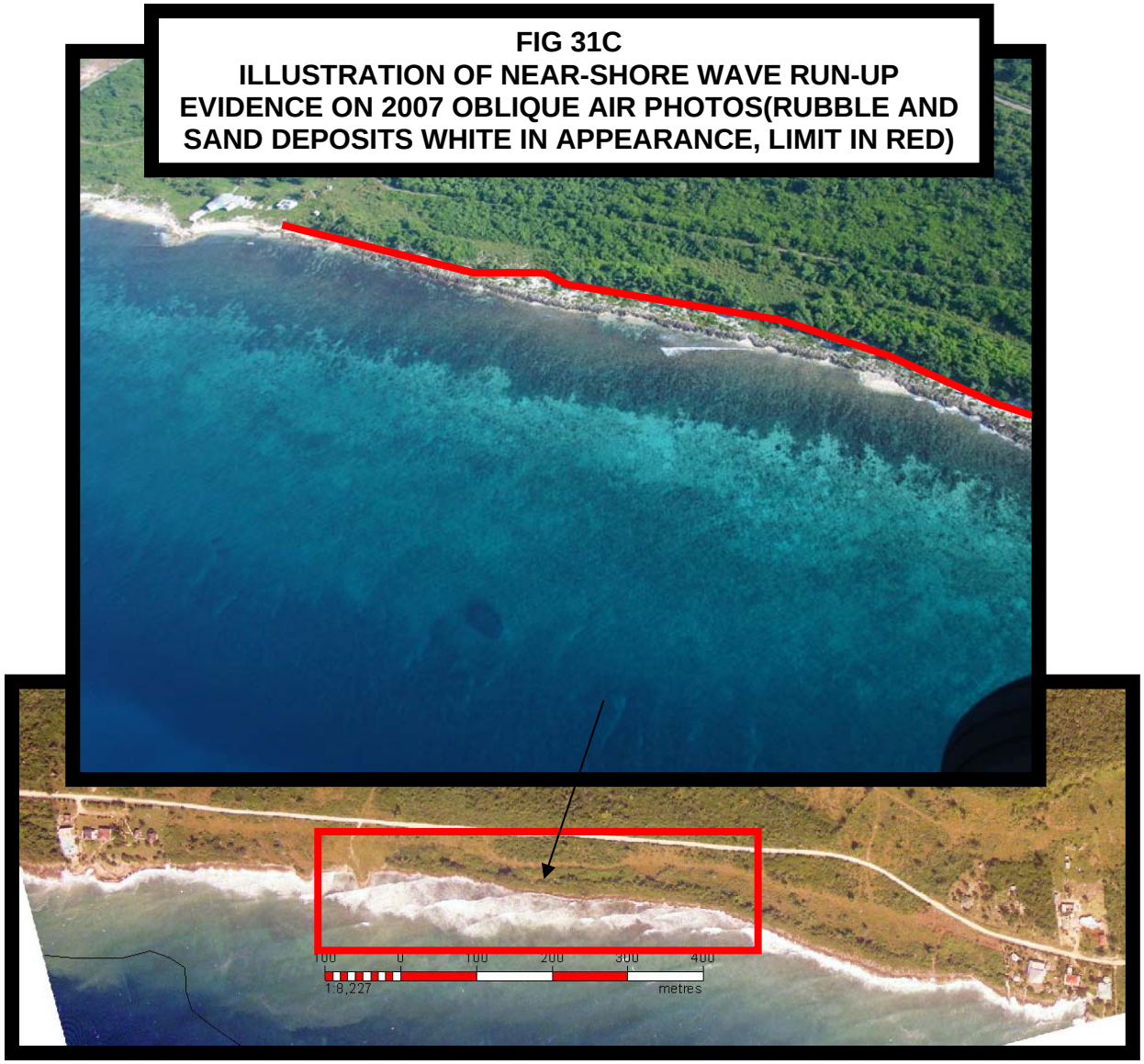


FIG 31D
ILLUSTRATION OF NEAR-SHORE WAVE RUN-UP EVIDENCE ON 2007 OBLIQUE AIR PHOTOS(RUBBLE AND SAND DEPOSITS WHITE IN APPEARANCE, LIMIT IN RED)

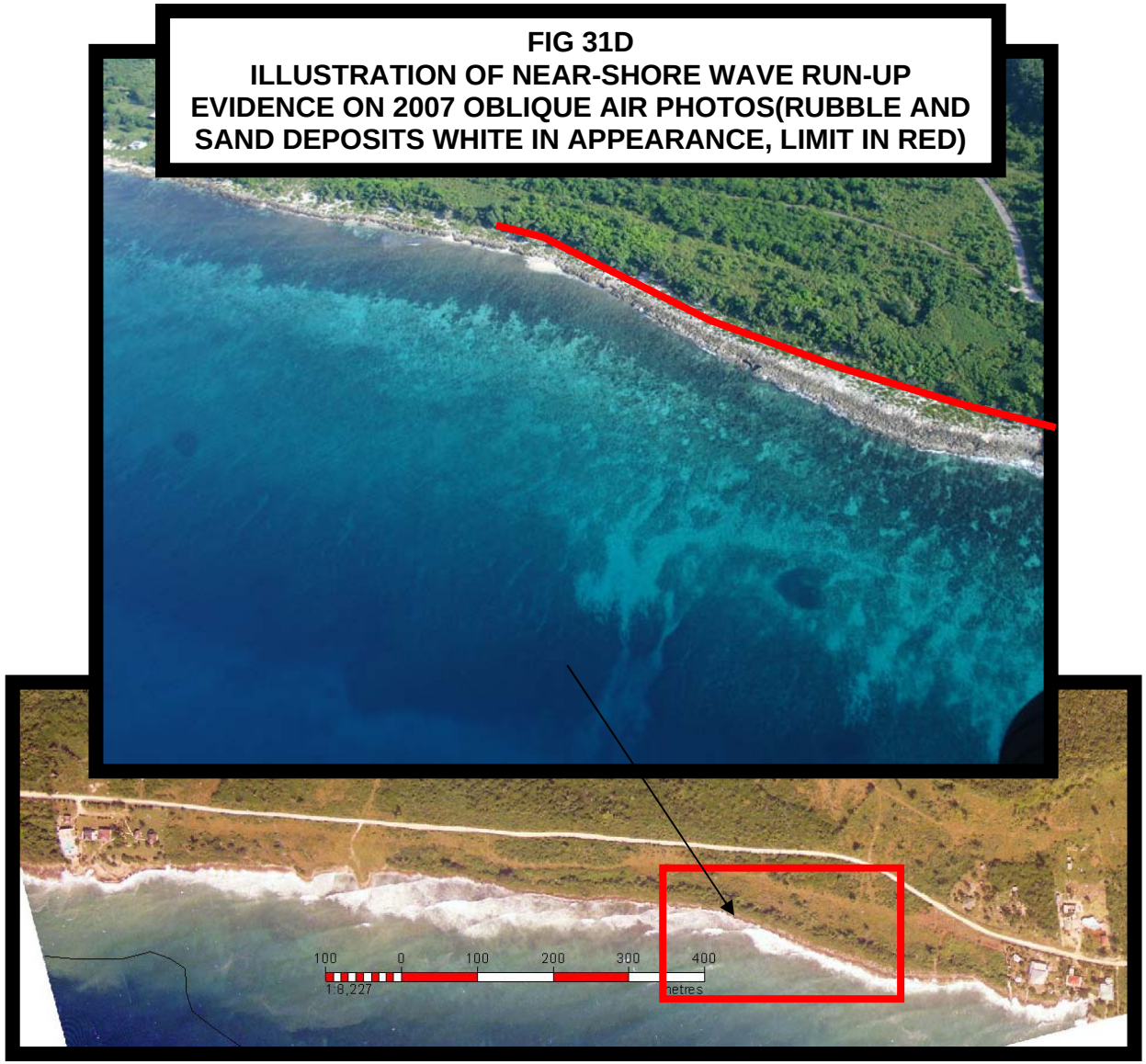
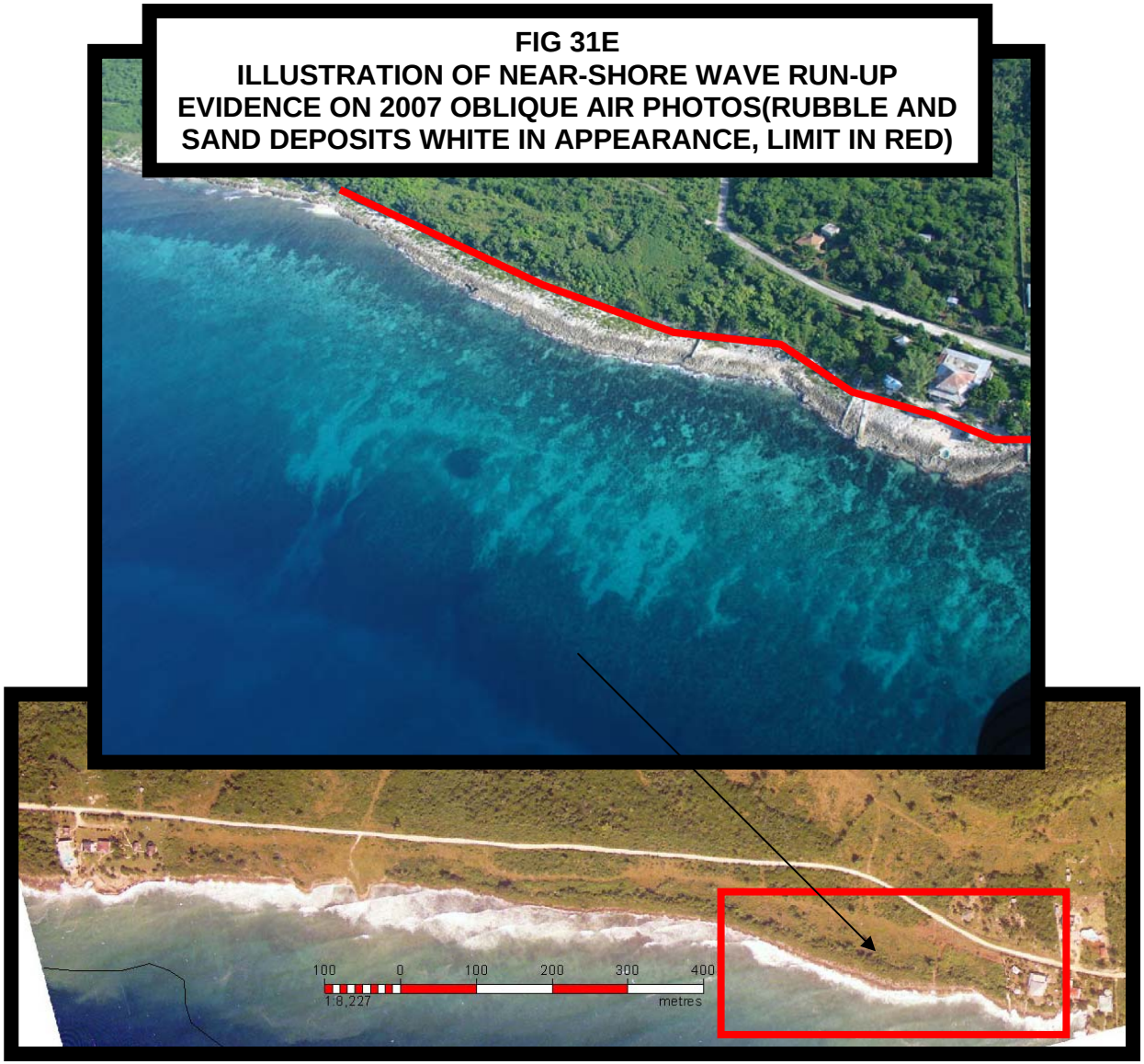


FIG 31E
ILLUSTRATION OF NEAR-SHORE WAVE RUN-UP EVIDENCE ON 2007 OBLIQUE AIR PHOTOS(RUBBLE AND SAND DEPOSITS WHITE IN APPEARANCE, LIMIT IN RED)



3.9.5 Results

3.9.5.1 Planning Setback Plots.

The Negril Peninsula Resort shoreline was determined to fall within the 1:4-1:20 slope category, with a planning setback of 15.2 meters applying. This was determined based on shore line heights of up to two metres as calculated from shore line cross sections drawn for the location. Note that this height would vary plus or minus the height of tide (which was extrapolated from measurements taken at Lucea by Smith/Warner International as being approximately 0.15 metres (footnote 27).The height of the shore line was recorded at distances of up to 30 meters from the water line, leading to a calculated slope angle of 1:15.

This setback distance was plotted on a geo-referenced aerial image of the development **(Figure 32).**

FIG 32
ILLUSTRATION OF NEAR-SHORE WAVE RUN-UP EVIDENCE ON 2007 OBLIQUE AIR PHOTOS(RUBBLE AND SAND DEPOSITS WHITE IN APPEARANCE, LIMIT IN BLACK) ALONG WITH 15.2M PLANNING SETBACK FOR 1:4-1:20 SLOPE (LIMIT IN RED)

3.9.5.2 Storm Surge Evidence Mapping

The observations of rubble distributed on the oblique aerial photographs of the Negril Peninsula Resort site were confirmed in the field. The positions of these observations were illustrated as a storm surge run-up line, also outlined on **Figure 32** for comparison with the planning setback. The maximum recorded near-shore surge limit distance was approximately 30 meters at two locations, one of which was at the western boundary of the property (**indicated on Figure 32 – 29.9m**)

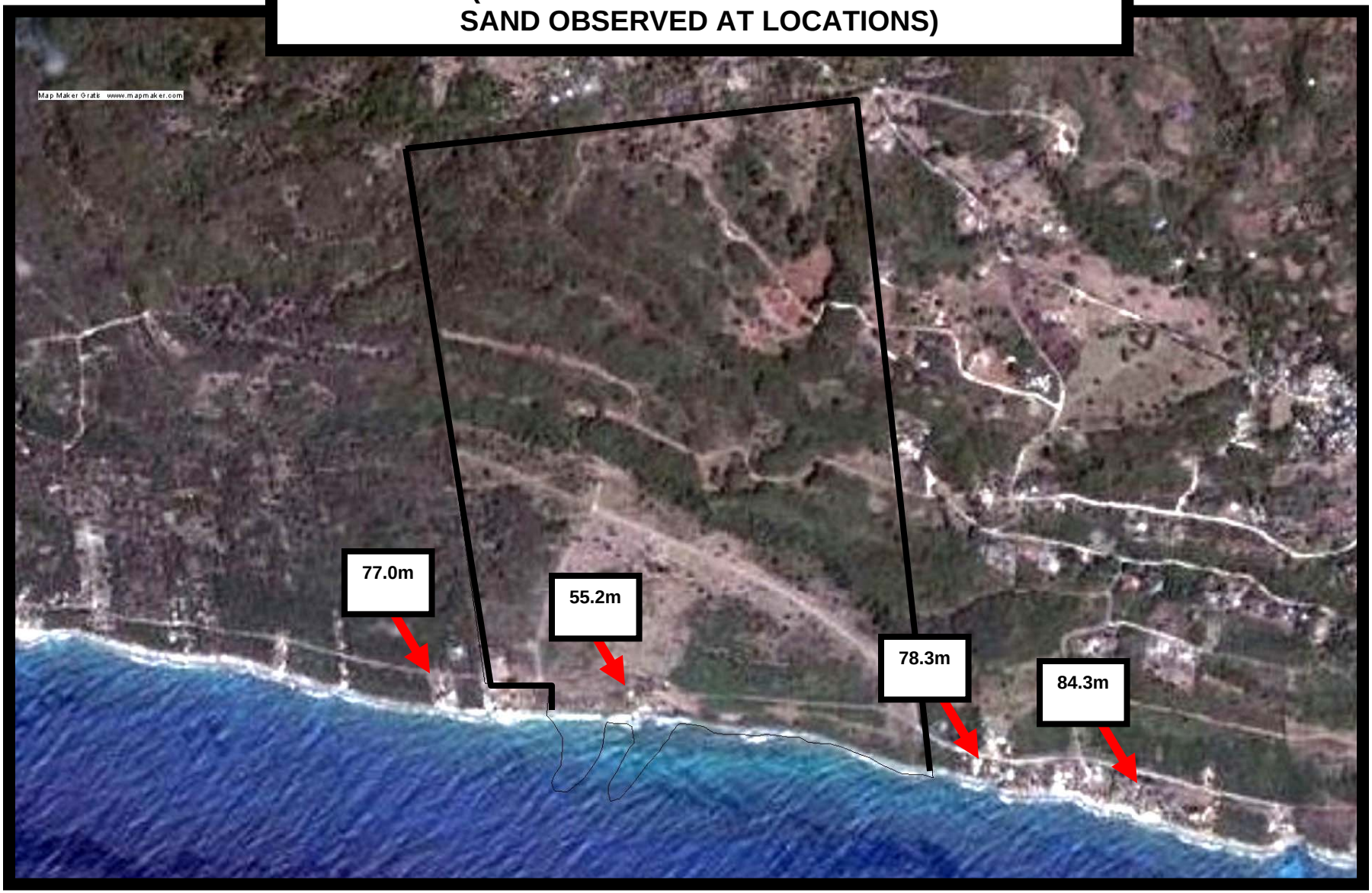
During the field mapping component of the storm surge evaluations, a number of the observations made were located a considerable distance from the shoreline. It became evident during the field component of the surge survey that there were two areas of coral rubble and marine sand deposition at the Negril Peninsula Resort shoreline.

Figure 32 outlined surge material that had been observed within 30 meters of the shoreline. **Figure 33**, on the other hand, illustrates additional observations made along a roadway traversing the property and extending to the east towards Homer's Cove and west back to Negril. It was evident that a surge event had resulted in the transportation of materials to the roadway defined on **Figure 33,** up to **80 meters** inland.

It was also evident that this inland transport coincided with areas where shoreline vegetation had been removed to facilitate development, since these observations were not made at naturally vegetated locations along the roadway alignment. .

Observations made in the field lead to the opinion that wave run-up distances were variable along the shoreline. This variability may have been linked to the presence or absence of shoreline vegetation. The coastal vegetation close to the shoreline appeared to have acted as a wave attenuator, greatly reducing the extent to which the storm wave's transportation force could project inland. This was opined owing to the fact that coral rubble tended to pile up at the seaward limit of coastal vegetation.

FIG 33
ILLUSTRATION OF AREAS OF PROBABLE STORM SURGE INFLUENCE (DEFINED BY CORAL COBBLES AND MARINE SAND OBSERVED AT LOCATIONS)



3.9.5.3 Storm Surge Height Research

Storm surge generated by hurricane systems is composed of 5 components that influence the elevation of seawater above mean sea level. These are as follows[7]:

1. Inverse barometric rise, which is the elevation of the water level due to pressure differences between the "eye" of the Hurricane and surrounding pressure. The reduced pressure in the eye results in the "mounding upwards" of seawater.

2. Wind set-up, which is caused by the horizontal displacement and tilting of seawater due to wind stress

3. Wave set-up, which results from the arresting of the forward motion of wave energy as they break nearshore.

4. Wave Run-up, which results as the waves run up the shore with the energy remaining in its motion after breaking nearshore.

5. Height of tide, which relates to water level changes influenced by the gravitational forces of the Moon and the Sun combined.

[7] Adapted from www.nrca.org/eias/Negril/NegrilCabins_EIA_FinalReport.pdf

Storm surge wave heights calculated for a development in Bloody Bay, Negril[8] indicated predicted wave heights for 1:50 year and 1: 100 year return periods being **2.15 and 2.34 meters**.

[1] Adapted from www.nrca.org/eias/Negril/NegrilCabins_EIA_FinalReport.pdf
[1]www.nrca.org/eias/Negril/NegrilCabins_EIA_FinalReport.pdf

Note, however, that the shoreline approaching the Bloody Bay area has a much gentler profile than that of the Negril Peninsula Resort location, with depths of 4 meters being measured at distances of over 300 meters offshore.[9] These distances were found within 100 meters of the shoreline at Wedderburn and it is likely that the wave climate that would be experienced at this location would approximate more closely the type of conditions that would be experienced at Oyster Bay in Trelawney. Calculations made for a development at that location suggested that storm surge heights of 3.7 meters for a 1:50year event would be experienced. [10]

With these predictions in mind, it is not surprising that storm surge influences were observed, as outlined in Figure 33. This influence may have been attributed to the effects of Hurricane Ivan in 2004, which was predicted as a 1:50 year event.

3.9.5.4 Storm Surge and Planning Setback Conclusions

Based on observations made in the field, it was concluded that the

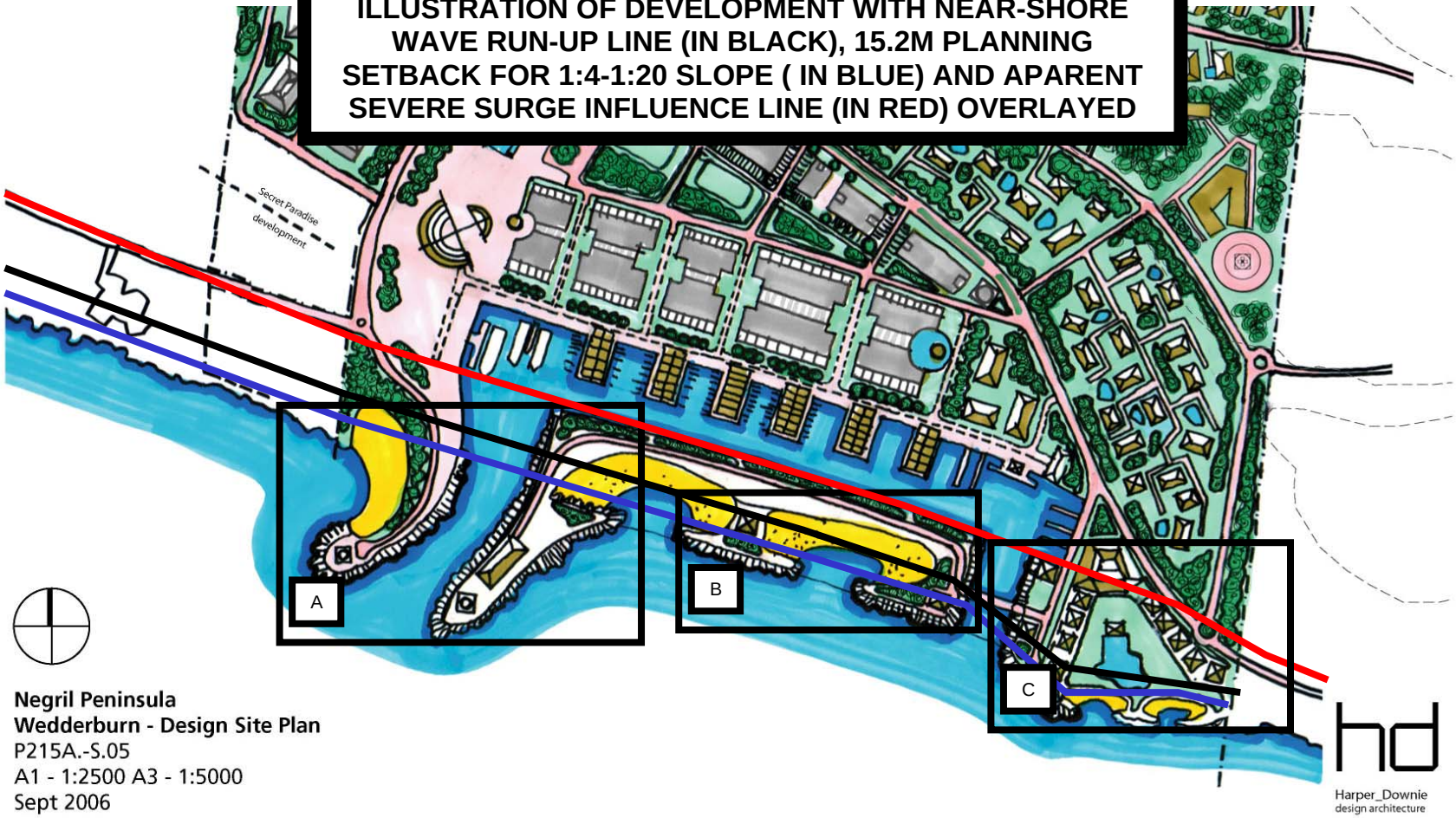
[8]www.nrca.org/eias/Negril/NegrilCabins_EIA_FinalReport.pdf
[9] www.nrca.org/eias/Negril/NegrilCabins_EIA_FinalReport.pdf

[10] www.nrca.org/eias/Trelawny/OysterBay/OysterBayEIA-Report.pdf

near-shore storm surge limit slightly further inland than the Planning Setback for the Negril Peninsula Resort shoreline. However, with evidence of storm surge influence extending up to 80 meters inland, an additional surge line was represented to define areas of the development that could be at risk of storm surge influence. These lines are illustrated on **Figure 34**. It is useful to note that the limits of the inland-most surge limit falls within what will be the basin of the Marina. However, buildings defined within boxes A, B and C on **Figure 34** would therefore be at risk of storm surge influence.

If the suggested 1:50 year surge height prediction of 3.7 meters is used, then it would be incumbent on the developers to design elevated buildings for this wave height. For these structures, engineering solutions, such as the use of elevating pilings, may be an appropriate mitigation measure to be adopted.

FIG 34
ILLUSTRATION OF DEVELOPMENT WITH NEAR-SHORE WAVE RUN-UP LINE (IN BLACK), 15.2M PLANNING SETBACK FOR 1:4-1:20 SLOPE (IN BLUE) AND APARENT SEVERE SURGE INFLUENCE LINE (IN RED) OVERLAYED



CHAPTER 4
HYDROGEOLOGICAL ASSESSMENT STUDY

4.1 Methodology

4.1.1 Baseline Environment

Baseline environmental conditions within the proposed project area were established through data generated from actual site investigations and a review of available literature. (See Appendix IV)

4.2 Hydrology

4.2.1 Background

The proposed Negril Peninsula Resort development will necessitate clearing of vegetation and soil/rock, construction of pavements for roads and the inclusion of roofs and other impervious areas. These are likely to have impacts (storm water drainage pattern and run-off volume) on the hydrological regime of the project area. Some concerns raised were:

1. The adverse change in the run-off characteristics of each drainage area;

- Reduction in base flow due to less infiltration (more paved areas)
- Increase in magnitude and frequency of flood flows
- Increase in flood stages in the low lying coastal basin
- Accelerated erosion of land and debris flows which can aggravate flooding by blocking of culverts and drains

2. Increase in water demand of the hydrologic basin in which the proposed development lies.

3. Possible adverse change in ground water quality resulting from sewage generation and disposal

4. Potential of flooding mainly in lower lying coastal basin area. Danger posed by potential coastal surges. The potential of flooding comes mainly from possible "back-up" of run-off in the low lying coastal basin area (drainage area 3)
5. Improper use of "sink holes" and depression areas and for dumping of solid waste etc
6. Change in ground water quality resulting from increased turbidity during construction and post-construction stages.

4.2.2 Objectives

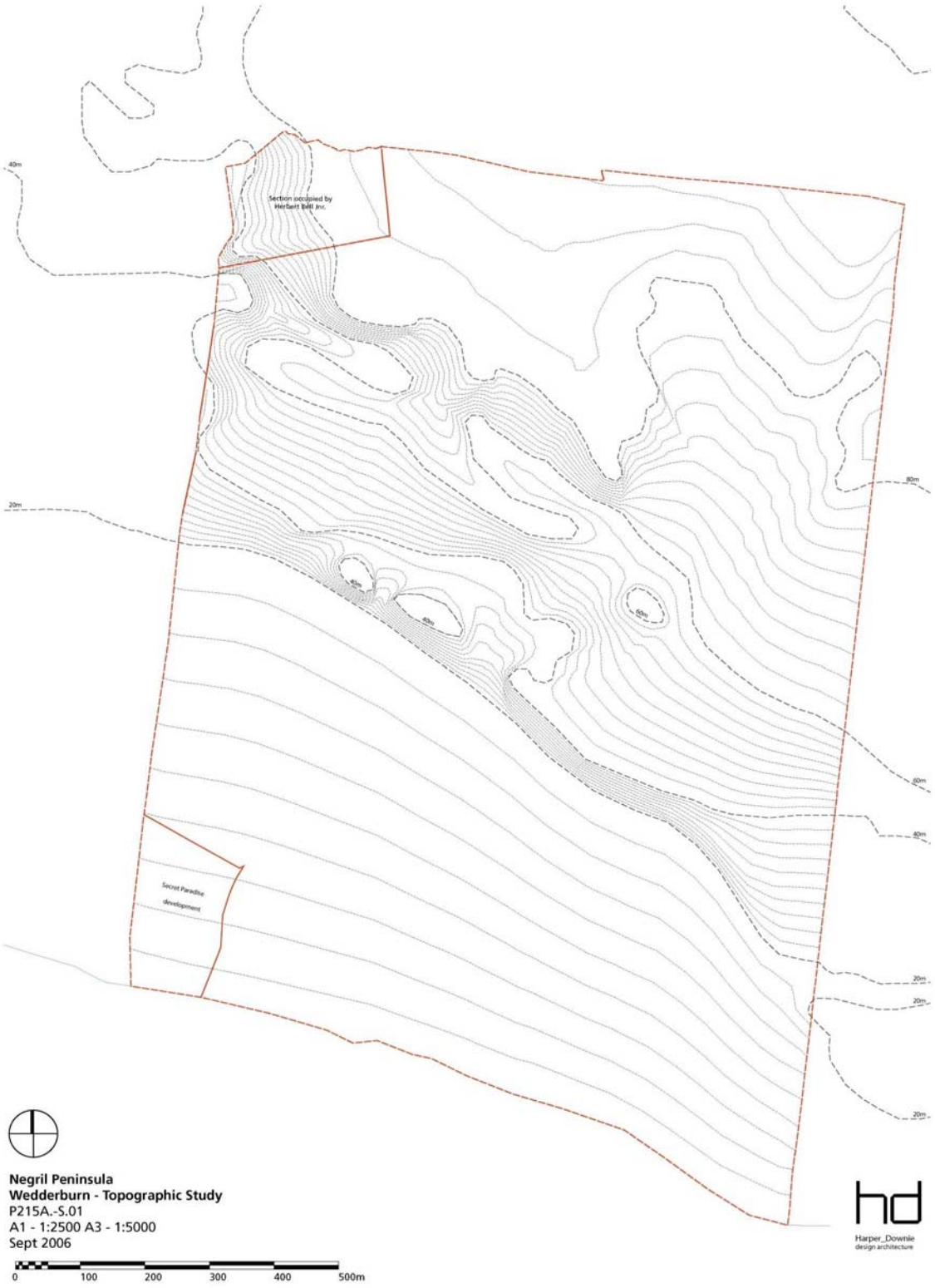
This component of the study will:

1. Describe the existing hydrology of the study area.
2. Assess the potential hydrological impacts associated with the development.
3. Make recommendations for avoiding any adverse impacts.

4.2.3 Results

4.2.3.1 Characterization of Study Area

The Negril Peninsula Resort property lies within the Carbarita River Hydrologic basin and does not encroach on any major drainage basin. Based on hydro-geological findings (WRA) there are no aquifers of importance in the study area. As shown in Figure 3 page 62, most of the property is underlain by Bonnygate Stony Loam, with patches of Chudleigh Clay Loam and Crane Sand, characterized as Montpelier Yellow Limestone Formation and is characterized by a number of "sink-hole" features which serve as natural disposal points for storm water run-off. As such the proposed development should have no significant effect on the hydrological regime of the study area.



4.2.3.2 Fig 1 **TOPOGRAPHY OF PROJECT AREA**

4.3. Description of Project area

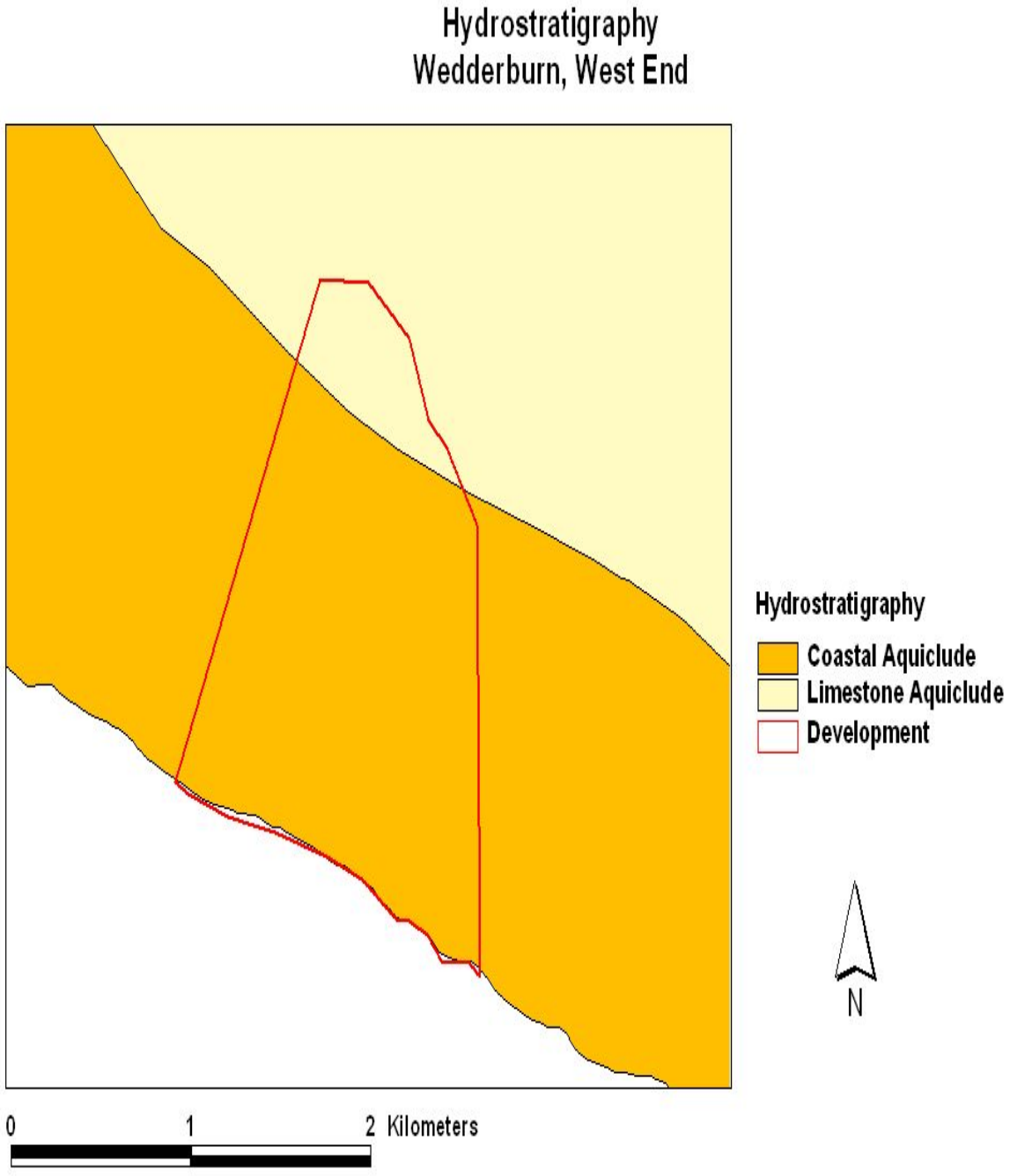
Physical:

The Peninsular Resort Development is located at Wedderburns in West End Negril in the parish of Westmoreland.
The Peninsular Resort' site is characterized by a wide lower coastal basin. The sea at this point, is at depths adequate for the passage of medium sized ocean-going vessels. The land stretching back towards a cliff-feature demarks the extent of the lower coastal basin.

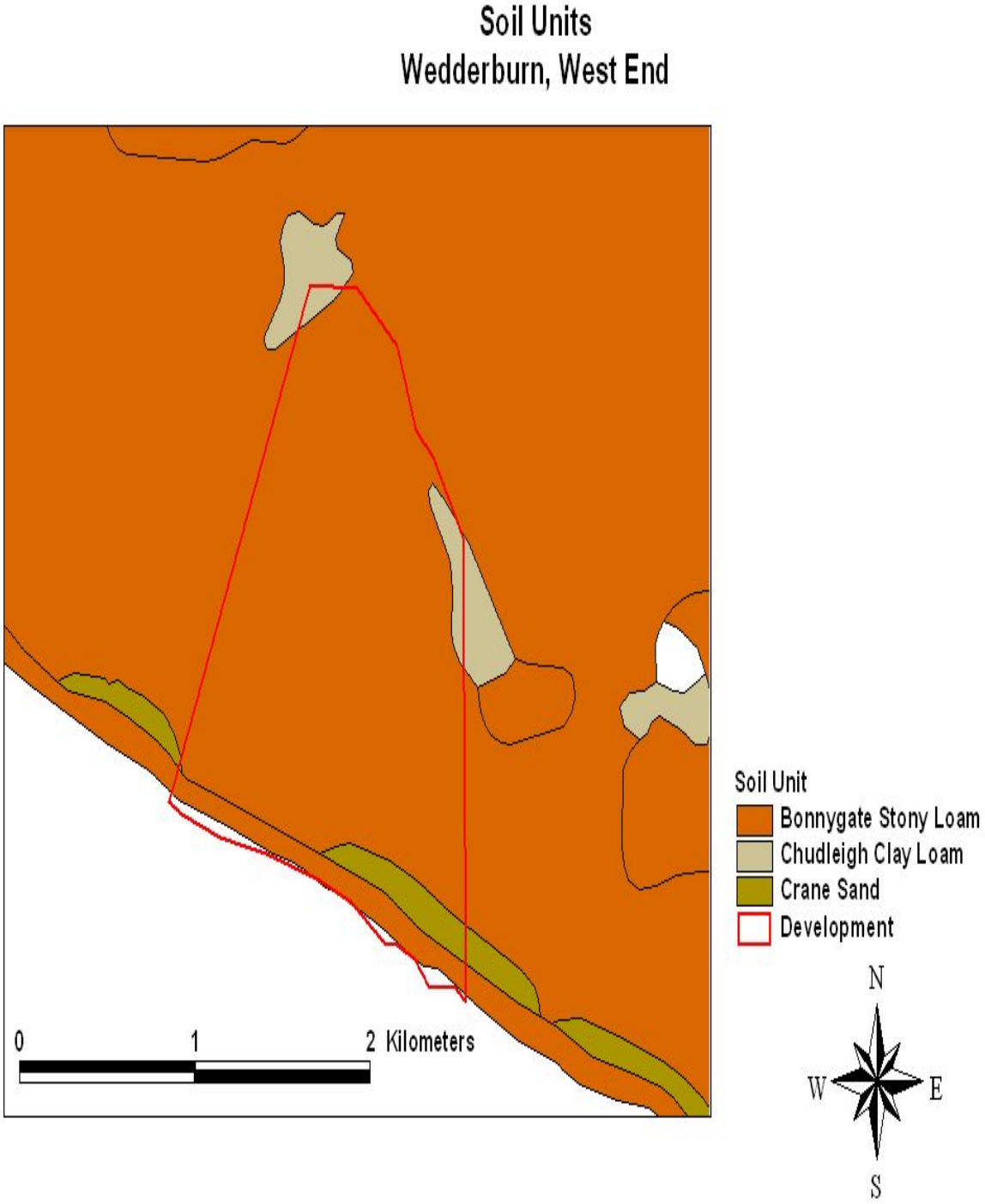
Above the cliff escarpment which runs east to west across the site, there is elevated terrain with terraces and escarpments, which will provide obvious zones for residential and tourism activities. The shoreline is primarily composed of an iron shoreline with varying size coral rocks and two small sandy areas.

The coastal basin consists of bare rocks along the shoreline and sand loam overburden of up to 1000 millimeters in other areas.

The Cliff feature on the site is very pronounced towards the central area of the basin area. The cliff varies in height and steepness growing from gentle gradients on the west side to buttresses projecting back and forward in the middle of the site and again taper and lessen in steepness towards the eastern side of the site.
Above the escarpment, there are rock out crops with areas of honeycombed Yellow Limestone and sections with sandy loam and clay soil overburden.



4.3.1 Fig 2 HYDROSTRATIGRAPHY OF STUDY AREA



4.3.2 Fig 3 SOIL PLAN OF STUDY AREA

4.4 Description of Drainage area

Owing to its topography, the entire project area generally drains in a southerly direction toward the sea. Apart from minor run-off from existing roadways (south eastern section) unto the project area, no encroachment of storm water run-off from off-site drainage areas is expected – the watershed (drainage area) for the development is conveniently demarked along the surveyed property boundaries. For convenience the proposed development area is divided into three (3) main drainage areas:

- Drainage Area 1: upper "shelf" – approximately 90 acres
- Drainage area 2: lower shelf – approximately 151 acres
- Drainage Area 3. – Approximately 120 acres. This includes low lying coastal lands. The coastal basin area covers approximately 33% of the property where the land is generally flat to gentle sloping toward the sea. Overburden is shallow on limestone outcrop in the lower coastal basin area.

Field excursions throughout the project area revealed that the general terrain was of a mix of tropical wooded and well-vegetated areas that contain steeply dissected slopes (15 – 60%). Short steep slopes were typical of the higher lying land parcels.

Site investigations indicated that approximately 66% of the project lands (higher lands) consist of hard honey-combed limestone outcrops and shallow overburden of stony soils. As a rule, overburden is normally

thicker in this project section where the depth of overburden can exceed estimated 3 meter at some locations.

The project area is also characterized by well defined "sink holes" – these natural features aid in providing for drainage (infiltration) of storm waters.

Owing to area's geology and land forms, the project site allows for easy drainage of storm water however, the potential exists for flooding in the lower lying coastal areas (proposed marina site) and depression (low) areas.

Minor (localized) flooding of road sections along Mt Airy Parochial Road were experienced during field excursions.

4.4.1 Rainfall

Rainfall data representative of the project area were available at Negril Point Light House Station. Estimates of the maximum 24-hour rainfall for selected return periods are as follows:

Table No. 1: Estimates of 24-hr Rainfall for selected Return Periods (T)

Return Period	2 yrs	5 years	10 years	25 years	50 years	100 yrs
Rainfall amount, in.	4.04	5.24	6.36	7.76	8.80	9.84
Rainfall amount, mm	101	131	159	194	220	246

Source: National Meteorological Service, Jamaica

4.5 SEDIMENTATION COMPONENT

The need to provide adequate protection from sedimentation of coastal waters cannot be over-emphasized. The "dumping" of earth and debris material into the sea can cause serious damage and as such the erosion and transport process of sediments must be considered in the required drainage plans.

This component of the study will:

- Assess the potential impacts of sedimentation associated with the development.

- Outline design approach for sediment component and

- Make recommendations for avoiding any adverse impacts.

4.5.1 Construction Stage

Turbidity is expected to be higher during the construction stage as a result of clearing of vegetation for the construction of roads and buildings. If not properly managed, clearing activities could adversely impact on the quality of coastal waters and the hydraulic capacity of sink holes areas to function effectively. The erosion of land and debris flows can also cause blocking of culverts and drains resulting in flooding. With proper planning however,

adequate measures (check dams and swales) can be put in place to minimize or avoid any adverse impact

4.5.2 Post Construction Stage

The inclusion of roofs and other impervious areas will result in the increase in magnitude and frequency of flood flows. Increased velocity in storm drains can cause erosion of soil where drain sections are not paved or stabilized. There is also the potential for erosion of soil from exposed project areas during periods of rainfall. It is expected to properly landscape and stabilize all exposed areas of vegetation to minimize erosion of soil and debris.

4.6 Design Approach

The mechanics of sediment transport is complex and the literature on the subject is voluminous. Many formulae have been developed over the decades, each one being limited in the range of condition to which it is applicable. What is important is that the proposed drainage designs incorporate effective hydraulic (stilling) features to deal with the problem of land erosion and sedimentation in coastal waters.

The design approach is simple - a network of swales and collector drains will discharge storm flows into designated stilling areas where sediments and debris can be trapped before discharging into the sea or sinkholes. Wide buffer areas must be allocated for this purpose. Storm drains will

also be designed to achieve “self cleansing velocities” while minimizing the threat of erosion.

As the project site allows for good percolation of surface water, the drainage designs will incorporate the natural drainage properties of the site by utilizing existing sinkholes and depressions and wide earthen swales where necessary. Gabions could be utilized in the design given their free-draining property.

Where necessary culverts will be installed at crossings and storm drains paved to prevent erosion.

The coastal “shelf” is particularly prone to flooding during storm surge events which may cause back-up of flows in the drainage system. The present longitudinal profile of the lower coastal shelf shows a relatively flat to gently slope draining towards the sea. Owing to this topography, deep storm drains would not be practical in the design of the drainage system for the low lying coastal area.

4.7 Mitigative Measures

Potential impacts can be minimized by ensuring the implementation of an effective drainage system(s) and strategies for the management of storm water.

1. Construction of stilling areas to trap silt/debris before final disposal of run-off.

2. The material excavated on the project site during construction must be properly managed and removed from the project on a regular basis thereby reducing the potential negative impact of sedimentation.

3. Areas allocated for buildings should be properly stabilized and landscaped in order to minimize soil erosion, hence high sediment run-off.

4. Vegetative buffer zones should be left alongside roads, storm drains and natural drainage features (sink holes and depressions).

5. Pipe laying activities should be coordinated with road construction to minimize any transport of sediment. Wide earthen swales are recommended along proposed roadways which will facilitate the retention of run-off generated from impermeable areas of roads and buildings.

6. Clearing activities should be phased to keep the area of exposed soil as small as possible.

7. The coastal limits of storm outlets discharging into the sea should be protected against storm flows and wave attacks. Gabions would be appropriate in coastal protection works and the construction of silt/debris trap for the following reasons:

1.7.1 Flexibility

Gabions permit a structure to tolerate differential settlement without fracture. This property is especially important when a structure is on unstable ground or in an area where scouring can undermine it.

1.7.2 Strength

Gabions are made to withstand and absorb the forces generated by wave actions and flowing water.

4.8 Durability

Gabion structures are to withstand the forces from wave action and flowing water.

4.9 Aesthetics

Gabion structures naturally and beautifully blend with the environment.

4.10 **Sewage and Waste Disposal**

As shown in Figure No.2 page , most of the property is underlain by the Montpelier Yellow limestone Formation which includes a Coastal and Limestone Aquiclude which has a low capacity to store ground water. Consequently, there is no significant ground water below the site that is likely to be contaminated by subsurface disposal of sewage. All sewage will be discharged off-site.

Although sewage disposal may not present a problem to groundwater, contamination of surface run-off from the property by suspended solids, organic compounds (pesticides etc) and solid waste is likely to occur which can result in contamination of water resources. The removal of vegetation from the project area during the construction stage is likely to result in increased turbidity. With proper planning and landscaping however, this problem of turbidity can be minimized during the post construction stage. Appropriate measures must be put in place to dispose of solid wastes as these are more likely to contaminate during the post construction stage.

4.11 Hydrological Impact Assessment(Identification and Mitigation)

This study section examines the aspects of the environment which will be impacted upon by the development and indicates the types, extent and magnitude of these impacts. It also indicates whether mitigation is possible and analyses the degree of the impacts. This is graphically represented by an impact matrix, showing the system and the impact. The matrices are located in Chapter 8

The project will necessitate the clearing of vegetation from some sections of the property and the inclusion of paved and impervious areas for roads and roofs. Changes in land use will naturally result in increased turbidity and run-off volume especially in the higher sections of the project area where slopes are relatively steep.

In general, for drainage areas 1 & 2, twenty five percent (25%) change of land use to urbanized conditions will not result in significant increase in peak flows (8-20 %).
For drainage area No. 3 (coastal basin), a fifty percent (50%) change of land use to urbanized conditions (high density commercial section) will result in significant increase in peak flows.

4.12 Impacts

4.12.1 Water Quality Impacts

The main impact anticipated during the construction stage is increased turbidity in surface run-off which could possibly affect the quality of coastal waters and infiltration of run-off via existing sink-holes. Other potential sources of pollution include sewage disposal and solid waste. The Contractors will be confined to strict controls to ensure that this does not occur.

4.12.2 Hydrological Impacts

The hydrological impacts that are likely to be associated with the project are as follows:

1. The possible adverse change in run-off characteristics of each drainage area namely, the increase in magnitude and frequency of flood flows especially in the low lying coastal areas resulting from

the increase in paved and impervious areas (roads, roofs and pavements).

2. The possibility of adverse change in ground water quality resulting from increased turbidity during the construction stage.
3. The possibility of adverse changes in ground water quality resulting from the generation and disposal of sewage. It must be again noted that all sewage will be discharged off-site.

4.13 Table #2 Project Activities and Potential Impacts on Water Quality

Project Activities	**Potential Water Quality impacts**
1. Construction phase: • Removal of vegetative cover; • Earth moving; • Stockpiling • Construction activities • Operation of heavy duty equipment	• Generation of solid waste on site • Increase in turbidity in surface run-off • Contamination of surface water run-off by fuel , oil spills etc • Improper disposal of solid waste in retention areas
2. Occupation Phase: • Inclusion of paved and impervious areas • Solid waste generation • Sewage generation	• Increase in fresh water run-off • Sedimentation of natural "sink holes" and near shore reefs.

During the occupation phase, the main potential impacts to water quality will be associated with increased surface run-off. There is also the potential for erosion of soils from exposed vegetated project areas during periods of heavy rainfall.

4.14 Mitigation

Potential impacts identified can be minimized or eliminated by ensuring the development and implementation of effective strategies for the management of storm water run-off and sewage. It is recommended that the mitigation plan include the following:

- Wide vegetative buffer zones should be left alongside all roads and natural drainage features. Every effort should be made to preserve and protect the natural vegetation and existing drainage features (sink holes, depression areas etc). Landscaping should also serve to enhance the aesthetics of the project site without significantly changing the natural environment.

- Construction of the project and the laying of pipes for sewage and potable water would necessitate the clearing of a large project area and therefore will cause loss of vegetation. Apart from the immediate impact of site clearance, the potential for erosion and sedimentation of near shore reefs must be of concern. Pipe laying activities should therefore be coordinated with road construction to minimize any additional impacts. It is proposed to construct swales along proposed roadways which will facilitate natural drainage and maximize the infiltration of surface run-off from future impermeable areas of roads and buildings.

- Vegetation clearing activities should be phased to keep the area of exposed soil as small as possible, thus reducing the effect of erosion.

- Slopes must be carefully cut or stepped and run-off from paved areas should be properly controlled to avoid soil erosion and slope failure.

- Reservation of adequate land area for storm water management.
- The development of a storm water management plan, to include arrangements for clearing of sediments and debris.
- Development of a drainage system should include the involvement of community residents.
- The development of a sewage management strategy to the ensure protection of surface run-off and subsurface waters.
- Coastal protection works to prevent flooding of lowing coastal areas and proposed infrastructure (sewage, storm water, buildings etc).
- An evacuation plan should be put in place for the project area given its vulnerability to hurricanes and storm surges.

4.15 Mitigation of Hydrological Impacts

1. The material excavated on the project site during construction must be properly managed. All debris should be properly held on site and removed on a regular basis thereby reducing the potential negative impact of this material on flooding within the project site.

2. Development of effective plan for solid waste disposal

3. The removal of vegetation should be carefully phased to reduce the possibility of high turbidity run-off into sink holes and the sea. Project areas allocated for buildings should be properly landscaped in order to minimize high sediment run-off.

4.16 Conclusion

Every effort should be made to preserve the project area's vegetation and natural features. Areas of land should be set aside as open/green areas and existing sink-hole features should be reserved for storm water disposal.

The project will necessitate clearing of lands and the construction of paved areas and naturally will impact on the existing drainage pattern. However the proposed development should not significantly impact on the hydrological regime of the area given the area's geology and topography which allows for relatively free drainage (percolation) and storm water discharge into the sea.

Changes in flood flows are expected to be small (8 – 20% increase) in drainage area No's 1 & 2 as a result of the development. However, owing to the proposed high density development in drainage area 3 (coastal basin area) a significant increase in storm water run-off flows is anticipated.

The main impact anticipated during the construction stage is increased turbidity in surface run-off which could possibly affect the quality of

coastal waters and infiltration of run-off via natural drainage areas(sink holes etc.).

4.17 Sewage:

Sewage generated from the project site will be discharged into an onsite treatment facility for treatment to very high standards and finally disposed of through a marine outfall at an appropriate distance and depth at sea.

4.18 Water:

Water supply will be provided by National Water Commission municipal system and as such no there will be no demand on the local drainage area for water supply. There is no significant ground water in the project area as the entire project site is underlain by coastal (limestone) aquiclude.
There are no bodies of surface water on site and therefore it eliminates the need to mitigate against contamination.
If during construction, underground water sources are identified, proper plans and actions will be instituted to ensure the protection of the water quality.

4.19 Assessment of Run-off Impacts

The run-off impact assessment entails a determination of the pre-development run-off from each of the project drainage (sub-drainage) area for different return periods (2, 5, 10, 25, 50 and 100 years) and a post development run-off for the same return periods.

DESIGN APPROACH

For convenience the proposed development area is divided into three (3) main drainage areas:

- Drainage Area 1: upper "shelf" – 90 acres (approx.)
- Drainage area 2: lower shelf – 151 acres (approx)
- Drainage Area 3. – 120 acres. The low lying coastal basin area covers approximately 33% of the property where the land is generally flat to gentle sloping toward the sea.

The proposed drainage system has been designed for two flood conditions: **Major Systems -** to provide for major storm events of 50 yr – 100 year return period and **minor (local) systems** (swales, kerb channels etc) which considers adequate drainage for more frequent rainfall events T = 5 years.

Drainage Design Criteria

Drainage designs will be in accordance with the criteria approved by the Ministry of Transport and Works/National Works Agency.

The design of the minor (local) systems (culverts etc) is based on 5 **-year return period.**

Major storm systems are designed based on **50 – 100 year return period** events to accommodate 24-hour rainfall (P) conditions. (Include depression areas and sink-holes and main storm drains).

Calculation of Run-off

The Rational Method has been used in the design of the storm water drainage systems where peak run-off or discharge (Q) is calculated as follows:

$$Qp = CIA \qquad \text{where}$$

C = dimensionless run-off coefficient depending on catchment characteristics such as geology, topography e**tc.**

I = average rainfall intensity, in/hr (mm/hr) lasting for a critical duration Tc.

A = total drainage area contributing to flow measured in acres

Concentration Time, T*c*

Concentration time is the time required for rain falling at the farthest point of the catchment basin to flow to the point of measuring. Peak flow **Q***p* occurs after time Tc. An average concentration time of twenty (20) minutes was estimated for Drainage areas No's 1 & 2 and an average concentration time of twenty five (25) minutes was used for drainage area no. 3 (coastal basin area).

Intensity of Rainfall, I

The average rainfall intensity used in our calculations corresponds to different return periods as follows: T = 2 yrs; T = 5 yrs; T = 10 years; T = 25 yrs; T = 50 years; T = 100yrs

Calculations of Peak Discharge

TABLE NO. 3 **Schedule of Land Use**

LAND USE	APPROXIMATE AREAS	
	ACRES	HECTARES
Accommodation	206	83
Parkland/Amenity	36	15
Marina	13	5
Beach	13	5
Beach Resort	7	3
Spa Hotel	8	3
Sports Recreation Hotel	5	2
Civic/Retail	31	13
Municipal Buildings	6	3
Support	12	5
Medical/Police Station	4	2
Sundry, Roads etc	20	8
TOTALS	**361**	**147**

TABLE NO. 4 Schedule of Main Drainage Areas

No.	Description of Drainage area	Approximate Area, acres
Drainage area 1	Upper shelf	90.0
Drainage area 2	Lower shelf	151.0
Drainage area 3	Coastal basin	120.0
	TOTAL AREA	**361.0**

TABLE NO. 5

Storm Flow Design Sheet (Pre-development) – Drainage Area No. 1

RETURN PERIOD, T	DRAINAGE AREA, (Acre)	PEAK FLOW **Q**p, (CFS)
T = 2 YR	90.0	54.00
T = 5 YR	**90.0**	**70.2**
T = 10-YR	90.0	85.05
T = 25-YR	90.0	103.70
T = 50-YR	**90.0**	**117.50**
T = 100-YR	90.0	130.00

TABLE NO.6

Storm Flow Design Sheet (Post-development) – Drainage Area No. 1

RETURN PERIOD, T	DRAINAGE AREA, (Acre)	PEAK FLOW **Q**p, (CFS)
T = 2 YR	90.0	72.00
T = 5 YR	**90.0**	**93.60**
T = 10-YR	90.0	113.4
T = 25-YR	90.0	138.24
T = 50-YR	**90.0**	**173.20**
T = 100-YR	90.0	173.20

TABLE NO.7

Storm Flow Design Sheet (Pre-development) – Drainage Area No. 2

RETURN PERIOD, T	DRAINAGE AREA, (Acre)	PEAK FLOW **Q**p, (CFS)
T = 2 YR	151.0	90.60
T = 5 YR	**151.0**	**118.00**
T = 10-YR	151.0	143.00
T = 25-YR	151.0	174.00
T = 50-YR	**151.0**	**197.10**
T = 100-YR	151.0	217.90

TABLE NO. 8

Storm Flow Design Sheet (Post-development) – Drainage Area No. 2

RETURN PERIOD, T	DRAINAGE AREA, (Acre)	PEAK FLOW **Q**p, (CFS)
T = 2 YR	151.0	120.80
T = 5 YR	**151.0**	**157.04**
T = 10-YR	151.0	190.30
T = 25-YR	151.0	232.00
T = 50-YR	**151.0**	**262.70**
T = 100-YR	151.0	290.50

TABLE NO. 9

Storm Flow Design Sheet (Pre-development) – Drainage Area No. 3

RETURN PERIOD, T	DRAINAGE AREA, (Acre)	PEAK FLOW **Q**p, (CFS)
T = 2 YR	120.0	60.00
T = 5 YR	**120.0**	**78.00**
T = 10-YR	120.0	94.50
T = 25-YR	120.0	115.20
T = 50-YR	**120.0**	**130.50**
T = 100-YR	120.0	144.30

TABLE NO. 10

Storm Flow Design Sheet (Post-development) – Drainage Area No. 3

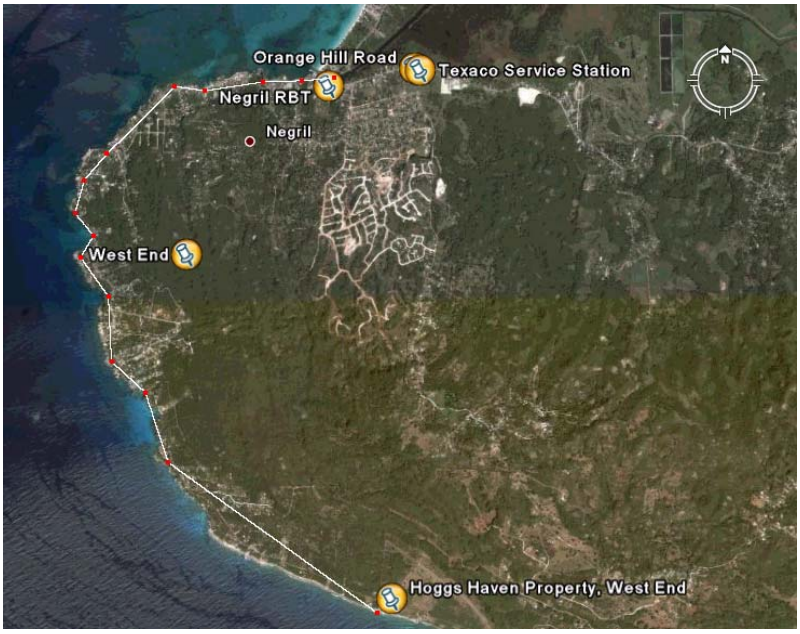
RETURN PERIOD, T	DRAINAGE AREA, (Acre)	PEAK FLOW **Q**p, (CFS)
T = 2 YR	120.0	120.00
T = 5 YR	**120.0**	**156.00**
T = 10-YR	120.0	189.00
T = 25-YR	120.0	230.40
T = 50-YR	**120.0**	**261.00**
T = 100-YR	120.0	288.6

CHAPTER 5
TRAFFIC ASSESSMENT REPORT

5.1 Introduction

This is an eco-tourism resort development by the former airstrip. The development comprises of 6,228 habitable rooms, a marina and commercial area (shopping centre etc). The Eco-tourism resort is targeted to tourists who are primarily vacationing and yacht owners. The development will be phased over a number of years with construction commencing in late 2007. (See location map figure 1.)

Location Map Figure 1

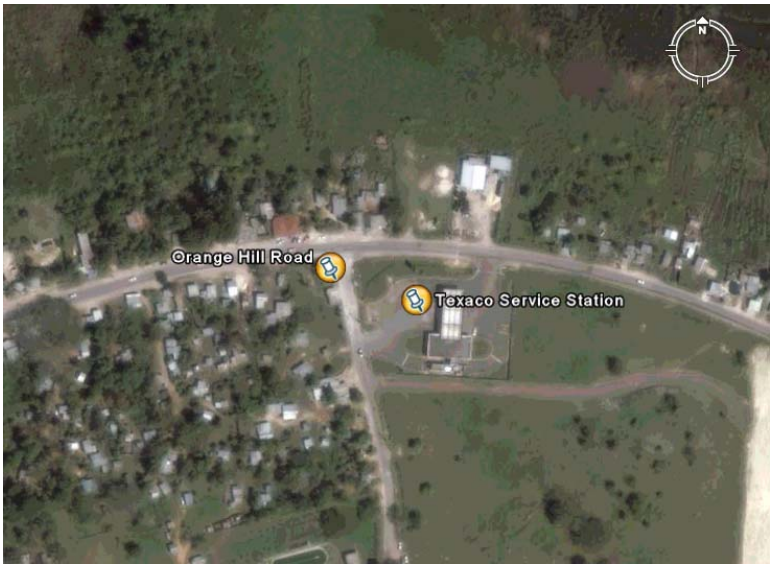


Access to the site is proposed to be taken from two existing Roadways: Predominantly from the Orange Hill/Mount Airy road from Negril, which is a distance, from the Burger King Island, of 7.7 km with an average time

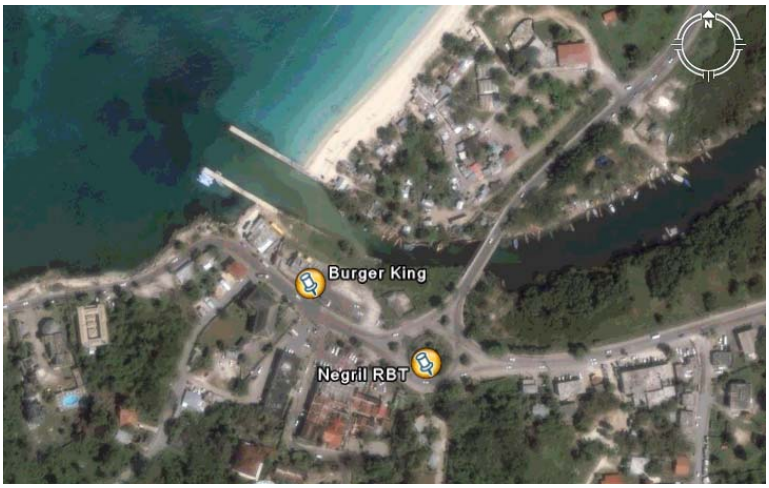
of 12 minutes. Secondly on the West End road, past the Lighthouse, with a distance of 8.1 km and an average time of 13 minutes.

Given the magnitude of the development, for safety purposes it is recommended that the developer upgrade the junctions with the Orange Hill Road near Orange Hill and near the Texaco service station to increase sight distance and provide the required turning lanes to be determined by TIA. The developer should also improve the roadway at selected locations to maintain a minimum 6.2 m Road width with grass shoulders. The developer should also improve selected curves, to allow safe passage of two typical tour vehicles simultaneously and a priority controlled T Junction, to facilitate access to the development and provide the requisite signage on approach to the intersection, indicating the presence of the entrance to the development.

Orange Hill Road intersection near Negril Texaco Service Station



Negril RBT


N
Burger King
Negril RBT

The Proposed development site of 361 acres is secondary forest and dense shrubbery.

5.2 The development will consist of the following:

LAND USE	APPROXIMATE AREAS	
	ACRES	HECTARES
Accommodation	206	83
Parkland/Amenity	36	15
Marina	13	5
Beach	13	5
Beach Resort	7	3
Spa Hotel	8	3
Sports Recreation Hotel	5	2
Civic/Retail	31	13
Municipal Buildings	6	3
Support	12	5
Medical/Security Centre	4	2
Sundry, Roads etc	20	8
TOTALS	**361**	**147**

5.3 Existing Conditions

The Negril Town to Lighthouse road way is partly a narrow two lanes and partly single track road at varying chainages. It runs approximately 7 kilometres south from the Negril RBT to the project site. Road width varies from 6.5 m near the RBT to 3.5 m near the project site. There are no shoulders or sidewalks provided. This Roadway bisects the property.

The two Roadway portions are described below:-

1. *The northern portion, from the Negril Roundabout to the Negril Lighthouse, is highly developed with numerous private accesses to*

hotels and residences and other commercial properties. The Roadway has a high degree of horizontal curvature. There is no scope for improvements along the northern 3 or 4 kilometres. Access by large tour buses would be significantly constrained. The surface along the northern portion is in excellent condition. It is however difficult to achieve or maintain 35- 45km/h on the northern portion.

2. *The remainder of the Roadway from the Negril Lighthouse to the Negril Peninsula Development is in poor condition, with significant surface loss and restricted width. This portion is referred to as a single track, in that average width barely exceeds 4.0 m. There is sufficient reservation to widen to 8.0 m. there were no evident drainage structures.*

The Orange Hill Road runs south From the Negril to Savannah La Mar Main Road in the vicinity of the Negril Texaco Service Station. This is a rural two lane Road way with no shoulders. Average width varies between 6.0 m and 7.5 m. the Road is in fairly good condition with several areas of local failures. Most of the accesses are to private homes with a few to commercial establishments. About 2 km south, the roadway climbs a small range at the northern end of the site. The roadway continues across the site before descending to near sea level.

This report highlights the impact the proposed development will have on the main Road network and make recommendations for analysis and improvement, if necessary, to maintain safety and operational Level of

Service (LOS) along the corridor and also at the access to the development. This report is a precursor to the Traffic Impact Assessment

For traffic analysis purposes a ten (10) year design horizon will be used to determine the effect of the traffic on the highway.

5.4 Trip Generation

A traffic Growth rate of 3.0% per annum will be used throughout the analysis for traffic projections over a 10 year design life as recommended by NWA Traffic Impact Analysis Preparation Guidelines.

Below are the room specific data which will be used to generate trip data:

5.4.1 **Table 2: Projected room development**

	House Type	Number of plots	Number of units	Habitable rooms per plot	Total habitable rooms
1	Cliff house C+E	7	14	6	42
2	Cliff house C+2E	7	21	9	63
3	Villa M	45	45	7	315
4	Villa 2M	109	218	14	1526
5	House I	6	6	4	24
6	House 2I	73	146	8	584
7	House G	1	1	4	4
8	House 2G	201	402	8	1608
9	House 3G	0	0	0	0
10	Apartments 3M	22	66	21	462
11	Apartments over retail	163	163	2/3	494
12	Marina apartments	120	120	5	600
13	Hotels				506
	Total	**754**	**1202**		**6228**

5.5 Trip Distribution/Assignment

Negril, the capital of Westmoreland is the closet urban centre to this development approximately 7 km to the West by Road. Accordingly it is assumed that the majority of trips will be towards Negril. Being that the proposed development is a tourist resort, a large number of attracted trips to bring workers and staff in to the development is projected. Based on the anticipated workforce of 2000 persons, it is estimated there will be 200 motor car trips... Workers are anticipated to arrive at 7am and shift change at 4pm. Most of these workers will arrive by public transport.

Guest of the development will arrive by tour buses etc from Montero Bay and by yachts at the marina. It is also expected that mobility around the site will comprise a lot of pedestrian movements and bicycling etc., in keeping with the nature of the development. Also the development is essentially self sustaining, so most guests trips would be via tour excursion buses etc.

Once the numbers of staff and the shift hours are ascertained, a reliable trip generation model can be calculated.

5.6 Analysis

In developing an access to the development particular needs were identified. These are:

1. *minimum interference/ effect on existing and future traffic flows*
2. *the highest level of safety for all motorists and pedestrians using these Roads*
3. *minimum amount of conflict points*

4. *low maintenance costs*
5. *aesthetically pleasing*
6. *provide adequate levels of service for future traffic*
7. *provide high traffic capacity*
8. *minimum delay*

Various intersection types are to be examined that facilitate the requirements as given. These are;

- **Priority (stop) controlled T junction with provided turning lanes.**
- **Traffic Signal controlled T junction with provided turning lanes.**
- **Roundabout**

A review of the options yielded the following:

5.7 Level of Service Calculations

The impact to the main Road network is based on two conditions:

- *The impact that the developments traffic will have on the corridor capacity*
- *The performance of the site collector road at its intersection with the highway*

The capacity and level of service of the two routes will be determined both with and without the development and the requisite inferences made

Service volume is calculated as

SV =2000(v/c) TW

Where SV is the service volume,
v/c is the volume capacity ratio
T is the truck adjustment factor
W is the adjustment factor for lane width and lateral clearance

5.8 Recommendations

Due to the size of the development and the importance of the main corridor, it is recommended that the developer

1. ***Upgrade West End Road to accept additional traffic.***
2. ***Use the Orange Hill Road as the main Entrance route***
3. ***Investigate the possibility of reactivating an abandoned parochial road, which exits into the Orange Hill/ Mount Airy Road, as an additional assess.***

CHAPTER 6

THE SOCIO-ECONOMIC ENVIRONMENT

6.1 Population-Demography

The parish of Westmoreland has a population which has shrunk significantly over the period 1991 – 2001. Over the same period the population of the Westmoreland has decreased, but the section of Negril has shown significant increases.

The 1991 census revealed a population of 126,136 residents for the parish of Westmoreland, whereas Negril registered a population of 4,040 residents or, 3.20% of the population of Westmoreland.

The 2001 census revealed a population of 94,638 residents for the parish of Westmoreland, while the population of Negril was recorded at 5,670 or, 6 % of the population of Westmoreland.

The housing stock in Negril moved from 1,212 houses during the 1991 census to 1,800 during the 2001 census. This represents a 48.5% increase for the period under review.

It must also be noted that during the period 2001 to the present, in excess of 300 additional housing solutions have been constructed in the Negril Region.

6.2 **Population Changes**

AREA	**1991**	**2001**	**CHANGES 1991-2001**
WESTMORELAND	126 136	94 638	-25%
NEGRIL	4 040	5 680	+40.6%

Source:
Population Census 1991 & 2001. Statistical Institute of Jamaica, Kingston Jamaica.

Negril continues to be a magnet to those who seek a better way of life and is becoming a more and more attractive prospect in the ongoing urban drift.

6.3 Employment

The labour force survey of April 2001 indicates a total of 51,548 workers in Westmoreland, of which 44,514 were employed and 7,034 or, 13.6% unemployed. This compares to 1,195,800 workers, island wide, of which 942,300 were employed and 253,500 (21.2%) unemployed.

This can also be compared to 42,916 workers registered in 1991, with 37,145 employed and 5,771 or, (13.45%) unemployed.

This indicates an increase in the workforce in Westmoreland, over the period of a decrease in the overall population count.

6.4 Labour Force for all Parishes, Westmoreland and Negril

	1991 Employed	1991 Unemployed	2001 Employed	2001 Unemployed	%
All Parishes			**942,300**	**253,500**	**21.2**
Westmoreland	**37,145**	**5,771**	**44,514**	**7,034**	**13.6**

Source:

Labour Force 1991 & 2001. Statistical Institute of Jamaica, Kingston Jamaica.

The project plans to generate in excess of 1,500 jobs in the initial construction phase and over 3,000 permanent jobs at the full start up of operations of all commercial, tourism and municipal activities.

6.5 Economic Activities

The main economic activity is the Tourism Industry. There are other activities within the area which can be considered as supplementary to the Tourism Industry, including cottage industries, small and subsistence farming, fishing and artisanship.

The Greater Negril area has provided such a unique tourism experience, that there has been a year to year increase in the tourism package on offer, without the equivalent development in the commercial and social infrastructure for the residents of Negril. This project will generate some of the increases in commercial and social activities which are needed to promote the further development of the community of Negril.

6.6 Manufacturing

Activity in this sector is negligible.

6.7 Commerce

There has been a parallel rise in the commercial activities alongside the rise in population, workforce and the Tourism Industry in Negril. A number of shopping centers, housing sites and various commercial and service entities have sprung up, to satisfy the needs of an ever increasing population and workforce.

6.8 Tourism

This is the cornerstone of the existence and expansion of Negril. Without tourism, Negril would still be the sleepy village hamlet it was some thirty years ago. The expansion has continued uninterrupted and has seen Negril spread into Hanover as far as the North Negril River and into the West End area. It must be noted that all Tourism activities are centered on the beaches and the coastline. Very little has found its way inland. Tourism has served Negril well, with an army of workers both resident and commuting from adjoining districts and parishes to cater to the needs of the tourism population.

6.9 Housing

In excess of 300 houses have been added to the housing stock in addition to the 1800 recorded in 2001. This cannot meet the demand for housing in Negril although the sale of service lots has attempted to meet some of the demands.

Housing and its availability will be a key component in attracting the level of workforce needed to make the project a success.

There are a number of factors which will affect the availability of adequate housing by increasing the housing stock:

- The Whitehall Housing scheme is presently being expanded and there exists on the site approximately 800 additional serviced lots which are either now available or will soon be put on the market.
- With the downturn in the fortunes of small hoteliers on the Negril West End, as a result of extreme competition from the larger hotels situated on the Norman Manley Boulevard, investigations have revealed that approximately 200 single and double bedroom apartments have come onto the market for rental on a monthly or yearly basis. This will help to fill some of the demands for housing in the area.
- Approximately fifty studio and single bedroom apartment condominiums are now under construction for renting on a monthly or yearly bases.
- The Negril Peninsula Resort Development is in essence expanding the boundaries of Negril and creating areas which will become attractive to develop. The extension of a major water pipeline into

the Development will create areas for the development of future housing stock.

These will serve to meet any immediate needs which might arise.

6.10 Public Amenities

6.10.1 Cemetery

Internments in Negril now take place in the Red Ground Cemetery. This is now near to capacity and the Negril community is in discussions with the National Housing Development Corporation (NHDC), who are in the process of expanding the White Hall Housing Scheme, to obtain additional acreage on that site to locate a new cemetery. It is proposed that this new cemetery will have a build-out life of 25 years.

6.10.2 Solid Waste Disposal

Although there is an adequate public waste disposal service, courtesy of the Western Parks and Markets under the authority of the Solid Waste management Authority, the proposed new development will require the existing facilities to be improved, thus creating even more local job opportunities. As an alternative the Development could develop its own waste disposal department, solely for its own use.

The existing waste dump is located at Retirement in St. James and approximately ninety (90) % of the solid waste will be required to be

transported out of the greater Negril area. The remaining ten (10) % will be recycled within the Negril community with the reactivation of the recycling center. A monitoring plan will be formulated to ensure the safe and proper transportation and dumping of the waste.

Total projected solid waste to be generated daily on the Negril Peninsula Resort Eco-Tourism venture, when the development is fully operational is equivalent to:

$M_{sw} = [(T \times 2)\Omega + T_w \times \alpha]/ 1000$ Kg

Where:

M_{sw} = Mass of solid waste discharged daily from the Wedderburn Property

T = Total number of Habitable rooms

Ω = Solid waste discharge /visitor/day (g)

α = Solid waste discharge from each worker over a eight (8) hour period. (g)

T_w = Maximum number of worker on a shift.

$M_{sw} = [(5\ 772 \times 2)800 + 3\ 000 \times 400)]/ 1000$ Kg

≈ 10.5 Tonnes

It is suggested that 10% or 1.05 tonne of this mass is recyclable, daily collection and disposal of all waste generated must have prepared for and as such the Owner/Operator of the development should either own or contract out the disposal services.

6.10.3 Schools

There are no secondary schools in Negril. All students going to secondary school commute on a daily basis. There are three basic schools

and two primary schools within the Negril area, which are considered by all members of the community, with whom a contact was made, as being adequate.

The Negril Peninsula Resort Development will attract workers to the area and the provision of additional housing will encourage the influx of families. The primary school spaces being considered as adequate will, in time, need expanding partly due to the expected influx.
There is more than adequate space for secondary school goers in close proximity, with in excess of eight traditional and non-traditional secondary schools within a maximum of thirty minutes commuting time.

6.10.4 Health Service

The public health delivery service is the responsibility of the Western Regional Health Authority who operates a public clinic. The other existing health facility is a privately run health clinic. There also exists an ambulance service, which has been described as adequate by most persons interviewed.
For hospital services, residents travel to either Savana-la-mar, Lucea or, in extreme cases, to the Cornwall Regional Hospital in Montego Bay, none of which is greater than sixty minutes travel time away..

The development will construct and maintain a state of the arts medical centre to ensure the safety and continued good health of the guests and in case of emergencies, residents and workers of Negril.

6.10.5 Postal Services

There is a post office which adequately meets the needs of those residents of Negril who require its services. With the advent of many other forms of communication systems, the postal service is less used than in previous times and therefore it is not envisaged that the development will cause a strain on the existing service and will bring extra business and help to increase the profitability of this service.

6.10.6 Fire Services

The fire station in Negril has served the community well for its duration. The Negril Peninsula Resort Development will provide for fire fighting and prevention services on site, with the construction and equipping of modern fire fighting facilities. Special training will be given to firemen stationed in this area, in accordance with the unique conditions of the Marina. This will also relieve the strain on the existing services.

6.10.7 Recreational Facilities

Negril is renowned for its nightlife, however other forms of recreation are lacking and there are not enough sports or leisure facilities.
The Negril Peninsular Resorts Development will include parks and nature trails, sports facilities and a theatre and other areas for cultural activities, in keeping with the wholesome nature of the development and surrounding area.

This will increase the range of the tourism product and provide alternatives to the wide spectrum of our visitors.

6.10.8 Police & Security

There is a police station located in Negril which has proven adequate for the general needs of the population.
Negril Peninsular Resorts propose to construct a security station on site, to provide for the safety and security of its inhabitants, therefore not overstretching the existing services in Negril. A certain level of interaction between the police and private security will also be required, thus increasing the security levels of both the visitors, the workers and residents of the surrounding community.

6.10.9 Transportation

The increase in road users, and the increase the quality of road surface to be traversed, will increase the demand for passenger seats along both road corridors.
As with most rural areas, there are no transport companies fulfilling the transportation needs of the populous. These needs are however adequately satisfied by the presence of route taxis, offering efficient point to point service with the bonus of being able to stop on demand.
Any needs which may arise as a result of commuting workers will be adequately addressed by the route taxi service.

6.11 Fishing

There is no fishing or bathing beaches present on site, there has never been such a beach as is evident in the rock formation along the coastal frontage. This as also been confirmed by the owners of the Wedderburn property and fisher folk living in the vicinity.

The presence of a marina and as such medium and large size vessels will have no great effect on the local fishermen as it is expected that most would be leisure crafts and those who are involved in commercial fishing would do so off shore at the Pedro banks for example.

The presence of a marina may see the transfer of technology from our visitors to the fishermen.

Figure 3.11 Location of nearest fishing beach to Development.

-This is the closest fishermen's beach to the proposed development of Negril Peninsula Resort as listed in the Town and Country Planning Act 1978 (Westmoreland Parish)

6.12 Archeological and Cultural Heritage

The Jamaica National Heritage Trust has been requested to visit the site and state the extent, if any, of the presence of archeological or cultural presence on site. This is both to fulfill the duty of a good corporate citizen and also to be able to protect and exploit any such findings which may be present. This would fit perfectly into the theme of the protection of our environment in all its forms.

From the preliminary site visit JNHT was able to state with confidence that the lower coastal basin area would not be of archeological importance. Consequently any further field study would be confined to the elevated plateaus of the site. It was indicated that any further field study could be completed in one day.
A letter from JHT can be seen in Appendix XIII

6.13 Stakeholder and Community Consultations.

Many consultative processes, with Government Service Agencies, Stakeholders and members of the general public, have been conducted. Respondents in a public survey consisted of a varied group of people including labourers, housewives, security personnel, fishermen, farmers

and tourists (see Appendix 8 for a copy of survey questionnaire). Another consultative exercise took the form of a “meet the people” program held at the Westender Inn, in West End Negril. There were approximately 60 people in attendance and a briefing of the development was undertaken with questions and comments being solicited (see Appendix 8 for attendee list and a copy of the Outline Planning Submission Information Summary Brochure dated December 2006 that was distributed)

A meeting has been held with Ms Grace Lea, the President of the Negril Chamber of Commerce (who was given a new Outline Planning Submission Information Summary Brochure dated March 2007, that can also be seen in Appendix 8). Ms Lea explained that she was overwhelmingly in support for the development in it`s entirety and that it can only be positive for Negril in terms of the Tourism Product and the community at large.Ms Lea felt it was to the Developers credit that they were prepared to undertake such an important scheme for Negril and she was pleased to see that it would include new public areas such as amenity spaces, beaches, market and leisure facilities that would be open to everyone and not exclusively for use of visiting guests. She explained that this type of open approach to resort development is very much welcomed and is the best way for resort development to be sustainable in itself. Ms Lea stated further that the inclusion of a medical centre, security centre and recycling centre demonstrated how Negril Peninsula Resorts Limited had approached the overall design of the resort; she made her unreserved support to the developers and to the project going forward. .

A meeting has also taken place between Ms Jean Brown, the President of the Negril Coral Reef Preservation Society (who was also given the

updated Information Summary dated March 2007 and a Draft copy of the Marine report from the EIA) and the Developers, during which Ms Brown stated that, in the light of the type of development and the fact that the Developers are going through all of the correct channels and agencies and appear to be adhering to all the regulations the project has an environmentally sustainable capacity. She went on to state that she personally liked the project and would feel comfortable, after discussing it with her board and would like to give it her blessing. The Negril Coral Reef Preservation Society has worked closely with Peter Wilson Kelly (author of the marine chapter of this EIA report) and believes in his judgment.

Also many consultations have occurred with Service Agencies providing Potable water, Electricity, Telecommunications, Waste disposal, Road access and Hazard Management and as a result the Developers have altered their design to recommendations made by these controlling Authorities.

From these events, it is apparent that there were no real concerns by the respondents, all were supportive and enthusiastic about the proposed development and welcomed the many improvements it will bring to the local community.

A number of impact issues were discussed that are worth mentioning because of their representation of wider concerns and their outcome.

6.13.1 Infrastructure

This is the greatest concern, especially to those who live away from the immediate coastal belt. However it was pointed out that the presence of such a development will, facilitate the improvement of the infrastructure to reflect the standards set for the development.
There will therefore be an improvement in the proposed roadway from Negril along the Good Hope road to Orange Hill and the site. It is projected that new water pipes will be laid to transport potable water to the site. This will mean some communities will have access to piped water for the first time. The same holds true for the provision of telecommunication services.

6.13.2 Security

Respondents were happy that the Developer, being aware of security concerns , has included a security force as a major component to the plans, with the close cooperation of the police and security forces being an important part of the process.

6.13.3 Economic benefits

Many of the respondents were concerned about the possibility of the development being of minimal economic benefit to the majority of the community. They express the anxiety of the development being like

countless others wherein the average community member cannot gain access to those properties.

This concern was acknowledged by the developer who has stated it`s intent to allow for close community participation in and access to the development upon completion.

6.14 Conclusion

To the extent that the project is:

- Responsive to the consensus that tourism development provides the best opportunity for economic growth and employment,
- Located in an area zoned for resort development
- Supported by the majority of survey respondents, 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

- Beautify the area

• Important addition to the tourism product

- Diversifies the Hotel and Leisure product of Negril into a brand new market area

CHAPTER 7
MITIGATION, MANAGEMENT AND PLANNING

7.1 Mitigation

7.1.1 Flood Mitigation

The possibility of flooding comes mainly from high tides and wave actions, these may cause an increase in the levels in the ground water resulting in, poor percolation of storm water flows and back up of storm water in the outlet drains.

Wide grassed buffer swales will be constructed adjacent to the roadways to provide for holding areas for excess storm flows. Road crossing culverts will be located at critical positions to further channel storm flows away.

The use of sink holes, located on the upper terraces of the development, will serve to minimize the flow of storm water to the coast.

Coastal protection works, proposed in the Coastal Report, will further protect the storm water conveyance system from possible coastal surges and the resulting erosion of the coastline.

7.1.2 Land Use Zoning

All the development is zoned for tourism related activities

7.1.3 Natural Gullies

To ensure the flow of storm water from the development site and not to create any hazards, all naturally occurring gullies will be utilized to convey the storm water away from the development.
There are no named gullies but, the depression at the base of the escarpment will also serve to dispose of storm water.

7.1.4 Maintenance of Drains

Tree trunks, trash and other debris normally block hydraulic structures. When this occurs, drainage channels must be regularly cleaned to prevent blockages during rainy seasons and minimize flooding. The drainage maintenance program will be designed with specific drainage maintenance schedules and will ensure they are adhered to. These will involve the participation of the surrounding community.

7.1.5 Erosion Protection Measures

Erosion should not pose a problem for the development as the underlying rock structures show a solid limestone aquiclude with overburden only 5-6 meters at its deepest.

7.1.6 Landslide Mitigation Measures

As with erosion, landslides are not considered to be a possible hazard and as such mitigation measures will not be considered.

7.1.7 Socio-Economic Mitigation

1. To address the impact of increased traffic the following recommendations are offered:

- Upgrade of the Orange Hill Road to provide access to the development.
- In collaboration with the relevant road agency, an attempt to upgrade the West End Road from the round-a-bout to the Lighthouse and to widen the road from the Lighthouse to the site of the development should be achievable.
- Reactivation of an abandoned parochial road from the Mount Airy section of the Orange Hill Road will be sought, which will lead to the North-Western boundary of the property.

2. Construction of a Police Station will provide additional security to the surrounding communities.

3. The construction and equipping of a modern medical centre will provide additional health resources to Negril area.
4. Construction of a marina will create new job opportunities, not before present in any large quantities in Negril. The workforce will naturally undertake new training in order to diversify into these new areas such as boat and engine maintenance.
5. To reduce the possibility of increased noise during the construction phase, the project proponent will ensure that the construction activities are limited to regular working hours. Dust abatement must be achieved through the use of sprinklers on a regular basis.

7.1.8 Biological Mitigation

7.1.8.1 Terrestrial Fauna

There are no economically or socially important fauna stocks identified in the studies. The need to preserve some types of woody trees and shrubbery, to enhance the eco-tourism concept being undertaken and prevent further habitat loss to resident and visiting species to the site, will be undertaken.

7.1.8.2 Flora

Because of the lack of possible impacts, such as erosion flooding and land slippage on the development area, and the absence of woody phanerophitic in large quantities, mitigation activities for flora will be minimal.

7.1.9 Mitigation Cost

The mitigation cost to ensure the elimination of all possible negative effects will be in excess JA $250 000 000.00, which will only be a small fraction of the overall project cost. This will include construction of all storm water and tidal protection modules, relocation of terrestrial flora and marine life as recommended, along with all other post and pre construction factors which may arise.

7.2 Disaster Mitigation and Management

Studies undertaken on the development site have indicated a few areas of possible disasters and as a result, preparedness for emergencies is a very important aspect of social activity.

Emergency preparedness is aimed at minimizing the loss of life and property during a natural catastrophe.

Actions should be preplanned in anticipation of any catastrophes during the event and immediately thereafter. There are two levels of preparedness:

1. Hazard awareness planning

2. Public safety information

Hazard awareness planning tries to improve the ability of a specific region to the response to disasters. Disaster preparedness entails the monitoring of known hazard emergencies and implementing evacuation plans, a warning system, emergency routes and the formulation of educational programs for public officials and professionals.

Public safety information is inclusive of the effort aimed at disseminating the required information to the public and promoting cooperation between the public and authorities in the case of a disaster. Important changes can

take place in public and private behavior during the course of an emergency or its aftermath.

7.2.1 Disaster Management Plan

It is vital to the nature of the endeavour being undertaken, that care be taken to implement a plan to mitigate against any possible catastrophe which might occur.

A proper disaster plan should include the following components and should be refreshed at specific intervals:

- **The Operation of the Disaster Management Program is the sole responsibility of the Owners** of the property**.**
- **Designate an Emergency Coordinator and Alternate Emergency Coordinator** for the property.
- **Designate Safety Monitors and Alternate Safety Monitors** for specific work areas on the property.
- **Obtain and post floor plans with evacuation routes** and other information as specified in the plan.
- **Establish Designated Meeting Sites** at safe locations outside of buildings.
- **Review your operations to determine which critical operating systems may require continuing attention or shutdown during an evacuation or other emergency condition**. Develop a procedure to ensure that requisite actions are taken during an emergency.
- **Train the Evacuation Coordinator and all Safety Monitors** on their responsibilities to implement the plan and to assist in the safe and orderly emergency evacuation of building occupants.

- **Ensure that a procedure is in place for communication** and evacuation/safe refuge of disabled persons.
- **Ensure that a procedure is in place for communication with the emergency services.** Enlist the support of Fire Brigade, Jamaica Constabulary Force, Ambulance Service, Jamaica Defense Force and Coast Guard.
- **Customize the text and appendices of the plan to your facility.** Designate responsibility for plan custody, storage and annual review and update.
- **Develop employee responsibilities lists** as designated in the plan appendices.
- **Develop a training program** outline for distribution and review by employees.
- **Conduct training in plan requirements with all building occupants**. Ensure that occupants are aware of evacuation procedures in the event of an emergency. Keep a copy of evacuation plan training records, using the training form in the plan appendix.
- **Conduct periodic evacuation drills and critique the drills**. Enlist the support of ODPEM and the Westmoreland Parish Council for technical assistance.

7.2.2 Tsunami

Sections of the project area, notably the Drainage Area # 3 – the Coastal Basin area, are susceptible to tsunamis and storm surges. Whereas there are no means of preventing the occurrence of such a phenomena, the

implementation of pre and post event activities are instrumental in providing relief and minimizing post event stress.

The Local Parish Council has received application plans for the proposed development. The Parish Council must ensure, under their remit that the development adheres to the standards they require and as such does not result in inconvenience and hardship for those living in near proximity to the site.

The main activities surrounding the occurrence of storm surges and tsunamis include:

- Pre event warning
- Evacuation
- Post event mitigation.

7.2.3 Flood Rescue and Relief

The Office of Disaster Preparedness and Emergency Management (ODPEM) is the main governmental agency dealing with post disaster relief and providing critical lifelines, facilities for emergency response, training, disaster rehearsal and the identification and distribution of relief resources. Shelters are set up in all areas of the island in the case of emergencies. Most churches and schools are used as emergency shelters.

7.2.4 Post Flood Rehabilitation and Construction

Relief activities are usually followed by post disaster rehabilitation. Whereas the repair of housing and other structures start up of commercial activities and restoring the normal functions of public Service, business and

commerce are important, they will most often fail if mitigating measures are not put in place to reduce or eliminate the possibility of an occurrence. Usually repairs are undertaken but no measures are put in place to reduce the possibility of damage recurring year after year.

It is important that reconstruction costs be inclusive of all mitigating activities to ensure that the possibilities of the recurrence of catastrophes are decreased.

7.2.5 Education and Training

Education and training, both formal and informal, prepares people at all levels to participate in hazard management. Informal learning can be delivered through brochures, booklets, audio and video tapes, prepared by ODPEM and other relief groups such as, Red Cross and OAS and through the national media. Additionally, courses, workshops, conferences and seminars, organized nationally and by community organizations, disseminating large amounts of information, relief management and planning strategies, are available to the community.
Finally, direct observation after disasters has, proven to be one of the most effective means of learning. Post disaster investigations describe the qualitative and quantitative aspects of natural disasters, such as flooding, they often improve on information produced, by modeling and conjectures, and indicate areas where development should be extremely limited or should not take place. Direct outcome of the learning processes are:

- The improvement of policies and program actions, building codes, standards and construction design skills.

- The improvement of the key logistic aspects of disaster awareness, such as communication and warning systems.
- The establishment of community and resource organizations to confront similar future disasters.

7.2.6 Forward Planning

The activities that will ensue, as a result of the construction of an eco-tourism development inclusive of a marina would, without proper planning, increase the possibility of the occurrence of a natural disaster and its associated human suffering and economic loss. It is therefore vitally important that all possible disasters be identified and mitigating activities put into place to, reduce these hazards and minimize damage and injuries to people and properties. The need therefore arises for this EIA study.

Drainage, irrigation ditches and other water diverting activities, can alter the discharge of storm water and the waterways ability to receive and convey the discharge. Construction of buildings, roads and other hardtop surfaces will increase storm water runoff from the site and as a result, alters the natural flows into the receiving water bodies and/or gullies. Proper drainage systems must be designed and constructed to handle these increased flows.

Deforestation decreases the ability of the flora to absorb the storm water and thus increases the run off volume.

The dynamics of the area to be developed must be taken into consideration and incorporated into the planning so as to prevent and minimize any future hazards or manmade disasters.

Changes as a result of development in any area will, affect the dynamics of the area and must be taken into consideration when planning,

7.3 Environmental Monitoring Program

7.3.1 Development Control

The Local Parish Council has received application plans for the proposed development. The Parish Council must ensure, under their remit that the development adheres to the standards they require and as such does not result in inconvenience and hardship for those living in near proximity to the site.

It is incumbent also on the owners and/or operators of the property to do so in such a manner to ensure there are no adverse effects both on their neighbours or the environment.

7.3.2 Sewage

For disposal of the sewage generated from this development, it will be discharged into a sewage treatment and disposal facility to be constructed on site.

Sewage generated from ocean going vessels using the marina, will be discharged through specially designed pumping units with fats, oils and grease being separated before discharge into the central conveyance system. The program for monitoring these specific activities is to be finalized with the various community-based environmental organizations and the Environmental Health Unit of the Ministry of Health.

With the potential threat of raw sewage discharged into the environment and the deleterious effects of the various salts contained in the untreated effluent on marine life, it is vitally important that a proper and effective monitoring plan be formulated and implemented.

Such a plan should be exclusive of but not inclusive to:

- Formulation of plan
- Identification of human and material resources
- Training – theoretic and practical
- Effluent testing on a frequent basis.
- Inspection of area of marine discharge to ensure no adverse effects.

7.3.3 Public Amenities/Open Spaces

All developments must provide a minimum of open space. This being an eco-tourism venture there will be parks, open spaces and walking trails. The monitoring, operation and maintenance of all these areas will be the responsibility of the owner/operators of the property.

7.3.4 Disaster Response and Management

The Office of Disaster Preparedness and Emergency Management has been mandated to provide effective public education and training programs, to ensure the training needs of community members to respond to natural disasters are met. The owners/operators will liaise with ODPEM to initiate seminars and training sessions for staff members and permanent residents. The Disaster Management Plan should be implemented as outlined in section 11.0

7.3.5 Community Based Organizations

There is a strong and vibrant group of community based organizations, NGOs, commercial interests and state organizations that are the watch dogs for the community interests in the socio-economic and environmental spheres.
Their role is to protect the interest of the community at every stage of the development process and ensure that any activity will not have deleterious effects on the community and its members.

CHAPTER 8

IMPACT MATRICES

8.1 Table # 1 Socio-economic Post Construction Factors (macro)

Factor	Indicator	Type	Extent	Magnitude	Mitigative Measures	Comments	Weights
Socio-economic Post Construction (macro)	General development	Positive direct, new	Long term	Very significant	N/A	Contribute to housing/ infrastructure	+ 8
	Agricultural			Negligible			-1
	Social facilities	Positive direct, new	Long term	Very significant	N/A	Provision of police and fire stations, medical centre	+7
	Cultural/heritage	Positive			N/A		+5
	National/Regional Development	Positive direct	Long term	Very significant	N/A	Contribute to national and regional development	+ 7
SUB TOTAL							**28**

8.2. Table # 2 Socio-economic Post Construction Factors (micro)

Factor	Indicator	Type	Extent	Magnitude	Mitigative Measures	Comments	Weights
Socio-economic Post Construction (micro)	Economic/employment	Positive direct	Long term	Very significant	N/A	Contribute total project cost of Ja$ 2 billion dollars	+ 8
	Community Development	Positive direct	Long term	Very significant	N/A	Direct benefits from economic/employment opportunities	+4
SUB TOTAL							**12**

8.3 Table # 3 Ecological Factors during Construction

Factor	Indicator	Type	Extent	Magnitude	Mitigation Measures	Comments	Weights
`**Ecological – during construction**	Loss of habitat due to construction etc.	Negative direct	Short term	Not Significant	Retention of larger trees and relocation of smaller adaptive species to protected areas		-3
	Increased sedimentation on near shore marine waters and coral reefs	Negative indirect	Short term	Significant	Phased clearing of lands not to include natural drainage features	Valuable near shore reefs and marine habitat at risk due to possible increased sedimentation	-3
	Increased dust & noise level from human activity, storage and transport of materials	Negative Indirect	Short term	Insignificant	Wetting of driveways etc. Raise public awareness	Phased implementation	-1
	Solid and liquid waste	Negative direct	Short term	Significant	Operation and maintenance procedures	Use garbage facility for proper disposal	-4
	Loss of some forest habitat	Negative direct	Long term	Not significant	Planting of additional species	Valuable near shore	-1
	Disposal of excavated material from marina unto shoreline & for groynes	Negative direct	Medium term	Significant	Construction procedures	There will be improvement to the shoreline by beach creation and the covering of some iron rocks on the shoreline	- 5
SUB TOTAL							**-18**

8.4 Table # 4 Ecological Factors during Post Construction

Factor	Indicator	Type	Extent	Magnitude	Mitigation Measures	Comments	Weights
- Post construction	Increased sedimentation on near shore marine and coral reefs	negative indirect	Long term	significant	Phased clearing of lands not to include natural drainage features	Reefs/marine habitat at risk due to possible increased turbidity	-1
	Increased dust & noise level from human activity	Negative indirect	Long term	Insignificant	Improvement of habitat, attention to housekeeping	Use garbage facility for proper disposal	-1
	Solid and liquid waste	Negative direct	Long term	Significant	Operation and maintenance procedures		-2
	Shift in natural drainage patterns facilitating nuisance species	Negative indirect	Long term	Not significant	Engineering to prevent such habitats		-1
	Improved and concentrated habitat for avifauna	Positive indirect	Long term	significant		Model for future development	+7
	Increased public appreciation of ecology of area due to improved access	positive indirect	Long term	significant			+7
SUB TOTAL							**10**
GRAND TOTAL							**32**

APPENDIX 1
TERMS OF REFERENCE

TERMS OF REFERENCES FOR AN ENVIRONMENTAL IMPACT ASSESMENT STUDY

PREPARED FOR THE NEGRIL PENINSULA RESORT ECO-TOURISM DEVELOPMENT LOCATED AT WEDDERBURNS, WEST END, NEGRIL, WESTMORELAND.

At a Minimum, the TORs outlines the aspects of the Environmental Impact Assessment (EIA) which when thoroughly addressed will provide a comprehensive evaluation of the site, in terms of predicted environmental impacts, needed mitigation strategies, potentially viable alternatives to the development proposed and all related legislation.

Significant environmental issues may be site specific and project specific. It is expected that these issues be incorporated accordingly.

Of special consideration are:

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

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

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

Terms of Reference

The **Environmental Impact Assessment** should (but not be limited to):

1) Provide a complete description of the existing site proposed for development. Detail the elements of the development, highlighting areas to be reserved for construction and the areas which are to be preserved in their existing state.
2) Identify the major environmental issues of concern through the presentation of baseline data which should include social and cultural considerations. Assess public perception of the proposed development.
3) Outline the Legislations and Regulations relevant to the project.
4) Predict the likely impacts of the development on the described environment, including direct, indirect and cumulative impacts, and

indicate their relative importance to the design of the development's facilities.

5) Identify mitigation action to be taken to minimise adverse impacts and quantify associated costs.
6) Design a Monitoring Plan which should ensure that the mitigation plan is adhered to.
7) Describe the alternatives to the project that could be considered at that site

TO ENSURE THAT A THOROUGH ENVIRONMENTAL IMPACT ASSESSMENT IS CARRIED OUT, IT IS EXPECTED THAT THE FOLLOWING TASKS BE UNDERTAKEN:

Task #1. Description of the Proposed Project

Provide a comprehensive description of the project, noting areas to be reserved for construction, areas to be preserved in their existing state as well as activities and features which will introduce risks or generate impact (negative and positive) on the environment. This should involve the use of maps, site plans, aerial photographs and other graphic aids and images, as appropriate, and include information on location, general layout and size, ancillary buildings, as well as pre-construction, construction, and post construction plans.

For projects to be done on a phased basis it is expected that all phases be clearly defined, the relevant time schedules provided and phase maps, diagrams and appropriate visual aids be included.

The plans for providing utilities, waste disposal and other services, sewage treatment system and treated effluent disposal, storm water collection and disposal should also be outlined.

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

Task #2. Description of the Environment

Baseline studies, data collection and interpretation

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

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

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

Baseline data should include:

(A) Physical

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

ii) **Water quality** of any existing wells, rivers, ponds, streams or coastal waters in the vicinity of the development. Water quality information should be substantiated by data, where possible. Indicators should include but not be limited to nitrates, phosphates, faecal coliform, and suspended solids.

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

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

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

vi) Availability of solid waste management facilities.

(B) Biological

Present a detailed description of the flora and fauna (terrestrial and aquatic) of the area, with special emphasis on rare, endemic, protected or endangered species, sensitive habitats, including mangroves. Migratory species and wild food crop plants should also be considered. There may be need to include micro-organisms to obtain an accurate baseline assessment. Generally, species dependence, habitats/niche specificity, community structure and diversity ought to be considered.

(C) Marine Environment

Marine ecosystem, including but not limited to any seagrass and coral community, with indication of its function and value in the project area.

(D) Socio-economic & cultural

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

Task #3 – 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 beach areas should be identified and addressed.

Task #4 - Legislative and Regulatory Considerations

Outline the pertinent regulations and standards governing environmental quality, safety and health, protection of sensitive areas, protection of endangered species, siting and land use control at the national and local levels. The examination of the legislation should include at minimum, legislation such as the NRCA Act, the Housing Act, the Town and Country

Planning Act, Building Codes and Standards, Development Orders and Plans and the appropriate international convention/protocol/treaty where applicable.

Task #5 – Identification and Assessment of Potential Impacts

Identify and analyse the major environmental and public health issues of concern and indicate their relative importance.

Identify and analyse potential impacts, and cumulative as they relate to, (but are not restricted by) the following:

- change in drainage pattern
- flooding potential
- landscape impacts of excavation and construction
- loss of natural features, habitats and species by construction and operation
- pollution of potable, coastal, surface and ground water
- Air pollution
- capacity and design parameters of proposed sewage treatment facility.
- socio-economic and cultural impacts.
- risk assessment
- noise
- solid waste
- the carrying capacity of the proposed site
- visual impacts, including view of sea and coastline from the mainroad.

Potential impacts should cover both the terrestrial and marine environment.

The **impacts that have occurred and those impacts which could still occur** as a consequence of the clearing works that were conducted on the site prior to the preparation of the TORs should also be identified and analysed.

Distinguish between significant positive and negative impacts, reversible or irreversible direct and indirect, long term and immediate impacts. Identify avoidable as well as irreversible impacts.

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

Task #6 – Storm Surge Analysis

Conduct storm surge analysis to inform coastal setbacks of buildings and other impact mitigation measures.

Task #7 – 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
iii. Drainage control for the gully dividing the property, to include impacts that this drain will have on the aestethics, water quality and sedimentation of the beach area, etc.

Task #8 Impact Mitigation

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

Task #9 – Environmental Management and Monitoring

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

An **outline monitoring programme should be included in the EIA**, and a detailed version submitted to NEPA for approval after the granting of the permit and prior to the commencement of the development.

At the minimum the monitoring programme and report should include:

- Introduction outlining the need for a monitoring programme and the relevant specific provisions of the permit/license(s) granted.

- The activity being monitored and the parameters chosen to effectively carry out the exercise.
- The methodology to be employed and the frequency of monitoring.

- The sites being monitored. These may in instances, be pre-determined by the local authority and should incorporate a control site where no impact from the development is expected.
- Frequency of reporting to NEPA
-
- Raw data collected. Tables and graphs are to be used where appropriate
- Discussion of results with respect to the development in progress, highlighting any parameter(s) which exceeds the expected standard(s).
- Recommendations
- Appendices of data and photographs if necessary.

Task #10 - Project Alternatives

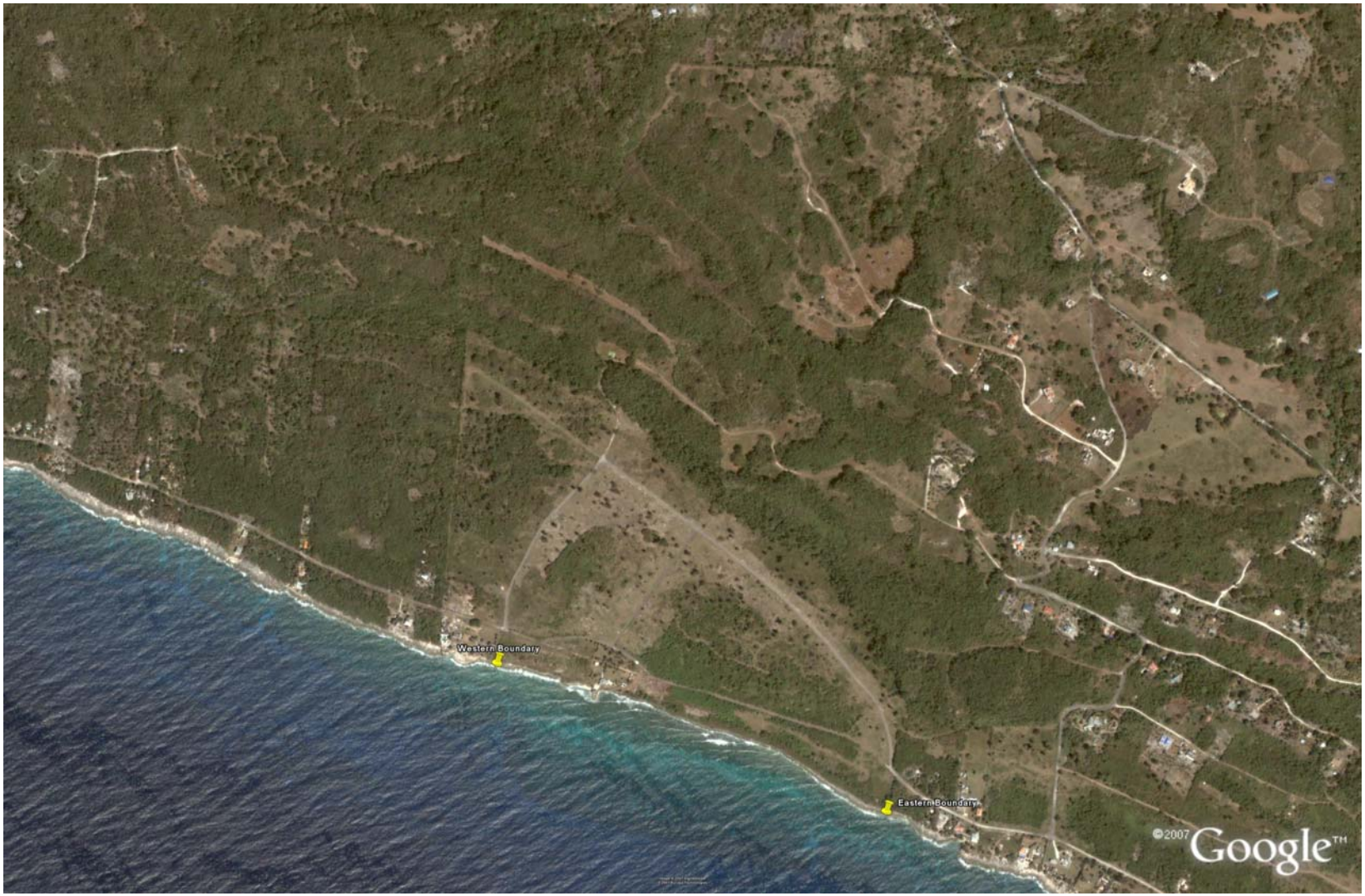
Examine alternatives to the project including the no-action alternative. This examination of project alternatives should incorporate the use history of the overall area in which the site is located and previous uses of the site itself.

The EIA Report

All Findings must be presented in the **EIA report** and must reflect the headings in the body of the TORs, as well as references. Ten (10) hard copies and an electronic copy of the report should be submitted.

The report should include an appendix with items such as maps, site plans, the study team, photographs, and other relevant information.

APPENDIX 11
LOCATION MAP


Western Boundary
Eastern Boundary
©2007 Google™

Wedderburn Development

LOCATION MAP

APPENDIX 111
STAKEHOLDER AND PUBLIC CONSULTATIONS

S.P.K. ENGINEERS LTD.

Civil and Environmental Engineers

MANAGING DIRECTOR

GARFIELD HAUGHTON P.E, MSc. (AACI)

Telephone: ***(876) 319 7220***

15 University Crescent ***(876) 927 2709***

Kingston 5 **Email: ghaughton@cwjamaica.com**

SOCIO-ECONOMIC QUESTIONAIRE

POSSIBLE EFFECTS OF PROPOSED ECO-TOURISM DEVELOPMENT TO BE LOCATED IN THE WEST END AREA OF NEGRIL, ON RESIDENTS AND COMMERCIAL INTEREST INNEGRIL

1. Status of Respondent:

Resident	----------
Commercial interest	----------
Commuting worker	----------

2. Are the infrastructure in Negril and the surroundings adequate to meet your needs;

A) Water supply Y____ N____

B) Sewage disposal Y____ N____

C) Proper road network Y____ N____

D) Proper and adequate health care Y____ N____

1) How near is Clinic _____Km

2) How near is Hospital _____Km

E) Adequate transportation Y____ N____

By 1) Bus ____

2) Route Taxi ____

3) Hackney Carriage ____

4) Private vehicle ____

F) Entertainment facilities Y____ N____

G) Adequate schooling

Basic school Y____ N____

Primary school Y____ N____

Secondary school Y____ N____

3. Are you in support of additional tourism development in Negril

Y____ N____

4. Would you be supportive of a major Eco-tourism development including a marina in the West End area of Negril. Y____ N____

5. Would such a development have a major economic effect on you

Y____ N____

6. Would such an effect be positive or negative Po___ Ne__

7. Would such a development have a major social effect on you

Y____ N____

8. Would such an effect be positive or negative Po___ Ne___

9. Please state below any positive or negative such a development would have on you or your family.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Signature of respondent: _____

Signature of questioner: _____

MARCH 07 INFORMATION SUMMARY

...The diversity of colour, sounds and textures enriches your immediate environment. You feel your spirits lifting.
The Negril Peninsula is an unique concept of bringing together the natural resources of Jamaica with first class resources in leisure, technology, physical and spiritual well-being to create a vacation / lifestyle experience"

Outline Planning Submission

Information Summary

Negril Peninsula Resorts Limited

Wedderburns Development Project

March 2007

Negril : Jamaica

negril peninsula

NEGRIL PENINSULA RESORTS LIMITED

EXECUTIVE SUMMARY AND DEVELOPMENT OVERVIEW

The accompanying documents and plans set out the proposals of Negril Peninsula Resorts Limited for the development of an Eco-Tourism Resort on the area of land situated deep in the west end of Negril, beyond the Lighthouse and known as **Wedderburns**, part of Retreat Estate on the Negril Peninsula.

The details will serve to illustrate how its approach will carefully generate a development of significant importance to the economy of Negril and to the Parish of Westmoreland, setting a new tone and standard for future growth.

Working closely and sympathetically with the natural beauty and unique topography of this location and extending what has become affectionately known as **'West End Life'**, this **New World Class Destination**, on the edge of the established resort town of Negril, will provide a **Sustainable Ecologically Friendly Mixed Use Scheme** comprising of a **Marina, Beaches, Shopping Mall, Car Park, a Medical Centre and a Security Centre, 1202 Dwellings ranging from Luxury Villas to sea view Condos and from Duplexes to a broad range of Apartments .The scheme includes a Beach Hotel, Spa Hotel, Equestrian Hotel, Civic Buildings, Retail Outlets, Restaurants, Offices and Municipal Buildings along with Park Land and an Amphitheatre for public events**. Set within its own oasis of calm offering breathtaking views, Negril Peninsula Resort's unique location will be built as a locally organized, quiet development of spacious hamlets and importantly, all underpinned by **Civic, Leisure and Health facilities that work in harmony with the community**.

The design approach will respond to the need for planned, sustainable development and recourse to Architecture that applauds the creativity and great tradition of building in a "Jamaican Vernacular".

Operated on a fully serviced basis, resort residences will be constructed using indigenous and natural materials, to give the impression of simplicity and organic assimilation within the setting, in so doing promoting a sense of wellbeing and holistic ecological balance.

Whilst exciting in any of its proposed phases, the development of Negril Peninsula Resort will be a signpost for responsible growth with concern for the social and economic welfare of our people and Island Life – **our 'Real' assets**.

DESCRIPTION OF PROPOSED DEVELOPMENT

It is proposed to develop an eco-tourism resort on three hundred and sixty one acres. This mixed use development will provide approximately six thousand two hundred and twenty eight (6288) habitable rooms..

The coastal shoreline of approximately nine hundred and fifty five meters, fronted by the Caribbean Sea at the south, is projected to accommodate a medium-sized marina to accept keeled yachts and medium-sized ocean-going vessels. In addition, five new beaches will be created to complete this new coastal destination.

For sustainability, a substantial part of the lower basin has been earmarked for commercial life and will see the establishment of new office buildings, retail areas, restaurants, sports and leisure facilities presently unrivalled anywhere in the region.

New infrastructure will include roads, sewage collection and conveyance systems inclusive of laterals, water supply systems, curb walls and side walks. Also included will be the construction of a secutity centre and medical facilities along with adequate car parking provision for the entire development in its constituent parts.

The areas adjoining the proposed development consist of Secret Paradise, a new Resort Hotel Development and by a number of land owners to the West. To the East lies Jackie's on the Reef, a New Age Spa and the Pitkelleney subdivision. The Caribbean Sea is to the South and a number of land owners with mainly uninhabited and heavily vegetated property are to the North.

4.0 Wedderburn Estate

aerial view of the Wedderburns Estate

2.0 Location & History

Even young middle-aged Jamaicans remember when Negril was really nothing more than a lighthouse to guide ships around the rocky western coast, and its population consisted mostly of land crabs... big red ones, good for eating. Tourist accommodation consisted of one house, which could be rented, called Llandtrissant, no doubt built by a Welsh resident in the first half of the century.
Llandtrissant is still there. But it has neighbours... hostelries accommodating thousands of tourists nowadays.
Even after Negril began its first tentative steps on the road to resort fame, it maintained a very low profile, but it was impossible to keep such a place secret and so, inevitably, the trickle of visitors became a flow, and then a flood.
The first to discover Negril's charms were the "Hippies and Flower Children" of the early seventies, who naturally gravitated to the laid-back lifestyle here and related to the warmth and gentleness of the sparse population. Their influx led to the development of Negril's West End on the cliffs beyond the lighthouse.

Hippies were followed closely by the better-heeled visitor whose concept of paradise went beyond a hammock and palm-thatched bohio; so luxury hotels began to sprout. The eighties saw even more expansion as Negril's fame spread and those same hippies, now lawyers, doctors and businessmen, began to return to recapture the idyll for a couple of weeks each year.
The hippies left their mark forever on Negril, and helped to create its carefree, unhurried atmosphere where friendships spring up between visitor and local, making Negril the ideal place to meet Jamaicans on their own turf.

Nowadays the people of Negril seem to be aware of their uniqueness and exhibit a pride in their territory which almost becomes a nationalistic attitude. They take great delight in telling the tale of the promoter who marketed Negril so skillfully that one arriving tourist was heard to exclaim: "But this is Jamaica, I thought we were going to the island of Negril".
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Hotels, none more than two stories high, grace the shoreline and most of them welcome the day visitor who can use their beach facilities and enjoy a few drinks at their beach bars.

Weddderburns Shoreline
looking South

Weddderburns Shoreline
looking North

Paradise comes in another guise as you leave this seven-mile strip and pass the roundabout in what could be called the centre of Negril. From here the road meanders along to the West End, where hotels and restaurants cling to the cliff's edge. Here there is no beach. White sand gleams from the seabed. Here there are caves to explore, and rocky bluffs where heroism can be added to holiday pastimes and doughty souls may hurl themselves from dizzying heights into the crystalline waters below.
Negril occupies no great place in the history books and especially not in the annals of naval warfare. British Admiral Benbow sailed ruefully into Negril (christened Negrillo by Spanish discoverers in 1494) and regrouped his forces after his ill-fated encounter with the French under Admiral DuCasse.

It was also from Negril that in 1814 the British expeditionary force reached New Orleans where they were defeated by Andrew Jackson two weeks after the Treaty of Ghent had already ended the 1812 war.

Negril was not too lucky for pirates, either. The infamous Calico Jack and Anne Bonney disported themselves in this area and were finally captured here. No doubt Negril's charm caused them to let down their guard.

It is easy to explore Negril. After all, it only has one road, and it runs along the beach or the foreshore. Take it easy and walk along the beach or the main highway (Norman Manley Boulevard). If you feel impelled to rush, push-bikes and motor bikes can be hired.

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This then, is Negril, as close to the conflagration of a Caribbean sunset as you can get in Jamaica, without falling off.

5.1 Natural Features

The Wedderburn site is characterized by the wide lower coastal basin which lends itself to a small village development. The sea depth at this point of coastline also provides adequate depth for keeled yachts, so the idea of a medium sized harbour marina makes sense. The coastline elsewhere along the coast has limited depth and restricts boat types to catermarans or retractable keeled boats. The Harbour marina will attract sea traffic, create the notion of sea taxis to ferry people along coast to other sights and form a new focal point to the coastline.

The land stretching back towards the Cliff feature demarks the extent of the lower village basin. Above the cliff escapement which runs east to west across the site, provides elevated terrain which over looks the coast and provides a dramatic location for villas or hotel properties. From the Cliff edge back up the site there is a middle terrace which reaches back to a second curving escarpment feature. This feature rises to protect the upper terrace at the back of the site. The proposed project development makes use of these terraces and basin to create obvious zones for residential and village activities.

5.2 Foliage And Natural Vegetation

Throughout the development it is proposed that all natural vegetation and mature trees are retained where possible. The feel and look concept of the public and residential areas is to create glimpses of views to sea, gardens and buildings. Arrival onto site from East or West is to have treed colonnades which welcome and direct visitors into and throughout the site. Tree lined walkways and roads, are essential to the feel and atmosphere of the village basin area. Where possible buildings blocks are inter-dispersed with green open or tree planted public spaces.

On the cliff and terraces plots will be developed around major trees and rock outcrops. The plots will be investigated when main roads are constructed to maximize use of natural vegetation. Throughout the site there is large variety of mature trees, groves, vines and cacti type plants. These are all important features, character of development and will act as means to prevent soil erosion or denuding of land. The various zones in the development can remain heavily vegetated before controlled thinning or landscaping.

5.3 Cliff Feature

The Cliff feature on the site is very pronounced towards the central area of the basin area. The cliff varies in height and steepness growing from gentle gradients on the west side to buttresses projecting back and forward in the middle of the site and again tapper and lessen in steepness towards the eastern side of the site. Access through the cliff at fist look appears to be difficult but on inspection there are variety of breaks and slopes which break through the feature. These breaks will be utilized for road and pedestrian access. The natural rock pockets in the limestone will lend themselves to hanging gardens if planted with appropriate plant types. The large trees with foliage canopies lend themselves to shading buildings and creating feature around which terraced building elements can be formed. The look and feel these dwelling will be a modern departure from the more traditional roof buildings proposed elsewhere.

The Cliff Spa concept for hotel is located on the prominent buttress area along the cliff feature. The remote location with superb views across the village to the coastline will provide a quiet and select development opportunity. The remote position can be overcome by road or for quick pedestrian access to the basin area, a cliff lift is proposed to allow hotel clients decend or ascend the steep cliff face.

5.4 Escarpment Feature

The upper escarpment feature to the rear of the site lends itself to a tree/ landscaped park area. A trail midway throughout the length of the slope west to east on the site is proposed. This public park area is an essential element for encouraging pedestrian trials or recreation, high up on the rear of the site.

5.5 Civic areas Public Activities

The approach to the village basin and residential areas is to create manageable public and civics spaces. The retail buildings and potential restaurants can be linked by the large civic spaces adjacent to the marina. The concept of pedestrian trails that start high up the site can link the upper terraces traveling south across the site.

The village plaza and park are proposed to provided multifunction opportunities at festival, seasonable periods in the year. A market canopy is included to promote covered market or concert use. An open air theatre area has also be suggested beyond the market area. Activities during potential regattas can also be catered for using the market canopy or have temporary structures erected on the plaza.

5.6 Mixed Amenities and Activities

The success of the whole development "residential and village concept" is reliant on the marina, retail and restaurant type buildings, which in turn will require support amenities for the various industries, servicing and management requirements. The coastal area dominated by the coast road and restricted access to the sea, will approach the Wedderburn project to discover an attractive open, spacious civic area. This approach will create a great relief and focal point to the coastal area.

5.7 Road Location Circulation And Pedestrian Access

The three terraces are accessed by perimeter north/ south roads and traversed along terraces via east west roads. Minor roads then access the building lots and sectors/ areas of housing. The approach to siting roads has been to following the natural lay of the land where possible. Steep sections occur at west and east ends of the cliff area. On site review there a natural breaks and gradients where roads will be possible to build within major engineering. consideration for vehicles and pedestrian travel have been incorporated into the site planning to encourage access on foot from northern parts of the site through to the basin coastal areas.

The development of horse/ bridal paths is possible around all boundaries to the site and in the escarpment park areas. this recreational activity could be extended to the community as a whole and link with the new Secret Paradise Equestrian development and future Providence Sites. The high terrace area on site has a suggested Equestrian/ Ranch Hotel which would benefit from bridal ways around and throughout the site.

Where possible controlled use of access routes have been encouraged to improve activity and multiple use of the hill top terraces and coastal basin.

6.0 Schedule of Accomodation **29th March 2007**

HOUSE TYPE	NUMBER OF DWELLINGS	HABITABLE ROOMS PER DWELLING	TOTAL HABITABLE ROOMS	NETT INTE RNAL AREA PER DWE LLING		TOTAL NETT INTERNA L AREA	
				M2	FT2	M2	FT2
Cliff house C+E	14	3	42	67.5	726	945	10,164
Cliff house C+2E	21	3	63	67.5	726	1,418	15,246
Villa M	45	7	315	271.4	2,921	12,213	131,445
Villa 2M	218	7	1,526	271.4	2,921	59,165	636,778
Villa 3M	66	7	462	271.4	2,921	17,912	192,786
House I	6	4	24	138.0	1,486	828	8,916
House 2I	146	4	584	138.0	1,486	20,148	216,956
House G	1	4	4	90.7	977	91	977
House 2G	402	4	1,608	90.7	977	36,461	392,754
Penthouse Apts over commercial	82	4	328	112.0	1,214	9,184	99,548
Marina Apts	120	5	600	104.2	1,122	12,504	134,640
Apts over retail BLDG`s C,D,E,F,G TYPE A	57	2	114	60.8	655	3,466	37,335
Apts over retail BLDG C TYPE B	2	2	4	74.7	804	149	1,608
Apts over retail BLDG`s D,F TYPE B	4	2	8	68.8	741	275	2,964
Apts over retail BLDG E TYPE B	4	2	8	69.3	746	277	2,984
Apts over retail BLDG G TYPE B	4	2	8	58.2	626	233	2,504
Apts over retail BLDG C TYPE C	2	2	4	71.4	769	143	1,538
Apts over retail BLDG`s D,F TYPE C	4	2	8	66.3	714	265	2,856
Apts over retail BLDG`s F TYPE D	4	3	12	69.3	746	277	2,984
TOTAL	1,202		5,722			175,955	1,894,983

LAND USE	APPROX AREAS		APPROX BUILD AREA	
	ACRES	HECTARES	M2	FT2
Residential	206	83	194,702	2,095,180
Parkland/Amenity	36	15		
Marina	13	5		
Beach	13	5		
Beach Hotel	7	3	9,337	100,498
Spa Hotel	8	3	10,045	108,122
Equestrian Hotel	5	2	17,712	190,648
Civic/Retail	31	13	98,933	1,064,907
Municiple Buildings	6	3	21,715	233,737
Support/Sewage Treatement/Waste Sorting Centre	12	5	21,438	230,757
Medical/Security Centre	4	2	5,904	63,551
Sundry,Roads etc	20	8		
TOTALS	361	147	379,786	4,087,400

9.0 Business and Employment Opportunities

The Wedderburn project is envisioned as an opportunity to provide new amenities and fabric to the Negril area. The development is seen as a new community that will enhance the local area and provide employment for those living or working near to or within the development. The opportunities for employment could be developed in the sectors listed below.
1.0 Retail/ Commercial. Located in the village basin area, a variety of shops and offices have been proposed over two stories.

2.0 Administrative/ Office. Located in Village area and housed above Retail stores or in the Support Sector to west of site.

3.0 Service Industry. The maintenance and servicing of residences and landscape areas is possible over all of the site. The various hotels, businesses or residences will require daily, weekly and monthly facility management.

4.0 Repair /Engineering. The marina area and by nature of boat repairs and servicing will generate a need for boats and marine engine repairs and servicing. Local cars and buses will also require servicing and general parts.

5.0 Education. Within the support or commercial retail areas there is opportunity for all levels of education nursery, primary to intermediate schooling. Adult study centers could also be incorporated in the office commercial or support areas.

6.0 Medical/ Healthcare. A suggested medical centre complete with helipad has been sited at the eastern side of the site.

7.0 Welfare. Private or public welfare offices and advise centres could be incorporated in the support and commercial sectors.

8.0 Financial. Local or international banks would ideally take spaces in and around the retail commercial areas.

9.0 Municipal/ Government. An area parallel to the western approach promenade has been suggested for potential centralization of Negril Municipal type department requirements.

10.0 Police Station. The development perceives the need for a local police station. Several areas locations are possible near to the western or eastern edge of the development close to the main road through the village area.

11.0 Hotel. The development has suggested three types of hotels on three very different locations. The Coastal Boutique hotel is sited on the south eastern edge of the site, with access to seas and private beach. The Spa Hilltop Hotel has been suggested centrally located at the high point of the Cliffs overlooking the village. The third Hotel looks to create a ranch style development making use of the upper terrace and tree/ landscaped environment. Each hotel will require different forms of servicing and staffing.

12.0 Recreation. The project encompasses recreational activities that can be either land or water based. Associated with these will instructor, trainer, servicing and operator employment opportunities. The land activities mentioned such as walking and horse riding could be expanded into rock climbing on the central limestone cliff area and also trekking within the jungle remote hills. these activities may require experts in the various fields. The later, trekking can take advantage of local farming and hill communities.

13.0 Tourism. The development will add greatly to the projects promotion and to the Negril west coast generally. Employment requirements may start reasonably small during marketing construction phases and grow into what may be a regional staffing opportunity.

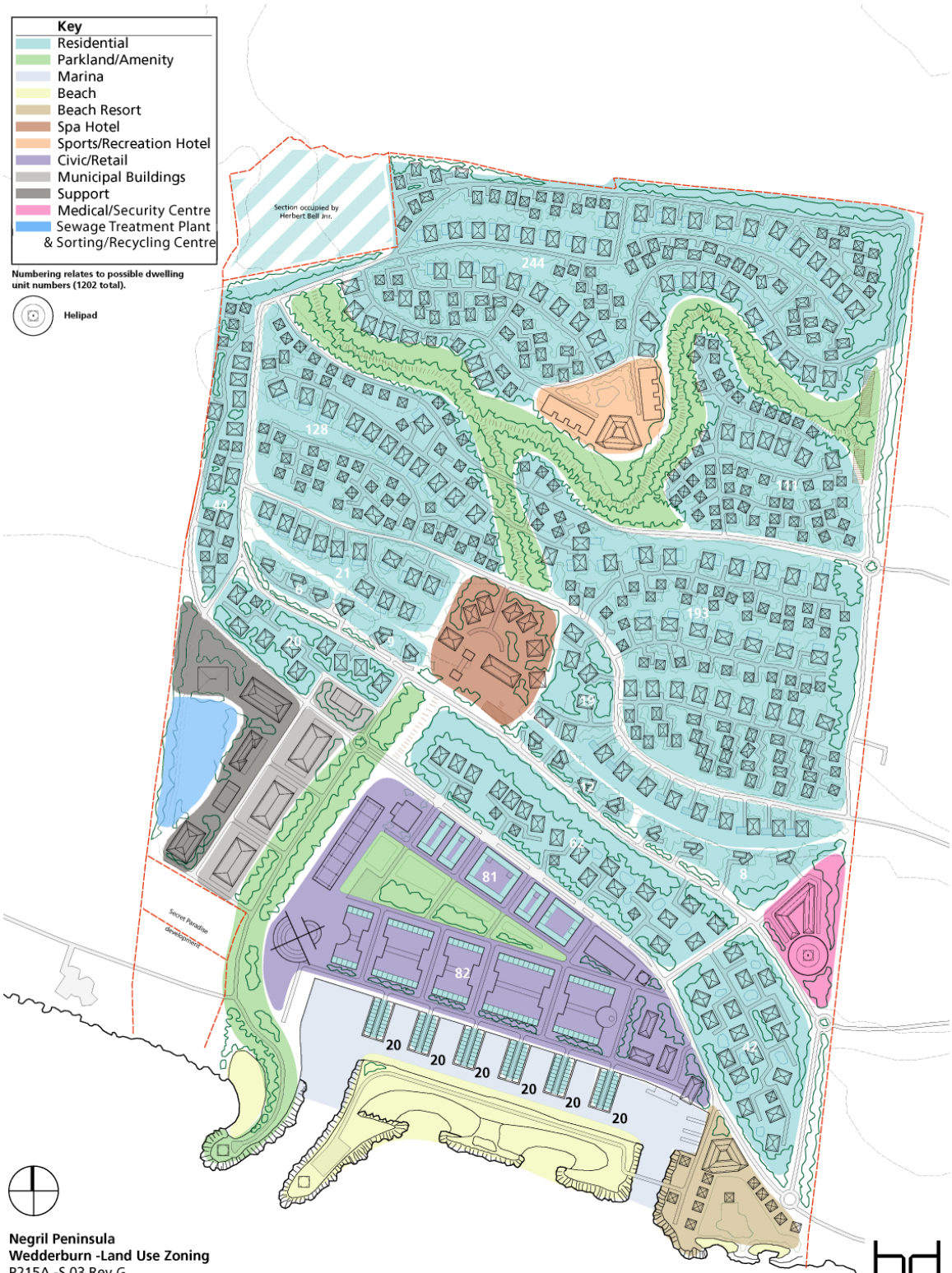
14.0 Transport. While new roads and access are being incorporated into the development, the demands for car, bike and cab hire will flourish to cater for the demand of local or visiting people. Coach and bus services could be located near to civic and support areas zoned in the development.

15.0 Food and Restaurant Industry. The creation of a new community will have demands for food and recreation eating. The inclusion of space in the commercial support and retail areas in the village will provide opportunity for food shopping centres and restaurants. The Hotels proposed will also assist with the demands for food and will encourage different types of venues for residents, workers and visitors.

Negril Peninsula
Wedderburn - Design Plan
P215A.-S.05 Rev F
A1 - 1:2500 A3 - 1:5000
Oct 2006

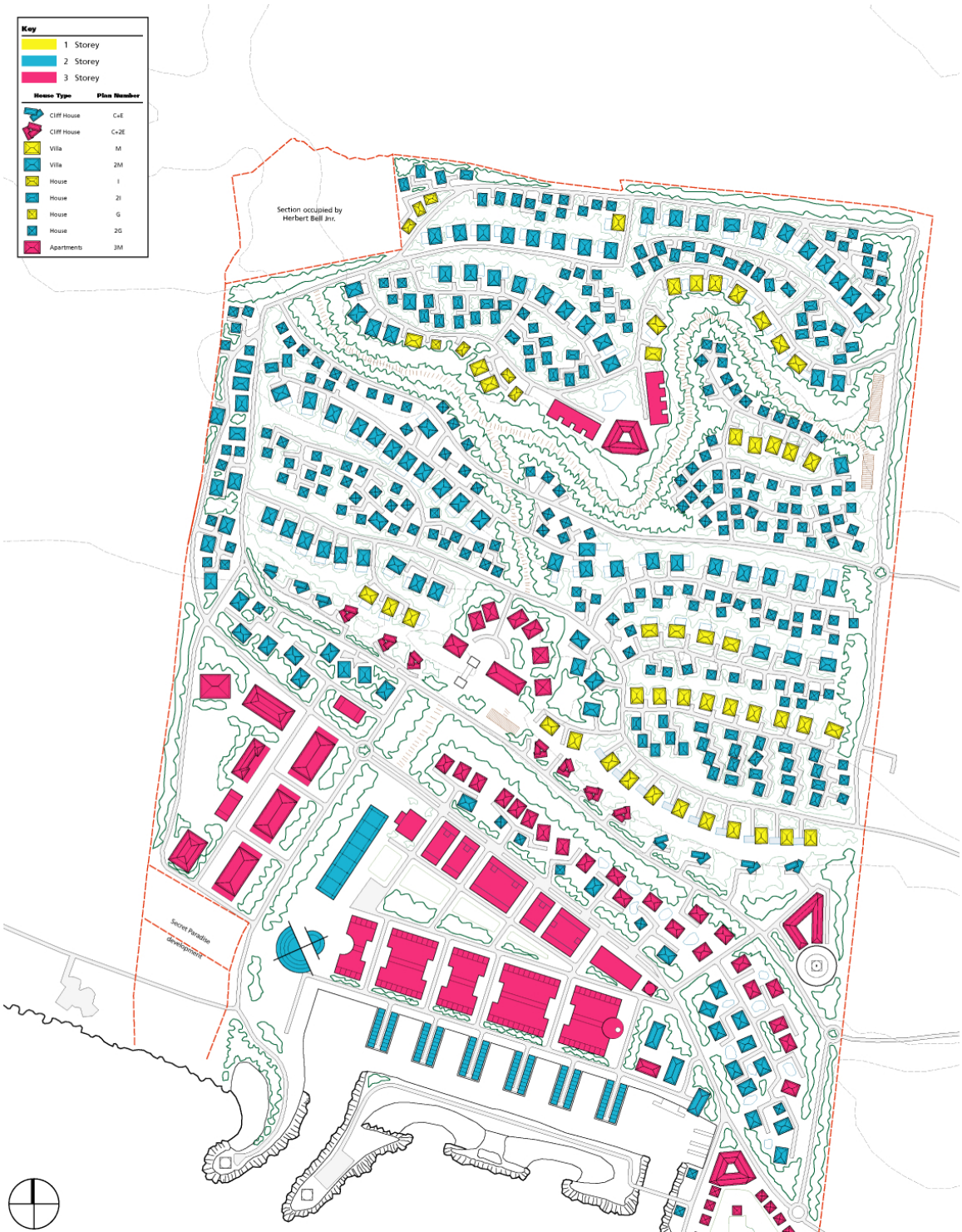
0 100 200 300 400 500m

Harper_Downie
design architecture



Negril Peninsula
Wedderburn -Land Use Zoning
P215A.-S.03 Rev G
A1 - 1:2500 A3 - 1:5000
Oct 2006

Harper_Downie
design architecture



Negril Peninsula
Wedderburn - Storey Height/Density Plan
P215A.-S.04 Rev G
A1 - 1:2500 A3 - 1:5000
Oct 2006

Harper_Downie
design architecture

Outline Planning Submission

Information Summary

Negril Peninsula Resorts Limited

Wedderburns Development Project

December 2006

Negril : Jamaica

...The diversity of colour, sounds and textures enriches your immediate environment. You feel your spirits lifting.
The Negril Peninsula is an unique concept of bringing together the natural resources of Jamaica with first class resources in leisure, technology, physical and spiritual well-being to create a vacation / lifestyle experience".

negril peninsula

DECEMBE
INFORMA
SUMMAR

NEGRIL PENINSULA RESORTS LIMITED

EXECUTIVE SUMMARY AND DEVELOPMENT OVERVIEW

The accompanying documents and plans set out the proposals of Negril Peninsula Resorts Limited for the development of an Eco-Tourism Resort on the area of land situated deep in the west end of Negril, beyond the Lighthouse and known as **Wedderburns**, part of Retreat Estate on the Negril Peninsula.

The details will serve to illustrate how its approach will carefully generate a development of significant importance to the economy of Negril and to the Parish of Westmoreland, setting a new tone and standard for future growth.

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1.0 The Vision

Walking lightly on this earth.

The Negril Peninsula; Providence Mountain and Wedderburn, combined with their immediate surroundings; hilly promontories, sea inlets, rocky coasts and sandy bays, is a place of great natural beauty, offering those that visit a chance to experience calmness and an association with the landscape that supports them.

This unique location can be gently adapted to extend it's potential to support a community that places the holistic values of inner calm alongside that of physical well being, and a desire to sustain the ecological balance of our earth.The morphology of the planned development will be akin to the organic growth of Jamaica as a whole. It will celebrate the balance between man and nature, landscape and colonisation. Buildings will respect the environment and will be constructed of indigeneous materials, to maximise the benefits of the natural world: light, wind, shade, sound and texture.

The overall impression will be of simplicity where the definition of beauty is "not when nothing else can be added but when nothing else can be removed."

The collective building will vary in form and colour but will share the desire to be enriching to the viewer and user while rejecting any degree of opulence. The entire development will feel at ease with it's function.

The Negril Peninsula aims to provide; a golf course and marina, boutique hotels of simplicity and sensitivity, a number of carefully planned villas, all built around locally organised hamlets, quiet and spacious leisure facilities, health, community buildings and retail.

This potential must be achieved with a complete understanding of the way of life in Negril. Nothing must be unnatural. It will be as concerned with the economic, social and political welfare of the island as it will be with the aesthetics and function of the proposed development. It will be integrated fully into the milieu.

The development will be a gentle catalyst for change and a signpost for responsible growth throughout the whole island, giving prosperity to all.

2.0 Location & History

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On the cliff and terraces plots will be developed around major trees and rock outcrops. The plots will be investigated when main roads are constructed to maximize use of natural vegetation. Throughout the site there is large variety of mature trees, groves, vines and cacti type plants. These are all important features, character of development and will act as means to prevent soil erosion or denuding of land. The various zones in the development can remain heavily vegetated before controlled thinning or landscaping.

5.3 Cliff Feature

The Cliff feature on the site is very pronounced towards the central area of the basin area. The cliff varies in height and steepness growing from gentle gradients on the west side to buttresses projecting back and forward in the middle of the site and again tapper and lessen in steepness towards the eastern side of the site. Access through the cliff at fist look appears to be difficult but on inspection there are variety of breaks and slopes which break through the feature. These breaks will be utilized for road and pedestrian access. The natural rock pockets in the limestone will lend themselves to hanging gardens if planted with appropriate plant types. The large trees with foliage canopies lend themselves to shading buildings and creating feature around which terraced building elements can be formed. The look and feel these dwelling will be a modern departure from the more traditional roof buildings proposed elsewhere.

The Cliff Spa concept for hotel is located on the prominent buttress area along the cliff feature. The remote location with superb views across the village to the coastline will provide a quiet and select development opportunity. The remote position can be overcome by road or for quick pedestrian access to the basin area, a cliff lift is proposed to allow hotel clients decend or ascend the steep cliff face.

5.4 Escarpment Feature

The upper escarpment feature to the rear of the site lends itself to a tree/ landscaped park area. A trail midway throughout the length of the slope west to east on the site is proposed. This public park area is an essential element for encouraging pedestrian trials or recreation, high up on the rear of the site.

5.5 Civic areas Public Activities

The approach to the village basin and residential areas is to create manageable public and civics spaces. The retail buildings and potential restaurants can be linked by the large civic spaces adjacent to the marina. The concept of pedestrian trails that start high up the site can link the upper terraces traveling south across the site.

The village plaza and park are proposed to provided multifunction opportunities at festival, seasonable periods in the year. A market canopy is included to promote covered market or concert use. An open air theatre area has also be suggested beyond the market area. Activities during potential regattas can also be catered for using the market canopy or have temporary structures erected on the plaza.

5.6 Mixed Amenities and Activities

The success of the whole development "residential and village concept" is reliant on the marina, retail and restaurant type buildings, which in turn will require support amenities for the various industries, servicing and management requirements. The coastal area dominated by the coast road and restricted access to the sea, will approach the Wedderburn project to discover an attractive open, spacious civic area. This approach will create a great relief and focal point to the coastal area.

5.7 Road Location Circulation And Pedestrian Access

The three terraces are accessed by perimeter north/ south roads and traversed along terraces via east west roads. Minor roads then access the building lots and sectors/ areas of housing. The approach to siting roads has been to following the natural lay of the land where possible. Steep sections occur at west and east ends of the cliff area. On site review there a natural breaks and gradients where roads will be possible to build within major engineering. consideration for vehicles and pedestrian travel have been incorporated into the site planning to encourage access on foot from northern parts of the site through to the basin coastal areas.

The development of horse/ bridal paths is possible around all boundaries to the site and in the escarpment park areas. this recreational activity could be extended to the community as a whole and link with the new Secret Paradise Equestrian development and future Providence Sites. The high terrace area on site has a suggested Equestrian/ Ranch Hotel which would benefit from bridal ways around and throughout the site.

Where possible controlled use of access routes have been encouraged to improve activity and multiple use of the hill top terraces and coastal basin.

6.0 Schedule of Accomodation **6-Nov-06**

HOUSE TYPE	NUMBER OF DWELLINGS	HABITABLE ROOMS PER DWELLING	TOTAL HABITABLE ROOMS	NETT INTE RNAL AREA PER DWE LLING		TOTAL NETT INTERNA L AREA	
				M2	FT2	M2	FT2
Cliff house C+E	14	3	42	67.5	726	945	10,164
Cliff house C+2E	21	3	63	67.5	726	1,418	15,246
Villa M	45	7	315	271.4	2,921	12,213	131,445
Villa 2M	218	7	1,526	271.4	2,921	59,165	636,778
Villa 3M	66	7	462	271.4	2,921	17,912	192,786
House I	6	4	24	138.0	1,486	828	8,916
House 2I	146	4	584	138.0	1,486	20,148	216,956
House G	1	4	4	90.7	977	91	977
House 2G	402	4	1,608	90.7	977	36,461	392,754
Penthouse Apts over commercial	82	4	328	112.0	1,214	9,184	99,548
Marina Apts	120	5	600	104.2	1,122	12,504	134,640
Apts over retail BLDG`s C,D,E,F,G TYPE A	57	2	114	60.8	655	3,466	37,335
Apts over retail BLDG C TYPE B	2	2	4	74.7	804	149	1,608
Apts over retail BLDG`s D,F TYPE B	4	2	8	68.8	741	275	2,964
Apts over retail BLDG E TYPE B	4	2	8	69.3	746	277	2,984
Apts over retail BLDG G TYPE B	4	2	8	58.2	626	233	2,504
Apts over retail BLDG C TYPE C	2	2	4	71.4	769	143	1,538
Apts over retail BLDG`s D,F TYPE C	4	2	8	66.3	714	265	2,856
Apts over retail BLDG`s F TYPE D	4	3	12	69.3	746	277	2,984
TOTAL	1,202		5,722			175,955	1,894,983

LAND USE	APPROX AREAS		APPROX BUILD AREA	
	ACRES	HECTARES	M2	FT2
Residential	206	83	194,702	2,095,180
Parkland/Amenity	36	15		
Marina	13	5		
Beach	13	5		
Beach Hotel	7	3	9,337	100,498
Spa Hotel	8	3	10,045	108,122
Equestrian Hotel	5	2	17,712	190,648
Civic/Retail	31	13	98,933	1,064,907
Municiple Buildings	6	3	21,715	233,737
Support	12	5	33,761	363,401
Medical/Police Station	4	2	5,904	63,551
Sundry,Roads etc	20	8		
TOTALS	361	147	392,109	4,220,044

9.0 Business and Employment Opportunities

The Wedderburn project is envisioned as an opportunity to provide new amenities and fabric to the Negril area. The development is seen as a new community that will enhance the local area and provide employment for those living or working near to or within the development. The opportunities for employment could be developed in the sectors listed below.

1.0 Retail/ Commercial. Located in the village basin area, a variety of shops and offices have been proposed over two stories.

2.0 Administrative/ Office. Located in Village area and housed above Retail stores or in the Support Sector to west of site.

3.0 Service Industry. The maintenance and servicing of residences and landscape areas is possible over all of the site. The various hotels, businesses or residences will require daily, weekly and monthly facility management.

4.0 Repair /Engineering. The marina area and by nature of boat repairs and servicing will generate a need for boats and marine engine repairs and servicing. Local cars and buses will also require servicing and general parts.

5.0 Education. Within the support or commercial retail areas there is opportunity for all levels of education nursery, primary to intermediate schooling. Adult study centers could also be incorporated in the office commercial or support areas.

6.0 Medical/ Healthcare. A suggested medical centre complete with helipad has been sited at the eastern side of the site.

7.0 Welfare. Private or public welfare offices and advise centres could be incorporated in the support and commercial sectors.

8.0 Financial. Local or international banks would ideally take spaces in and around the retail commercial areas.

9.0 Municipal/ Government. An area parallel to the western approach promenade has been suggested for potential centralization of Negril Municipal type department requirements.

10.0 Police Station. The development perceives the need for a local police station. Several areas locations are possible near to the western or eastern edge of the development close to the main road through the village area.

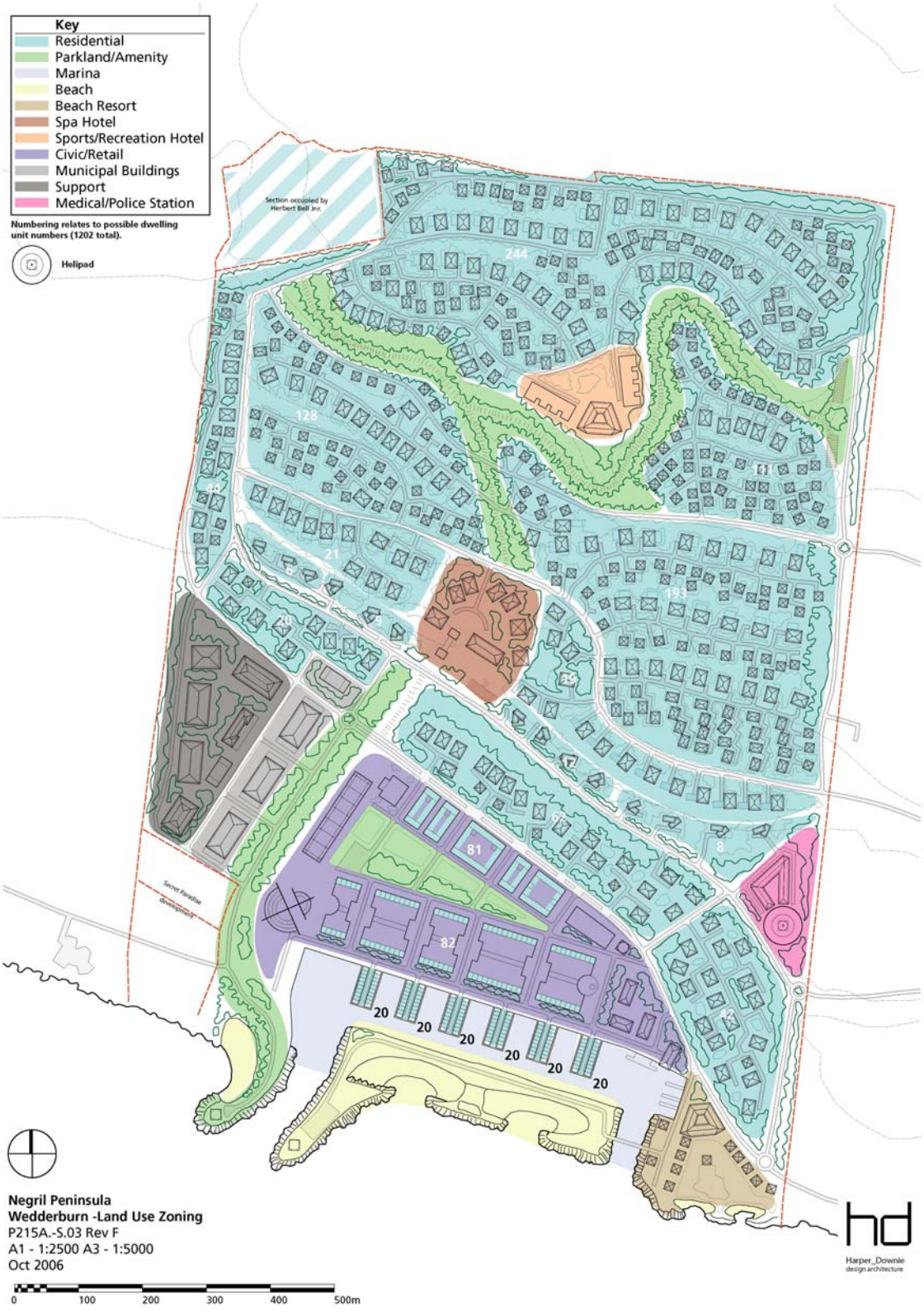
11.0 Hotel. The development has suggested three types of hotels on three very different locations. The Coastal Boutique hotel is sited on the south eastern edge of the site, with access to seas and private beach. The Spa Hilltop Hotel has been suggested centrally located at the high point of the Cliffs overlooking the village. The third Hotel looks to create a ranch style development making use of the upper terrace and tree/ landscaped environment. Each hotel will require different forms of servicing and staffing.

12.0 Recreation. The project encompasses recreational activities that can be either land or water based. Associated with these will instructor, trainer, servicing and operator employment opportunities. The land activities mentioned such as walking and horse riding could be expanded into rock climbing on the central limestone cliff area and also trekking within the jungle remote hills. these activities may require experts in the various fields. The later, trekking can take advantage of local farming and hill communities.

13.0 Tourism. The development will add greatly to the projects promotion and to the Negril west coast generally. Employment requirements may start reasonably small during marketing construction phases and grow into what may be a regional staffing opportunity.

14.0 Transport. While new roads and access are being incorporated into the development, the demands for car, bike and cab hire will flourish to cater for the demand of local or visiting people. Coach and bus services could be located near to civic and support areas zoned in the development.

15.0 Food and Restaurant Industry. The creation of a new community will have demands for food and recreation eating. The inclusion of space in the commercial support and retail areas in the village will provide opportunity for food shopping centres and restaurants. The Hotels proposed will also assist with the demands for food and will encourage different types of venues for residents, workers and visitors.



Negril Peninsula
Wedderburn -Land Use Zoning
P215A.-S.03 Rev F
A1 - 1:2500 A3 - 1:5000
Oct 2006

Harper_Downie
design architecture

List of Attendees Westender Inn 15/12/06

Mr Bill Williams LTU Villas Negril
Ms Jackie Lewis Jackie's on the Reef Negril
Mr. Courtney Miller Ten Sing Pen Negril
Mr. Ricki Westender Inn Negril
Mr Derris Hogg Company Director Orange Hill Negril
Mr and Mrs Richard Murray Ten Sing Pen Negril
Mr Ray Arthur's JP Negril
Mr. Keith Duhaney Negril.com Negril
Mr. Chris Tomney Seastar Inn Negril
Mr. Larry Hilton

Security Negril
Pirates Cave Negril
General Manager Rockhouse Hotel Negril Owner Jungle Nightclub Negril
Mr. Sonny Lynch Archway Pizza Negril
Mr. Dane Eyre Hotel and Water Sports Negril
Mr. Gregory Hogg Mechanic Negril
Mr. Cosmo Hogg Executive Printers Negril
Mr. Morris Fenton Juta Operator Negril
Mr. Errol Wagstaff C and E Hotel Supplies Negril
General Manager Negril Escape Negril
Mr. Tony Vassell Local Resident/ Tour Operator Negril

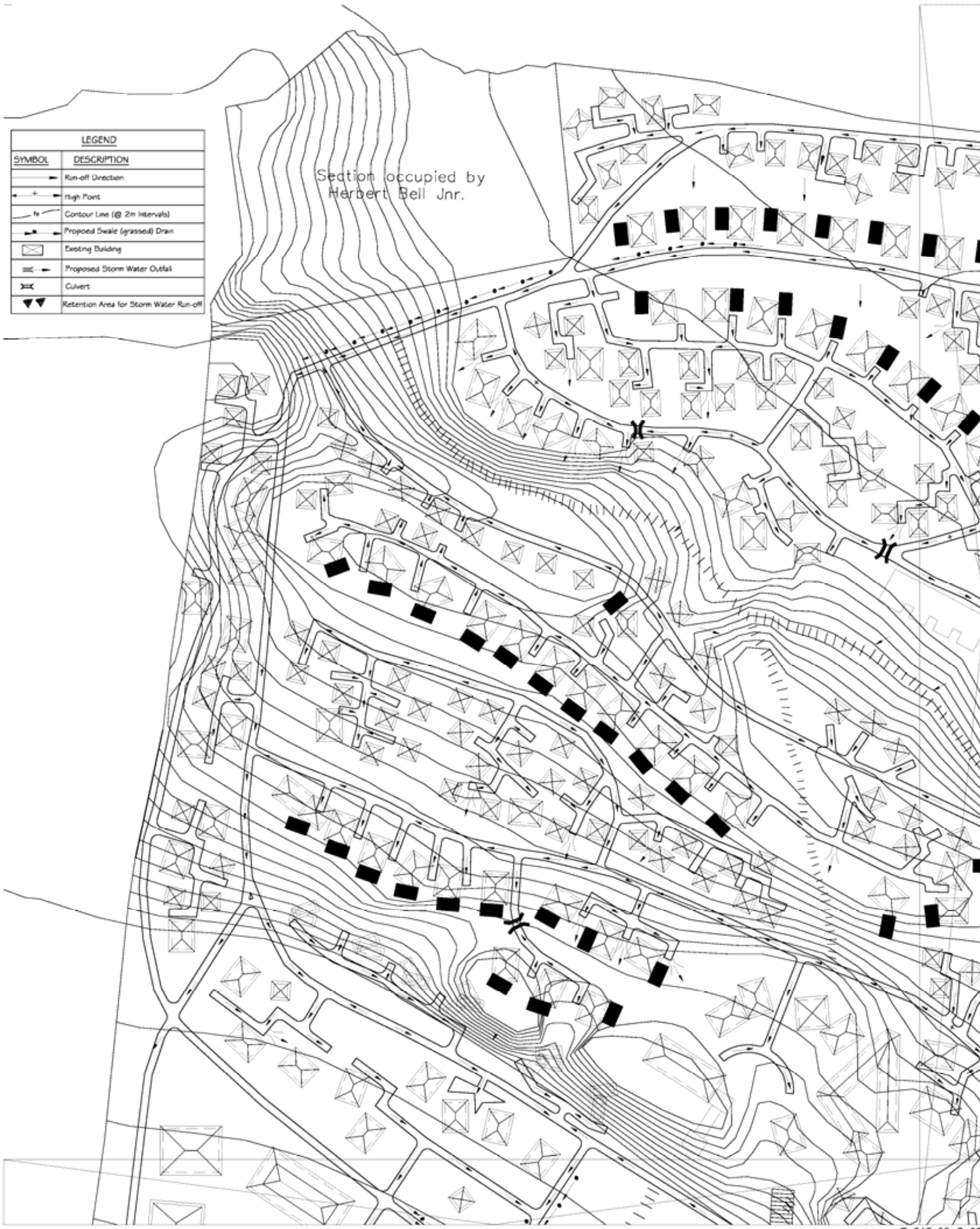
Dr Hursie Davis-Sullivan Sullivan Family Medicine Clinic
Mr. Ricky Hogg Business man Negril

APPENDIX 1V

HYDROLOGY

TOPOGRAPHICAL PLAN

BOUNDARY PLAN



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Local Project Management Consultant: AEBC
Local Civil Consultant: SPK Engineering
Local Hydraulic Consultant: Howard Prendegast
Local Structural Consultant: Solomon Burke
Development Consultant: David Walker
Architect: Harper Dowrie
Project Co-ordinator: Charles Bloomfield
Cost Consultant: Pierce Hill Cost Management
Project Title: Negril Wedderburns Eco-Tourism Development
Drawing Title: Storm Water Drainage Zone B
North
Scale: 1:250 @ A1
Date: 10.12.06
Drawn by: ED
Project Number: 06215 Drawing Number: P_215_00_B_001 Revision: A

2B NELSON STREET
MAY PEN
CLARENDON
JAMAICA W.I.
T 876 902 6453
F 876 902 7750

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Key Plan

00_A | 00_B | 00_C | 00_D

Revision | Date | By

Local Project Management Consultant
AEBC

Local Civil Consultant
SPK Engineering

Local Hydrolic Consultant
Howard Prendegast

Local Electrical Consultant
Solomon Burke

Development Consultant
David Walker

Architects
Harper Downie

Town Councellor
Charles Bloomfield

Cost Consultant
Pierce Hill Cost Management

Project Name
Negril Wedderburns
Eco-Tourism Development

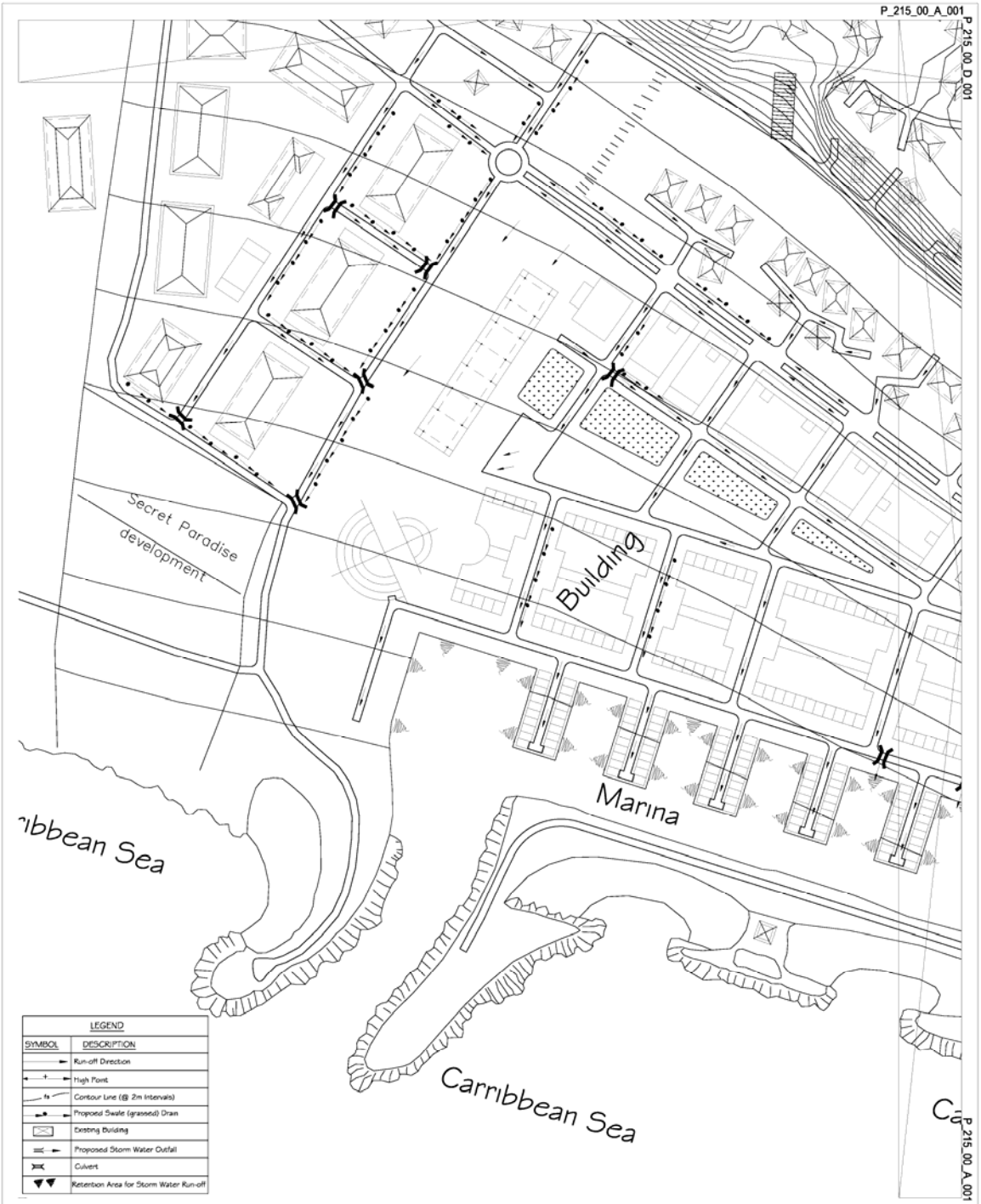
Drawing Title
Storm Water Drainage
Zone A

North

Scale 1:250 @ A1
Date 10.12.06
Drawn by ED
Project number 06215
Drawing number P_215_00_A_001
Revision A

28 NELSON STREET
MAY PEN
CLARENDON
JAMAICA W.I.

T 876 902 8453
F 876 902 7580



LEGEND	
SYMBOL	DESCRIPTION
	Run-off Direction
	High Point
	Contour Line (@ 2m Intervals)
	Proposed Swale (grassed) Drain
	Existing Building
	Proposed Storm Water Outfall
	Culvert
	Retention Area for Storm Water Run-off

Local Project Manager/Client Contact
AEBC

Local Civil Consultant
SPK Engineering

Local Hydrate Consultant
Howard Prendegast

Local Electrical Consultant
Solomon Burke

Development Consultant
David Walker

Architects
Harper Downie

Project Co-ordinator
Charles Bloomfield

Cost Consultant
Pierce Hill Cost Management

Project Title
Negril Wedderburns
Eco-Tourism Development

Drawing Title
Storm Water Drainage
Zone B

North

Scale 1:250@ A1

Date 10.12.06

Drawn by ED

Project number 06215

Drawing number P_215_00_B_001

Revision A

Revision

Date

By

Key Plan

00_A 00_B 00_C 00_D

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MAY PEN
CLARENDON
JAMAICA W.I.

T 876 902 6453
F 876 902 7750

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P_215_00_B_001

P_215_00_C_001

LEGEND	
SYMBOL	DESCRIPTION
	Run-off Direction
	High Point
	Contour Line (@ 2m Intervals)
	Proposed Swale (grassed) Drain
	Existing Building
	Proposed Storm Water Outfall
	Culvert
	Retention Area for Storm Water Run-off

P_215_00_B_001

Lead Project Management Consultant
AEBC

Lead Civil Consultant
SPK Engineering

Lead Hydrolic Consultant
Howard Prendegast

Lead Electrical Consultant
Solomon Burke

Development Consultant
David Walker

Architects
Harper Downie

Project Co-ordinator
Charles Bloomfield

Cost Consultant
Pierce Hill Cost Management

Project Manager
Negril Weddorburns
Eco-Tourism Development

Drawing Title
Storm Water Drainage
Zone A

North

Scale 1:250@A1
Date 10.12.06
Drawn by ED
Project Drawing number 06215 P_215_00_A_001 Revision A

Revision | Date | By

Key Plan

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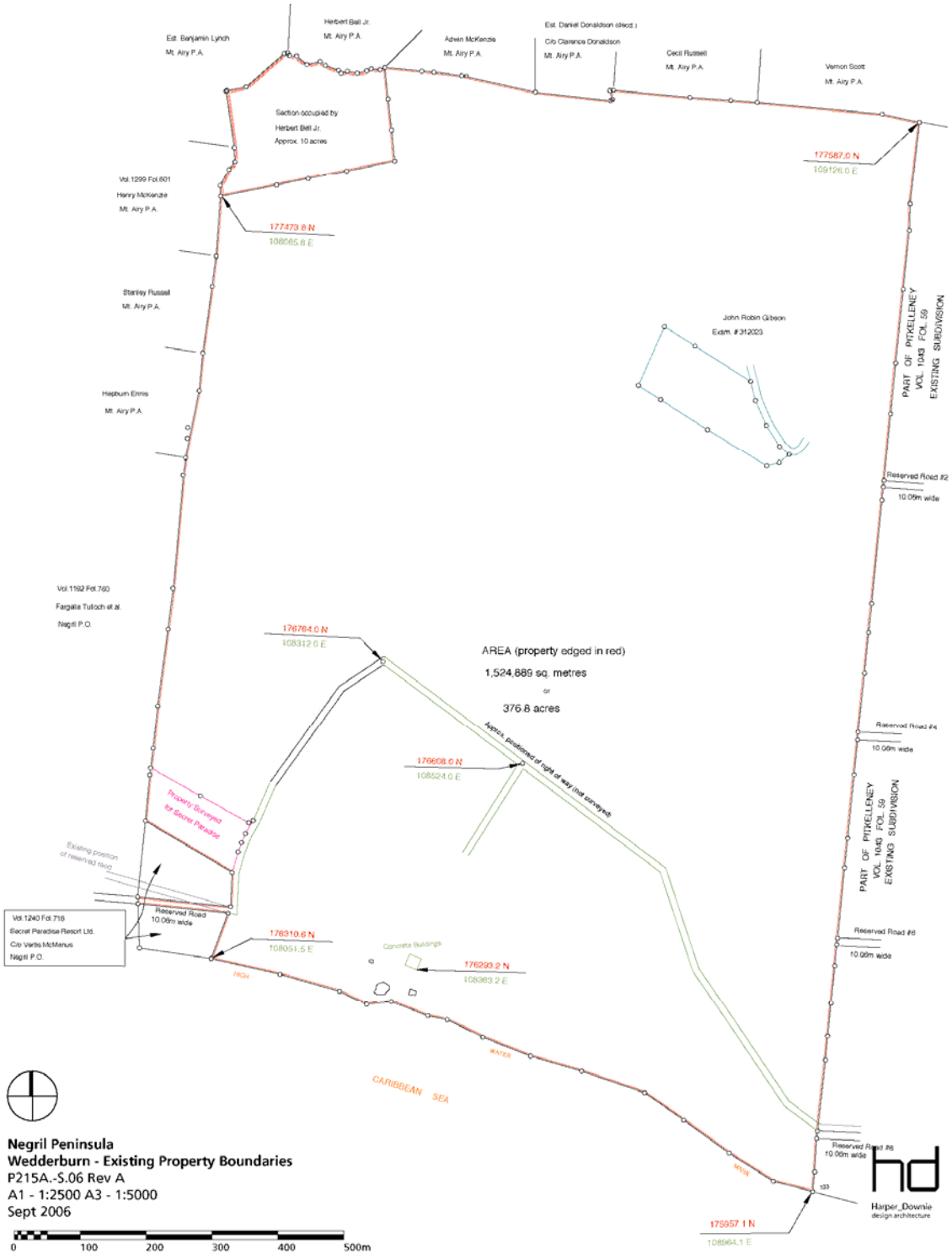
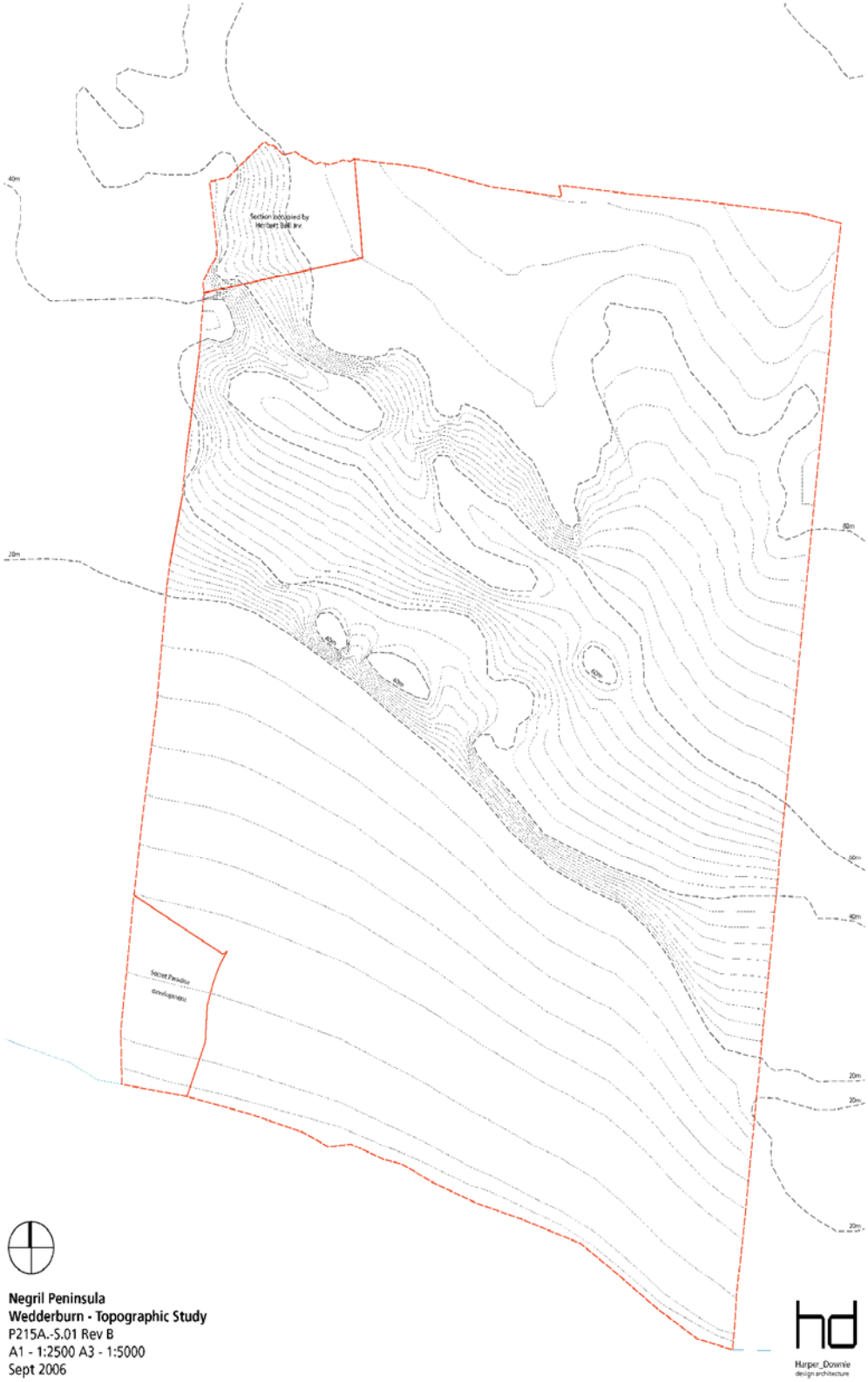
MAY PEN
CLARENDON
JAMAICA W.I.

T 876 902 8415
F 876 902 7310



Negril Peninsula
Wedderburn - Existing Property Boundaries
P215A.-S.06 Rev A
A1 - 1:2500 A3 - 1:5000
Sept 2006

Harper_Downie
design architecture



Negril Peninsula
Wedderburn - Topographic Study
P215A.-S.01 Rev B
A1 - 1:2500 A3 - 1:5000
Sept 2006

0 100 200 300 400 500m

Harper_Downie
design architecture

Hydrology

Baseline Data Collection

Field and office visits were made to procure baseline data and information including:

- Topographic, geologic and soils maps of the area
- Rainfall, stream flow and other hydro-geologic data.

The proposed project area was delineated on topographic maps of scales 1:5000 and 1: 2500 and also on geology and soil maps. This along with information obtained from field visits, aerial photographs and literature reviews, enabled a hydrological description of the drainage area(s) encroached by the development.

Assessment of the proposed development

Run-off impacts

The run-off impact assessment entails a determination of the pre-development run-off from each of the project drainage (sub-drainage) area for different return periods (2, 5, 10, 25, 50 and 100 years) and a post development run-off for the same return periods. Given the existing physical conditions and the size of each sub-drainage areas, the Rational Formula was used for the calculation of run-off or peak discharge. Where peak discharge

Q = CIA . …… (1)

Where

C - dimensionless run-off coefficient depending on catchment characteristics such as geology, topography, vegetative cover

I - average rainfall intensity, in/hr (mm/hr) lasting for a critical duration Tc. Rainfall intensity corresponds to different return period **T**

A - total drainage area contributing to flow measured in acre (less than 400 acres)

TABLE NO. 3 **Schedule of Land Use**

LAND USE	APPROXIMATE AREAS	
	ACRES	HECTARES
Accommodation	206	83
Parkland/Amenity	36	15
Marina	13	5
Beach	13	5
Beach Resort	7	3
Spa Hotel	8	3
Sports Recreation Hotel	5	2
Civic/Retail	31	13
Municipal Buildings	6	3
Support	12	5
Medical/Police Station	4	2
Sundry, Roads etc	20	8
TOTALS	**361**	**147**

TABLE NO. 4 Schedule of Main Drainage Areas

No.	**Description of Drainage area**	**Approximate Area, acres**
Drainage area 1	Upper shelf	90.0
Drainage area 2	Lower shelf	151.0
Drainage area 3	Coastal basin	120.0
	TOTAL AREA	**361.0**

TABLE NO. 5

Storm Flow Design Sheet (Pre-development) – Drainage Area No. 1

RETURN PERIOD, T	DRAINAGE AREA, (Acre)	PEAK FLOW **Q**p, (CFS)
T = 2 YR	90.0	54.00
T = 5 YR	**90.0**	**70.2**
T = 10-YR	90.0	85.05
T = 25-YR	90.0	103.70
T = 50-YR	**90.0**	**117.50**
T = 100-YR	90.0	130.00

TABLE NO.6

Storm Flow Design Sheet (Pre-development) – Drainage Area No. 1

RETURN PERIOD, T	DRAINAGE AREA, (Acre)	PEAK FLOW **Q**p, (CFS)
T = 2 YR	90.0	72.00
T = 5 YR	**90.0**	**93.60**
T = 10-YR	90.0	113.4
T = 25-YR	90.0	138.24
T = 50-YR	**90.0**	**173.20**
T = 100-YR	90.0	173.20

TABLE NO.7

Storm Flow Design Sheet (Post-development) – Drainage Area No. 2

RETURN PERIOD, T	DRAINAGE AREA, (Acre)	PEAK FLOW **Q**p, (CFS)
T = 2 YR	151.0	90.60
T = 5 YR	**151.0**	**118.00**
T = 10-YR	151.0	143.00
T = 25-YR	151.0	174.00
T = 50-YR	**151.0**	**197.10**
T = 100-YR	151.0	217.90

TABLE NO. 8

Storm Flow Design Sheet (Post-development) – Drainage Area No. 2

RETURN PERIOD, T	DRAINAGE AREA, (Acre)	PEAK FLOW **Q**p, (CFS)
T = 2 YR	151.0	120.80
T = 5 YR	**151.0**	**157.04**
T = 10-YR	151.0	190.30
T = 25-YR	151.0	232.00
T = 50-YR	**151.0**	**262.70**
T = 100-YR	151.0	290.50

TABLE NO. 9

Storm Flow Design Sheet (Pre-development) – Drainage Area No. 3

RETURN PERIOD, T	DRAINAGE AREA, (Acre)	PEAK FLOW **Q**p, (CFS)
T = 2 YR	120.0	60.00
T = 5 YR	**120.0**	**78.00**
T = 10-YR	120.0	94.50
T = 25-YR	120.0	115.20
T = 50-YR	**120.0**	**130.50**
T = 100-YR	120.0	144.30

TABLE NO. 10

Storm Flow Design Sheet (Post-development) – Drainage Area No. 3

RETURN PERIOD, T	DRAINAGE AREA, (Acre)	PEAK FLOW **Q**p, (CFS)
T = 2 YR	120.0	120.00
T = 5 YR	**120.0**	**156.00**
T = 10-YR	120.0	189.00
T = 25-YR	120.0	230.40
T = 50-YR	**120.0**	**261.00**
T = 100-YR	120.0	288.6

APPENDIX V

SEWAGE

COLLECTION
CONVEYANCE
TREATMENT
DISCHARGE

Cost Project Management Consultant
AEBC

Local Civil Consultant
SPK Engineering

Local Hydraulic Consultant
Howard Prendegast

Local Electrical Consultant
Solomon Burke

Development Consultant
David Walker

Architect
Harper Downie

Project Co-ordinator
Charles Bloomfield

Cost Consultant
Pierce Hill Cost Management

Project Title
Negril Wadderburns
Eco-Tourism Development

Drawing Title
Sewage Layout
Zone B

North

Scale 1:250 @ A1

Date 10.12.06

Drawn by ED

Project number 06215

Drawing number P_215_00_B_001

Revision A

Revision | Date | By

Key Plan

00_A | 00_B | 00_C | 00_D

AEBC

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28 NELSON STREET
MAY PEN
CLARENDON
JAMAICA W.I.
T 876 902 8453
F 876 902 8453
enquiry@aebc.com

P_215_00_A_001

P_215_00_D_001

28 NELSON STREET
MANDEVILLE
CLARENDON
JAMAICA W.I.
T 876 902 6453
F 876 902 7750

Project Number: 062215
Drawing Number: P_215_00_A_001
Revision: A

Scale: 1:250 @ A1
Date: 10.12.06
Drawn by: ED
Check by:

North

Drawing Title: Sewage Layout Zone A

Project Title: Negril Wedderburns Eco-Tourism Development

Cost Consultant: Pierce Hill Cost Management

Project Co-ordinator: Charles Bloomfield

Architects: Harper Downie / David Walker

Development Consultant: Solomon Burke

Local Electrical Consultant: Howard Prendegast

Local Hydraulic Consultant: SPK Engineering

Local Civil Consultant: AEBC

Local Project Management Consultant: AEBC

Revision | Date | By

Key Plan

00_A | 00_B | 00_C | 00_D

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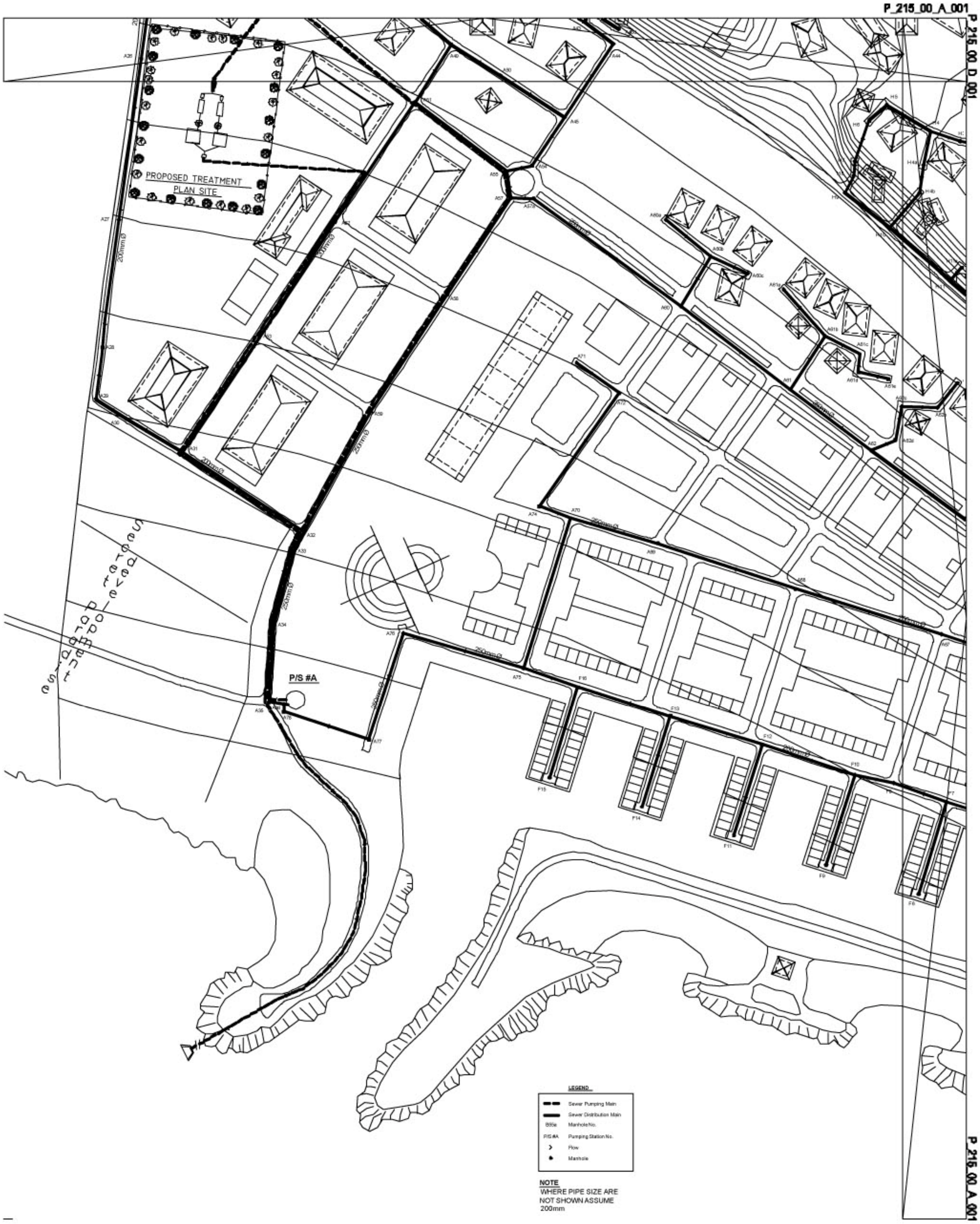


LEGEND

▬ ▬	Sewer Pumping Main
▬▬	Sewer Distribution Main
B55a	Manhole No.
P/S #A	Pumping Station No.
›	Flow
•	Manhole

NOTE
WHERE PIPE SIZE ARE NOT SHOWN ASSUME 200mm

AEBC

Key Plan

Sewage Layout
Zone B

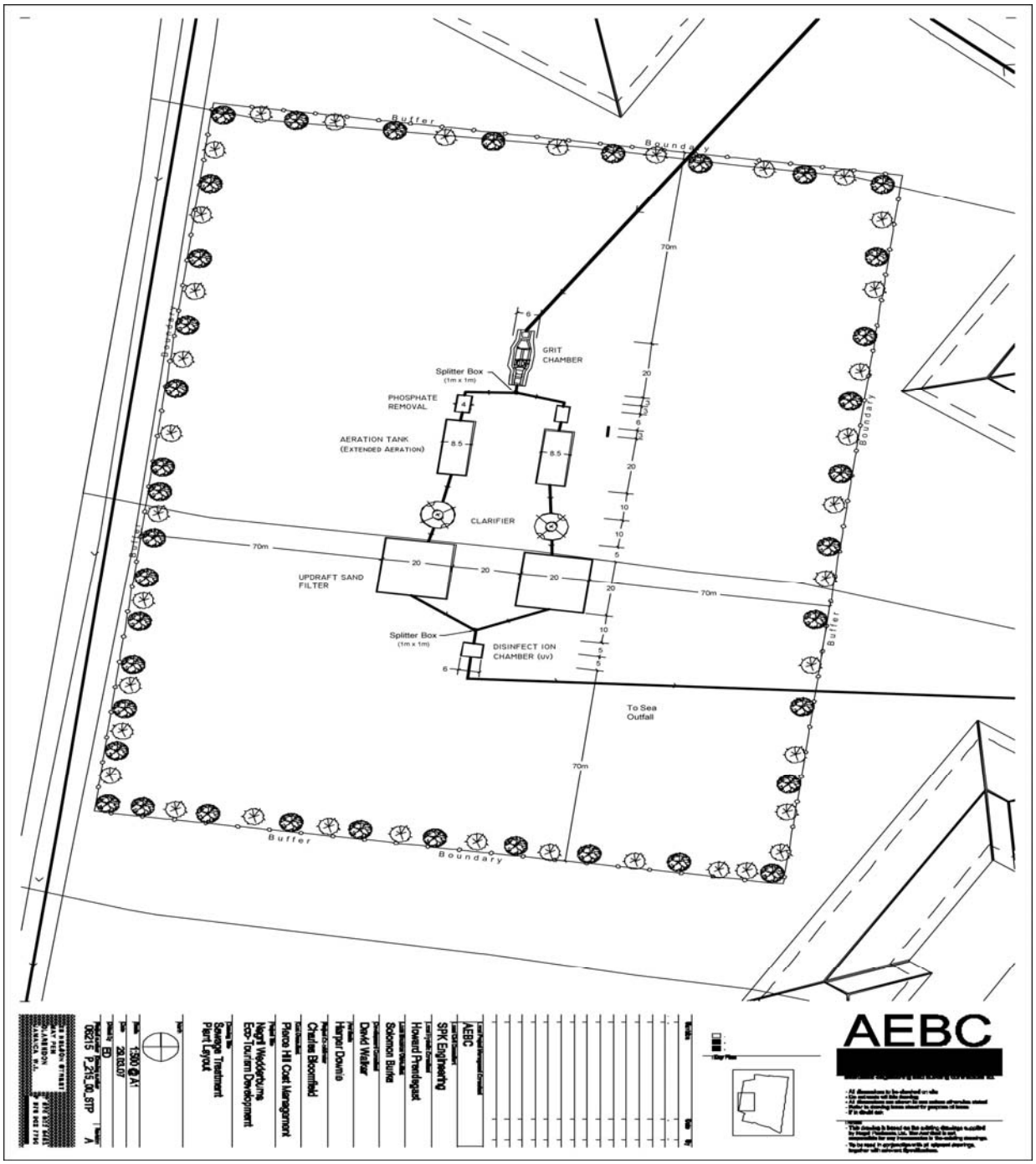
Negril Wedderburne
Eco-Tourism Development

Flanco Hill Cost Management
Charles Bloomfield
Harper Downie
David Walker
Solomon Burke
Howard Prendagast
SPK Engineering
AEBC

Scale 1:2500@A1
Date 10.12.08
Drawn by ED
06215 P_215_00_B_001 B

28 NELSON STREET
MAY PEN
CLARENDON
JAMAICA W.I.

SEWAGETREATMENT PLANT LAYOUT



APENDIX V1

WATER SUPPLY

OFF-SITE

WATER DISTRIBUTION

ON-SITE

STORAGE

P_215_00_B_001

P_215_00_C_001

AEBC

affordable engineering and building contractors ltd.

- All dimensions to be checked on site
- Do not scale off this drawing
- All dimensions are shown in mm unless otherwise stated
- Refer to drawing issue sheet for purpose of issue
- If in doubt ask

Notes
- This drawing is based on the existing drawings supplied by Negril Peninsula Ltd. The Architect is not responsible for any inaccuracies in the existing drawings.
- To be read in conjunction with all relevant drawings, together with relevant Specifications.

Key Plan: 00_A, 00_B, 00_C, 00_D

Revision	Date	By

Local Project Managment Consultant
AEBC

Local Civil Consultant
SPK Engineering

Local Hydrolic Consultant
Howard Prendegast

Local Electrical Consultant
Solomon Burke

Development Consultant
David Walker

Architects
Harper Downie

Project Co-ordinator
Charles Bloomfield

Cost Consultant
Pierce Hill Cost Management

Project Title
Negril Wedderburns
Eco-Tourism Development

Drawing Title
Water Layout
Zone B

North

Scale 1:250 @ A1
Date 10.12.06
Drawn by ED

Project number	Drawing number	Revision
06215	P_215_00_B_001	A

28 NELSON STREET
MAY PEN
CLARENDON
JAMAICA W.I.
T 876 902 6453
F 876 902 7750
aebcjamaica@yahoo.com

P_215_00_D_001

Local Project Management Consultant
AEBC

Local Civil Consultant
SPK Engineering

Local Hydraulic Consultant
Howard Prendegast

Local Electrical Consultant
Solomon Burke

Development Consultant
David Walker

Architects
Harper Downie

Project Co-ordinator
Charles Bloomfield

Cost Consultant
Pierce Hill Cost Management

Project Title
Negril Wedderburns
Eco-Tourism Development

Drawing Title
Water Layout
Zone A

North

Scale: 1:250 @ A1
Date: 10.12.06
Drawn by: ED
Project number: 06215 | Drawing number: P_215_00_A_001 | Revision: A

28 NELSON STREET
MAY PEN
CLARENDON
JAMAICA W.I.
T 876 902 8453
F 876 902 7750

Revision | Date | By

Key Plan

00_A	00_B
00_C	00_D

AEBC

affordable engineering and building contractors ltd.

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P_215_00_A_001

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Key Plan: 00_A, 00_B, 00_C, 00_D

Revision | Date | By

Local Project Management Consultant: AEBC
Local Civil Consultant: SPK Engineering
Local Hydraulic Consultant: Howard Prendegast
Local Electrical Consultant: Solomon Burke
Development Consultant: David Walker
Architects: Harper Downie
Project Co-ordinator: Charles Bloomfield
Cost Consultant: Pierce Hill Cost Management
Project Title: Negril Wedderburns Eco-Tourism Development
Drawing Title: Water Layout Zone B
North
Scale: 1:250@ A1
Date: 10.12.06
Drawn by: ED
Project number: 06215
Drawing number: P_215_00_B_001
Revision: A

28 NELSON STREET
MAY PEN
CLARENDON
JAMAICA W.I.
T 876 902 6453
F 876 902 7750

AEBC

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Local Civil Consultant: SPK Engineering

Local Hydrolic Consultant: Howard Prendegast

Local Electrical Consultant: Solomon Burke

Development Consultant: David Walker

Architects: Harper Downie

Project Co-ordinator: Charles Bloomfield

Cost Consultant: Pierce Hill Cost Management

Project Title: Negril Wedderburns Eco-Tourism Development

Drawing Title: Water Layout Zone A

North

Scale: 1:250@ A1

Date: 10.12.06

Drawn by: ED

Project number: 06215 | Drawing number: P_215_00_A_001 | Revision: A

28 NELSON STREET
MAY PEN
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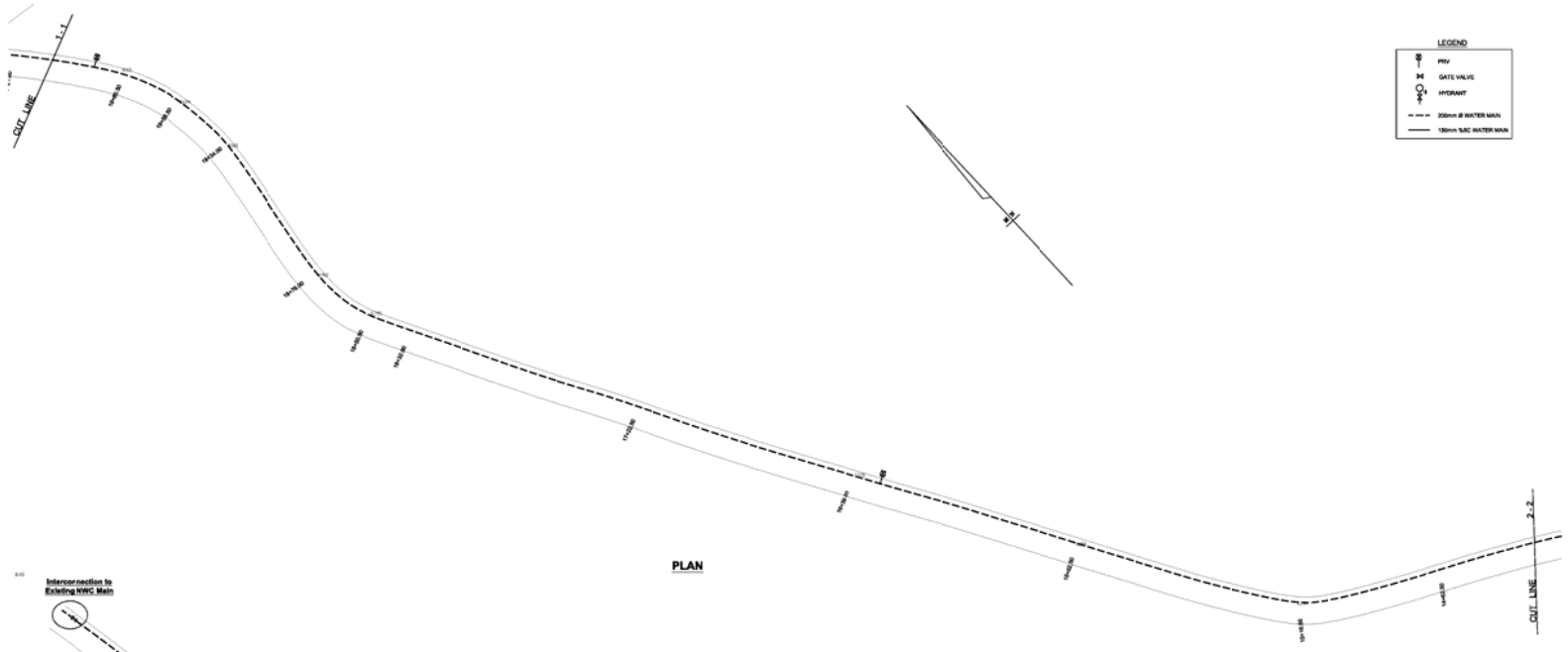
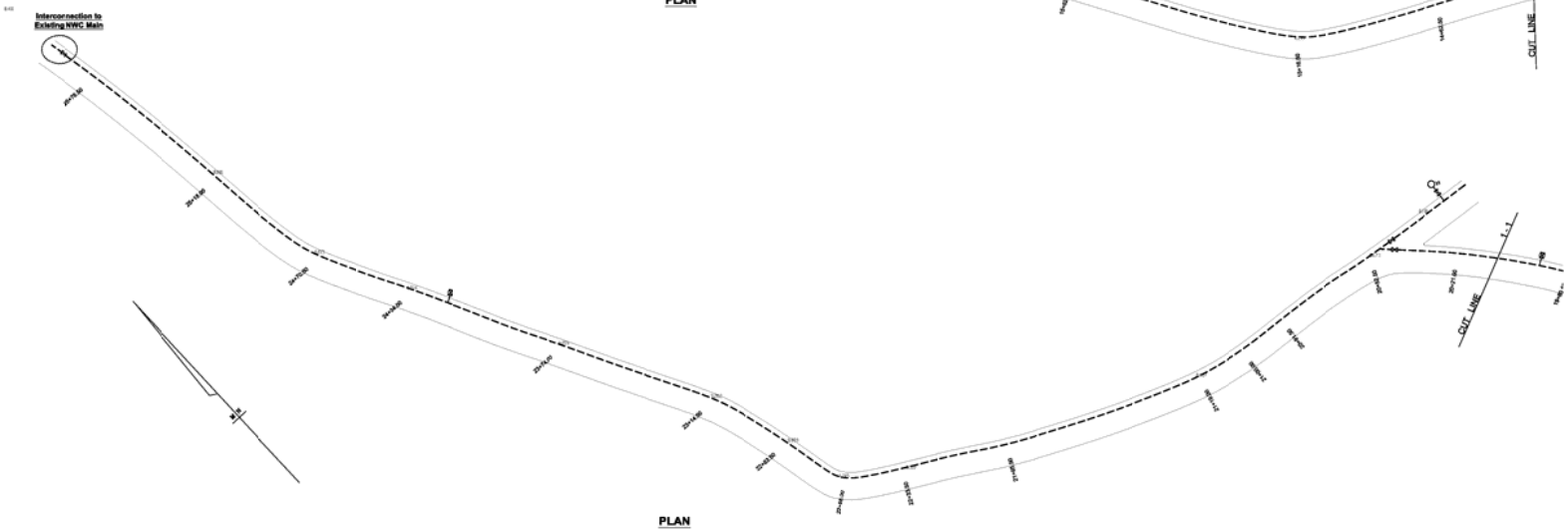
T 876 902 6453
F 876 902 7750





AEBC

affordable engineering and building contractors ltd.

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- To be read in conjunction with all relevant drawings, together with relevant Specifications.

Revision	Date	By

Local Project Management Consultant
AEBC

Local Civil Consultant
SPK Engineering

Local Hydrolic Consultant
Howard Prendegast

Local Electrical Consultant
Solomon Burke

Development Consultant
David Walker

Architects
Harper Downie

Project Co-ordinator
Charles Bloomfield

Cost Consultant
Pierce Hill Cost Management

Project Title
Negril Wedderburns
Eco-Tourism Develcpment

Drawing Title
Water Supply along Main Road to Project Site

North

Scale 1:750 @ A1

Date 10.20.06

Drawn by RR

Project number	Drawing number	Revision
06215	—W1	A

28 NELSON STREET
MAY PEN
CLARENDON
JAMAICA W.I.
T 876 902 8453
F 876 902 7750

APPENDIX V11
CAR PARK SCHEDULE

CAR PARKING SCHEDULE

DESCRIPTION /LOCATION	CARPARK DRWG No	SIZE FT2 or No SHOPS or No SEATS No BEDROOMS	PLANNING REQUIREMENT	CAR PARK LOCATION	TOTAL PLANNING REQUIREMENT	ACTUALLY ACHIEVED
918 Houses/Villa's/Apts	Within lot curtailage	-	-	Within lot curtailage	-	-
120 Marina duplex apts	GA 18-	-	-	Within lot curtailage	-	-
83 Apts over retail	GA36A & GA37A	-	-	Basement	83	-
81 Apts over commercial	GA36A & GA37A	-	-	Basement	81	-
Commercial Bldg B	GA36A & GA37A	43,401	1 Space per 500ft2	Basement	87	-
Commercial Bldg C	GA36A & GA37A	37,340	1 Space per 500ft2	Basement	75	-
Commercial Bldg D	GA36A & GA37A	36,364	1 Space per 500ft2	Basement	73	-
Commercial Bldg E	GA36A & GA37A	84,637	1 Space per 500ft2	Basement	169	-
Commercial Bldg F	GA36A & GA37A	32,654	1 Space per 500ft2	Basement	65	-
Commercial Bldg G	GA36A & GA37A	61,354	1 Space per 500ft2	Basement	123	-
Commercial Bldg H	GA36A & GA37A	70,887	1 Space per 500ft2	Basement	142	-
Marina Bldgs A (Total)	GA36A & GA37A	34,896	1 Space per 500ft2	Basement	70	-
Marina Bldgs B (Total)	GA36A & GA37A	14,977	1 Space per 500ft2	Basement	30	-
Retail Bldg J/Amphi Commercial	GA36A & GA37A	10	1 Space per 3 Shops	Basement	3	-
Retail Bldg K	GA36A & GA37A	8	1 Space per 3 Shops	Basement	3	-
Retail Bldg L	GA36A & GA37A	16	1 Space per 3 Shops	Basement	5	-
Retail Bldg M	GA36A & GA37A	14	1 Space per 3 Shops	Basement	5	-
Retail Bldg N	GA36A & GA37A	16	1 Space per 3 Shops	Basement	5	-
Retail Bldg O	GA36A & GA37A	16	1 Space per 3 Shops	Basement	5	-
Retail Bldg J/Amphi Seating	GA36A & GA37A	500	1 Space per 10 seats	Basement	50	-
Beach Hotel Main Bldg	GA36A & GA37A	92	1 Space per 3 Bedrooms	Basement	31	-
Beach Hotel 30 No Serviced Apts	GA36A & GA37A	60	1 Space per 3 Bedrooms	Basement	20	-
Beach Hotel 2 No Serviced Apts	GA36A & GA37A	8	1 Space per 3 Bedrooms	Basement	3	-
Spa Hotel Bldg A	GA36A & GA37A	16,593	1 Space per 500ft2	Basement	33	-
Spa Hotel Bldg B	GA36A & GA37A	36,264	1 Space per 500ft2	Basement	73	-
Spa Hotel Bldg C 12 Serviced Apts	GA36A & GA37A	48	1 Space per 3 Bedrooms	Basement	16	-
Spa Hotel Bldg D 6 Serviced Apts	GA36A & GA37A	12	1 Space per 3 Bedrooms	Basement	4	-
Municiple/Support Bldg A (Total)	GA36A & GA37A	397,926	1 Space per 500ft2	Basement	796	-
Municiple/Support Bldg B (Total)	GA36A & GA37A	90,288	1 Space per 500ft2	Basement	181	-
Municiple/Support Bldg C (Total)	GA36A & GA37A	39,376	1 Space per 500ft2	Basement	79	-
Municiple/Support Bldg D (Total)	GA36A & GA37A	69,546	1 Space per 500ft2	Basement	139	-
Basement Carpark	GA37A					2,161
Surface Parking around Commercial	GA36A					329
					2447	2,490
Equestrian Hotel Main Bldg	GA59A	92	1 Space per 3 Bedrooms	Within lot curtailage	31	-
Equestrian Hotel Bldg B 34 Apts	GA59A	68	1 Space per 3 Bedrooms	Within lot curtailage	23	-
Equestrian Hotel Bldg C 34 Apts	GA59A	68	1 Space per 3 Bedrooms	Within lot curtailage	23	76
					76	76
Medical/Police Station	GA36A	63,551	1 Space per 600ft2	Within lot curtailage	106	106
TOTALS					**2629**	**2672**

CAR PARKING STANDARDS REQUIRED	
UNIT	**PARKING**
CINEMA	1 PER 10 SEATS
SHOPS	1 PER 3 SHOPS
COMMERCIAL SPACE	1 PER 500 FT2
HOSTPITAL SPACE	1 PER 600 FT2
OFFICE SPACE	1 PER 700 FT2
HOTEL SPACE	1 PER 3 BEDROOMS

PLEASE NOTE
Municiple and Support Buildings Type A,B,C and D, have been assessed as Commercial at 500 ft2 per space.Technically they are Offices and could be assessed at 700 ft2 per space.We have therefore overprovided

APPENDIX V111

NWC LETTER RE SEWAGE TREATMENT

☐ 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) 929-4840-4
Fax: (876) 960-0582

☐ 2a Manhattan Road
Kingston 5
Tel: (876) 929-3540
Fax: (876) 968-8247

NATIONAL WATER COMMISSION

Water is Life

☐ 231A Old Hope Road
Kingston 6
Tel: (876) 977-4998-9
977-5000
Fax: (876) 927-1870

☐ 28-30 Church Street
Kingston
Tel: (876) 922-8110-9
Fax: (876) 967-1499

WITHOUT PREJUDICE

April 3, 2007.

S.P.K. Engineers Limited
15 University Crescent
Kingaston 5.

Dear Sirs;

Re: Availability of Water Supply to Proposed Development in Hogg's Heaven, West End Negril, Westmoreland NWC Ref # 0898/06

We refer to previous correspondence enquiring about the availability of water supply and sewage disposal services to your proposed development.

The National Water Commission (NWC) advises that it may be possible to supply potable water to your development provided that you are prepared to undertake the improvement works required to extend the NWC's water supply system to your location.

These works include, but are not limited to the design and installation of: (i) a booster station, (ii) the 450 mm dia. transmission main and appurtenances, (iii) the connections to the tank(s) and (iv) upgrades to the Logwood water treatment plant.

It is our suggestion that you examine the foregoing and give us some assurance that you will be able to meet the requirements, and thus enable us to issue an approval.

We also suggest that you provide this information as soon as possible as there have been requests from other developers in this supply area for potable water, which is not infinite.

Please note that the NWC does not operate a sewerage system in the vicinity of your proposed development and as such the onus of sewage treatment will be yours.

We trust that you find this information useful and look forward to hearing from you.

Yours truly
NATIONAL WATER COMMISSION

Paul Burgess
For Development Committee

APPENDIX 1X
NWC LETTER RE: POTABLE WATER

☐ 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) 929-4840-4
Fax: (876) 960-0582

☐ 2a Manhattan Road
Kingston 5
Tel: (876) 929-3540
Fax: (876) 968-8247

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WITHOUT PREJUDICE

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Yours truly
NATIONAL WATER COMMISSION

Paul Burgess
For Development Committee

APPENDIX X
NSWMA LETTER RE: SOLID WASTE

APPENDIX X1
JPS LETTER RE:ELECTRICITY

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

March 22, 2007

AEBC Ltd
3B Nelson Street
May Pen, Clarendon

Attention: Mr. Anthony Darling – Project Officer

Dear Sir or Madam:

Re: Proposed Resort Development at Wedderburn Retreat Estate, Negril West End – Electrical Supply

With reference to the captioned proposed development at Wedderburn Retreat Estate, Negril West End, JPS will be please to provide you with supply at this site. The following conditions are, however, critical to the JPS deliverables in this project. The developer should:

1. Provide load details to include voltage, frequency and any special rating factor where applicable

2. Provide the schedule for each phase along with the related load requirements for each.

3. Be duly advised of the requirements (including timelines) regarding supply to subdivision, hotels and villas as per JPS License Rate Category and the Standard Terms and Conditions of Contract.

The Jamaica Public Service will always be of service to you and fully appreciates your business.

Yours truly,
JAMAICA PUBLIC SERVICE COMPANY LIMITED

for

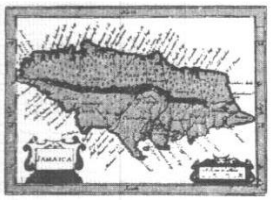
Denzil Dickenson, P. Eng.
Chief Engineer
Engineering & Standards Department
693A Spanish Town Road
Kingston 11
Tel. : 514-0320

APPENDIX X11
NWA LETTER RE: ROADS

APPENDIX X111
JNHT LETTERS RE: ARCHEOLOGY

JAMAICA NATIONAL HERITAGE TRUST

79 DUKE STREET,
HEADQUARTERS HOUSE,
KINGSTON,
P.O. BOX 8934, KINGSTON C.S.O.,
JAMAICA, W.I.



TELE: (876) 922-1287-8
(876) 922-3990
FAX: (876) 967-1703

March 23,2007

Mr Garfield Haughton
S.P.K. Engineers Ltd
15 University Cresent
Kingston 5.

Dear Mr. Haughton,

Enclosed please find the Terms of Reference for the Archaeological Assessment of the Negril development.

Programme of Work for Archaeological Assessment

In order to ascertain the extent of impact and the level of archaeological significance, the following programmes of work needs to be conducted for an archaeological assessment. (1) Desk-Based Assessment, (2) Archaeological Appraisal, (3) Archaeological Evaluation

1. Desk – Based Assessment (extensive)

This is an assessment of the known or potential archaeological resources within a specified area or site on land or underwater, consisting of a collection of existing written and graphic information in order to identify the likely character, extent, quality and worth of the known or potential archaeological resources in the local, regional, national or international context as appropriate.

2. Archaeological Appraisal

It is an archaeological reconnaissance of an area or site to identify whether a development proposal has a potential archaeological dimension requiring further investigation.

3. Archaeological Evaluation

A limited programme of non-intrusive and/ or intrusive fieldwork which determines the presence or absence of archaeological features, structures, deposits, artefacts or ecofacts within a specified area or site, and if present defines there character and extent, and relative quality. It enables an assessment of their worth in a local, national, regional or international context as appropriate.

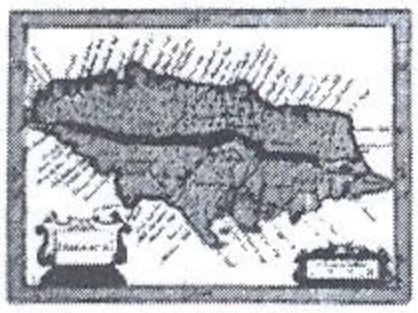
Depending on the results of both the Desk-based Assessment and the Archaeological Appraisal, an Archaeological Evaluation might not be required.

This programme of work will require funding.

Dorrick Gray
Deputy Technical Director of Archaeology
Jamaica National Heritage Trust

JAMAICA NATIONAL HERITAGE TRUST

79 DUKE STREET,
HEADQUARTERS HOUSE,
KINGSTON,
P.O. BOX 8934, KINGSTON C.S.O.,
JAMAICA, W.I.



TELE: (876) 922-1287-8
(876) 922-3990
FAX: (876) 967-1703

April 11, 2007

Wedderburn / Hoggs Haven Development
West End Negril
Westmoreland

Archaeological Evaluation

On March 13, 2007, The Jamaica National Heritage Trust (JNHT) received a development proposal from S.P.K. Engineers Limited re: the Wedderburn / Hoggs Haven Development to be located at West End Negril, Westmoreland. The site is situated on the south coast of Negril and Negril Hills.

A Desk-base Assessment of JNHT *Sites and Monument Record* revealed that there are at least five listed Taino sites found in the Negril area to date. The accompanying map extract identifies the location of three, namely the Negril Bridge Midden Site, Negril Cave, and New Mountain Indian Head Cave (See Map 1). The specific locations of the other two are uncertain, but they are said to be in the vicinity of Negril Spot, and Mount Airy. The existence of these sites is testimony that the Taino have traversed the Negril Hills; hence, there is a strong possibility of undiscovered sites in the area, especially in unsettled locales.

A preliminary site visit was carried out on March 28, 2007. The purpose of the visit was to determine whether or not there is an archaeological or potential archaeological component to the site, and to determine the most appropriate methods and techniques in effecting a comprehensive archaeological evaluation.

On April 2, 2007 a team of archaeologists from the JNHT conducted an archaeological evaluation of the site.

A Transect Linear Field Walk Reconnaissance was employed to identify and assess areas of pre-historical and / or historical activities and features. The site was divided into three Survey Zones (See Map 2). Each zone was surveyed in an east to west direction, as far as the topography and vegetation cover would permit. The 360 acres property comprise primarily of *Karst* limestone relief that supports a Dry Limestone Forest, shrubs, creepers and guinea grass.

Zone 1 is an uplifted coral platform about 4 meters above sea level that forms a narrow coastal plain. It is characterised by calcareous limestone outcrop, shallow pockets of soil with shrub and punctuated dry limestone forest vegetation. One dominating plant of the area is cotton *(Gossypium ssp.)*. Cotton was one of the few non-edible crops cultivated by the Tainos. It was an invaluable

multifunctional product for Tainos and was the base material for many of their artifacts.

The archaeological survey of Zone 1 revealed no significant pre-historical or historical cultural context.

Zone 2 is a terrace dry valley with pockets of Terra Rosa soil and heavily eroded limestone ridges. It is separated from zone 1 by a cliff that runs the entire width of the property from southeast to northwest and situates approximately 300 metres north of the Caribbean Sea. The rugged homey-comb limestone ridges and cliffs were searched for caves that may contain; Taino rock arts (pictographs, petroglyph and mobiliary), cave burials and other artefacts. A search of the valleys' Terra Rosa soil was carried out to ascertain the presence / absence of Taino midden deposits and / or lithic site, or historical features including burials.

Although five pieces of historical artefacts were observed, namely two olive-green cylindrical wine bottle fragments and three ceramic sherds, **no significant archaeological feature was found.**

Zone 3 is the second terrace dry valley situated above zone 2 to the north. Guinea Grass and shrub that is well over a metre high dominates the valley. Several pieces of historical artefacts ranging from ceramic sherds, bottle fragments, and metal, were found in highly dispersed locales. **No archaeological feature was encountered.**

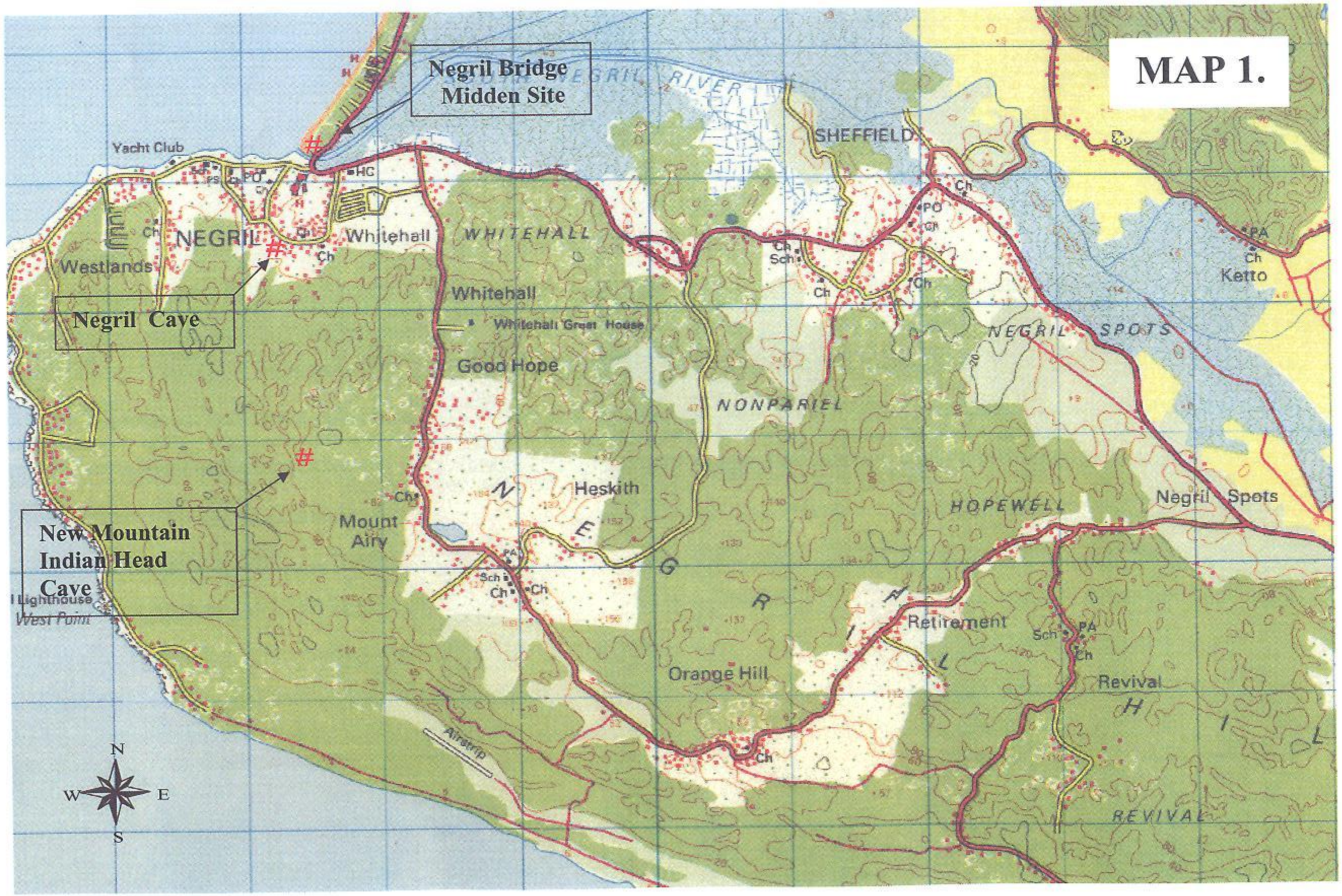
<u>Conclusion.</u>

All cultural materials found on the site are from the historical period. However, there dispersed surface provenance does not placed them in any archaeological context. The absence of surface water or Active Cave (a cave which has a stream flowing in it) may have been the fundamental contributing factor for the absence of Taino settlement on the site. Based on the archaeological evidence, **the JNHT has no objection to the proposed development. However, it is being recommended that an archaeological watching brief be conducted during the period subsequent to vegetation clearance, and during infrastructure foundation excavation.**

Dorrick Gray
Deputy Technical Director of Archaeology
Jamaica National Heritage Trust

cc. Mrs Lalita Davis-Mattis, Executive Director, JNHT

Taino Sites
Found in Negril



ARCHAEOLOGICAL SURVEY ZONES

MAP 2.

APPENDIX X1V
POSTED NOTICES AND BEACH LICENSE APPLICATION FORMS

negril peninsula

Negril Peninsula Resorts Ltd
Investment & Development

UK Correspondence Office
1 Walmley Chambers
3 Walmley Close
Walmley
Sutton Coldfield
West Midlands
United Kingdom
B76 1NQ
T 0044 (0)121 351 2600
F 0044 (0)121 351 3700
E david.walker@nergrilpeninsula.com
E charles.broomfield@nergrilpeninsula.com
E richard.pierce@nergrilpeninsula.com

Mrs Royster
West Cliff Property
West End
Mount Airey
Negril PO
Westmoreland
Jamaica

Dear, Mrs Royster

Re; Negril Peninsula Resorts Ltd, Development Application,
Ref; 2660-10015-PB00368

As you are probably aware we have made an Outline Planning Application to construct an Eco-Tourism Resort totalling 361 acres on part of Mr Hoggs land commonly known as Retreat Estate Wedderburns, a location plan is enclosed for your reference.

As part of the application we have to erect two (2) signs displaying clearly "Form B First Schedule" of the Beach Control Law 1955, showing that we have applied to alter the present shoreline. These signs are being positioned on the beach and next to the main road between the Secret Paradise Hotel and Jackie's on the Reef, for the public to clearly see.

Also as part of the application we have to serve a copy of the notice on owners of adjacent land to the development area, as defined in paragraph 2 of the application. Please therefore find attached your copy of the "Notice of Application- Form B First Schedule."

Should you have any comments on our Application I would be delighted to answer them personally. I will be staying in West End from Friday the 23rd of March until Sunday 1st of April and I would be delighted to meet with you.

Thanking you for your help and support in this matter.

Yours Sincerely

David Walker
Director
Negril Peninsula Resorts Ltd

negril peninsula

Negril Peninsula Resorts Ltd
Investment & Development

UK Correspondence Office
1 Walmley Chambers
3 Walmley Close
Walmley
Sutton Coldfield
West Midlands
United Kingdom
B76 1NQ
T 0044 (0)121 351 2600
F 0044 (0)121 351 3700
E david.walker@nergrilpeninsula.com
E charles.broomfield@nergrilpeninsula.com
E richard.pierce@nergrilpeninsula.com

Mr J McCarthy
National Environmental and Planning Agency
10 - 11 Caledonian Avenue
Kingston
Jamaica W1

Dear Mr McCarthy

We have been requested to inform N.E.P.A of a particular action we have undertaken as part of our outline planning submission.

We are erecting two (2) signs displaying Notice of Application- Form B First Schedule, one on the beach/shoreline itself and one on the main road between Secret Paradise Hotel and Jackie's on the Reef, being the nearest road.

We have also served these notices, attached to a letter, which are hand delivering to the relevant neighbours, copies of these are enclosed with this letter as instructed.

Thanking you for your help in this matter.

Yours Sincerely

David Walker
Director
Negril Peninsula Resorts Limited

Enclose letters and plans to;

Mrs Royster, West Cliff Property, West End, Mount Airey, Negril PO, Westmoreland, Jamaica

Justine McManus, Secret Paradise Resort Ltd, West End, Mount Airey, Negril PO, Westmoreland, Jamaica.

Doug, Westender Inn, West End, Negril, Jamaica, W1

Jackie Lewis , Jackies on the Reef, West End, Negril Jamaica, W1.

negril peninsula

Negril Peninsula Resorts Ltd
Investment & Development

UK Correspondence Office
1 Walmley Chambers
3 Walmley Close
Walmley
Sutton Coldfield
West Midlands
United Kingdom
B76 1NQ
T 0044 (0)121 351 2600
F 0044 (0)121 351 3700
E david.walker@nergrilpeninsula.com
E charles.broomfield@nergrilpeninsula.com
E richard.pierce@nergrilpeninsula.com

Justine McManus
Secret Paradise Resort Ltd
West End
Mount Airey
Negril
Westmoreland
Jamaica

Dear, Justine

Re; Negril Peninsula Resorts Ltd, Development Application,
Ref; 2660-10015-PB00368

As you are probably aware we have made an Outline Planning Application to construct an Eco-Tourism Resort totalling 361 acres on part of Mr Hoggs land commonly known as Retreat Estate Wedderburns, a location plan is enclosed for your reference.

As part of the application we have to erect two (2) signs displaying clearly "Form B First Schedule" of the Beach Control Law 1955, showing that we have applied to alter the present shoreline. These signs are being positioned on the beach and next to the main road between the Secret Paradise Hotel and Jackie's on the Reef, for the public to clearly see.

Also as part of the application we have to serve a copy of the notice on owners of adjacent land to the development area, as defined in paragraph 2 of the application. Please therefore find attached your copy of the "Notice of Application- Form B First Schedule.".

Should you have any comments on our Application I would be delighted to answer them personally. I will be staying in West End from Friday the 23rd of March until Sunday 1st of April and I would be delighted to meet with you.

Thanking you for your help and support in this matter.

Yours Sincerely

David Walker
Director
Negril Peninsula Resorts Ltd

Negril peninsula

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E richard.pierce@nergrilpeninsula.com

Jackie Lewis
Jackie's on the Reef
West End
Negril
Jamaica
W1

Dear, Jackie

Re; Negril Peninsula Resorts Ltd, Development Application,
Ref; 2660-10015-PB00368

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Thanking you for your help and support in this matter.

Yours Sincerely

David Walker
Director
Negril Peninsula Resorts Ltd

negril peninsula

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Investment & Development

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E richard.pierce@nergrilpeninsula.com

Doug
Westender Inn
West End
Negril
Jamaica
W1

Dear, Doug

Re; Negril Peninsula Resorts Ltd, Development Application,
Ref; 2660-10015-PB00368

As you are probably aware we have made an Outline Planning Application to construct an Eco-Tourism Resort totalling 361 acres on part of Mr Hoggs land commonly known as Retreat Estate Wedderburns, a location plan is enclosed for your reference.

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Thanking you for your help and support in this matter.

Yours Sincerely

David Walker
Director
Negril Peninsula Resorts Ltd


NOTICE OF APPLICATION
NEGRIL PENINSULA RESORTS LIMITED
AGENT M.R. ANTHONY DARLING OF AEBC
26 NELSON ST. MAY PEN PARISH OF CLARENDON
JAMAICA W.I. HAVE APPLIED TO THE BEACH
CONTROL AUTHORITY FOR A LICENCE TO ENCROACH
ON AND OR USE THAT PART OF THE FORESHORE
AND OR FLOOR OF THE SEA AT WEDDERBURNS,
PART OF RETREAT ESTATE NEGRIL
WESTMORELAND JAMAICA, DESCRIPTION 1.1KM
OF FORESHORE LYING BETWEEN SECRET PARADISE
HOTEL TO THE WEST AND JACKIES ON THE REEF
SPA HOTEL TO THE EAST, FOR THE PURPOSE OF
CONSTRUCTION OF NEW BEACHES AND MARINA
IN ACORDANCE WITH OUTLINE PLANNING
APPLICATION ECO TOURISM DEVELOPMENT
REF-2660-10015-PB00318
DATE THE 6 DAY OF DECEMBER 200
NEGRIL PENINSULA RESORTS LIMITED
SIGNATURE OF APPLICANT


NOTICE OF APPLICATION
NEGRIL PENINSULA RESORTS LIMITED
AGENT M.R. ANTHONY DARLING OF AEBC
26 NELSON ST. MAY PEN PARISH OF CLARENDON
JAMAICA W.I. HAVE APPLIED TO THE BEACH
CONTROL AUTHORITY FOR A LICENCE TO ENCROACH
ON AND OR USE THAT PART OF THE FORESHORE
AND OR FLOOR OF THE SEA AT WEDDERBURNS,
PART OF RETREAT ESTATE NEGRIL
WESTMORELAND JAMAICA, DESCRIPTION 1.1KM
OF FORESHORE LYING BETWEEN SECRET PARADISE
HOTEL TO THE WEST AND JACKIES ON THE REEF
SPA HOTEL TO THE EAST, FOR THE PURPOSE OF
CONSTRUCTION OF NEW BEACHES AND MARINA
IN ACCORDANCE WITH OUTLINE PLANNING
APPLICATION ECO TOURISM DEVELOPMENT
REF-2660-10015-PB00318
DATE THE 6 DAY OF DECEMBER 200
NEGRIL PENINSULA RESORTS LIMITED


THE BEACH CONTROL AUTHORITY LICENSING REGULATION 1956.
NOTICE OF APPLICATION
NEGRIL PENINSULA RESORTS LIMITED,
AGENT M.R. ANTHONY DARLING OF AEBC
26 NELSON ST. MAY PEN PARISH OF
CLARENDON JAMAICA W.I. HAVE APPLIED TO
THE BEACH CONTROL AUTHORITY FOR A LICENCE
TO ENCROACH ON AND OR USE THAT PART OF THE
FORESHORE AND OR FLOOR OF THE SEA AT
WEDDERBURNS, PART OF RETREAT ESTATE
NEGRIL WESTMORELAND JAMAICA, DESCRIPTION
1.1KM OF FORESHORE LYING BETWEEN SECRET
PARADISE HOTEL TO THE WEST AND JACKIES ON
THE REEF SPA HOTEL TO THE EAST, FOR THE
PURPOSE OF CONSTRUCTION OF NEW BEACHES AND
MARINA IN ACCORDANCE WITH OUTLINE
PLANNING APPLICATION ECO TOURISM
DEVELOPMENT REEF 2660-10015-PB
DATED THE 6 DAY OF DECEMBER
NEGRIL PENINSULA RESORTS
SIGNATURE OF APPLICANT

THE BEACH CONTROL LAW, 1955

Notice of Application – Form B First Schedule

1. Every applicant for a licence shall exhibit for a period of at least one month after the application has been received by the Authority notices in the Form B set out in the First Schedule to these Regulations in a conspicuous place on that part of the foreshore mentioned in the application and on any land adjacent thereto and under the control of the applicant.

2. The notice on the foreshore shall face and be visible from the sea and that on the adjacent land shall be placed on the verge thereof which is nearest to a main or parochial road or path used by the public and shall if possible face and be visible from such road or path.

3. The applicant shall serve, either personally or by registered post a copy of the notice on every person, who is the owner of any land adjacent to the area defined in paragraph 2 of the application, so, however, that failure to comply with the provisions of the paragraph shall not be deemed to invalidate any licence granted by the Authority.

4. Every such notice shall be clearly printed or painted in letters and figures not less than one inch high.

FORM B

The Beach Control Authority (Licensing) Regulations, 1956

NOTICE OF APPLICATION

I NEGRIL PENINSULA RESORTS LIMITED
Agent: MR Anthony Darling (Name of applicant in block letters)
of AEBC, 2b NELSON ST, MAY PEN in the parish of Clarendon, Jamaica, W.I.

have applied to the Beach Control Authority for a licence to encroach on and/or use that

use that part of the foreshore and/or floor of the sea at WESTERBURNS, Part of Retreat Estate, NEGRIL, Westmoreland, Jamaica.
description: 1.1km of foreshore lying between Secret Paradise Hotel to the West and Jackies on The Reef Spa Hotel, to the East.
(Insert description of the area)

for the purpose of Construction of new beaches and marina in accordance with Outline Planning application for Ecotourism development. Ref: 2660-1001S-PB00368

DATED the 6 day of DECEMBER 2006.

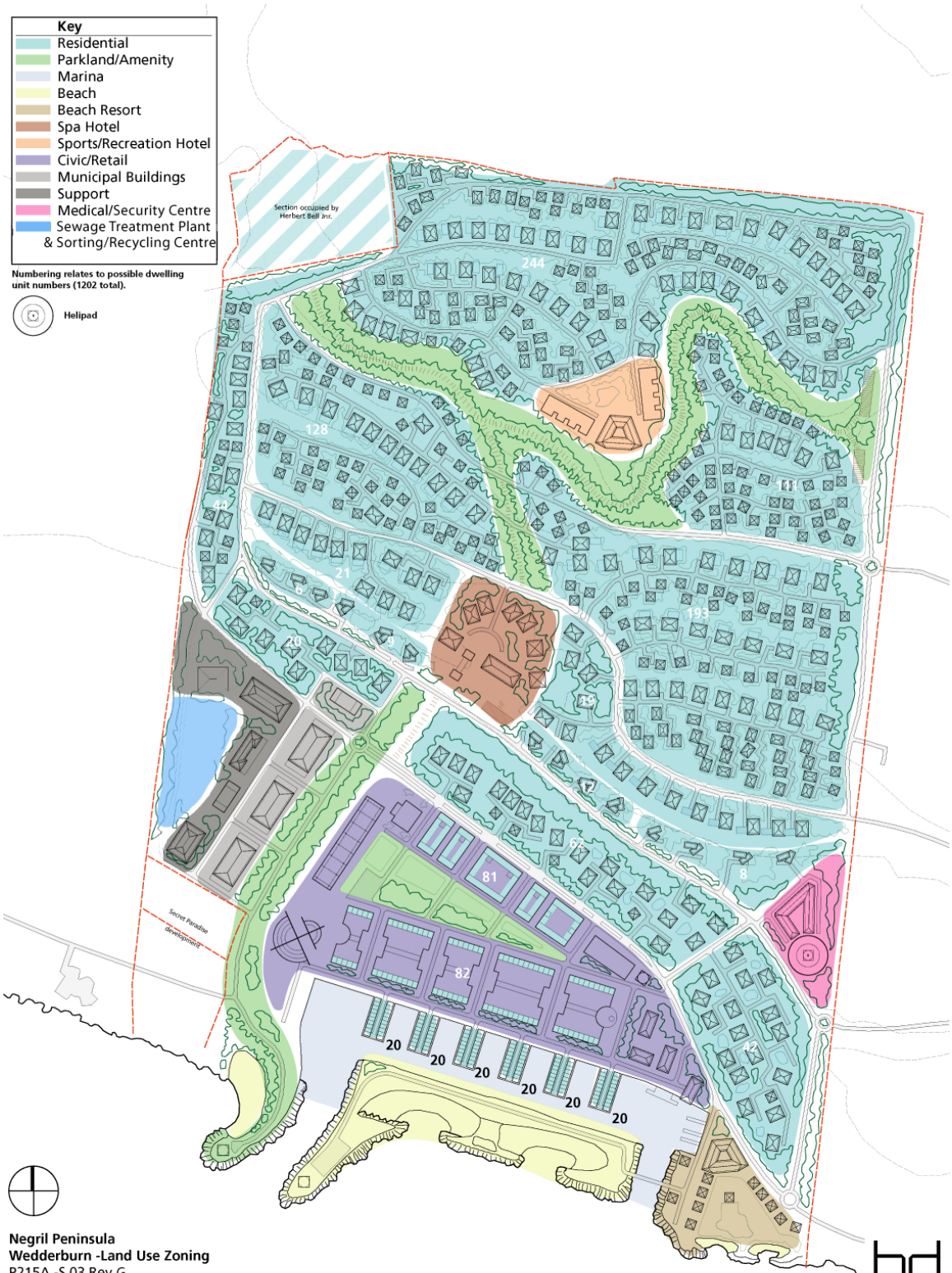
Signature of Applicant

APPENDIX XV
REVISED SITE LAYOUT PLANS

Negril Peninsula
Wedderburn - Design Plan
P215A.-S.05 Rev F
A1 - 1:2500 A3 - 1:5000
Oct 2006

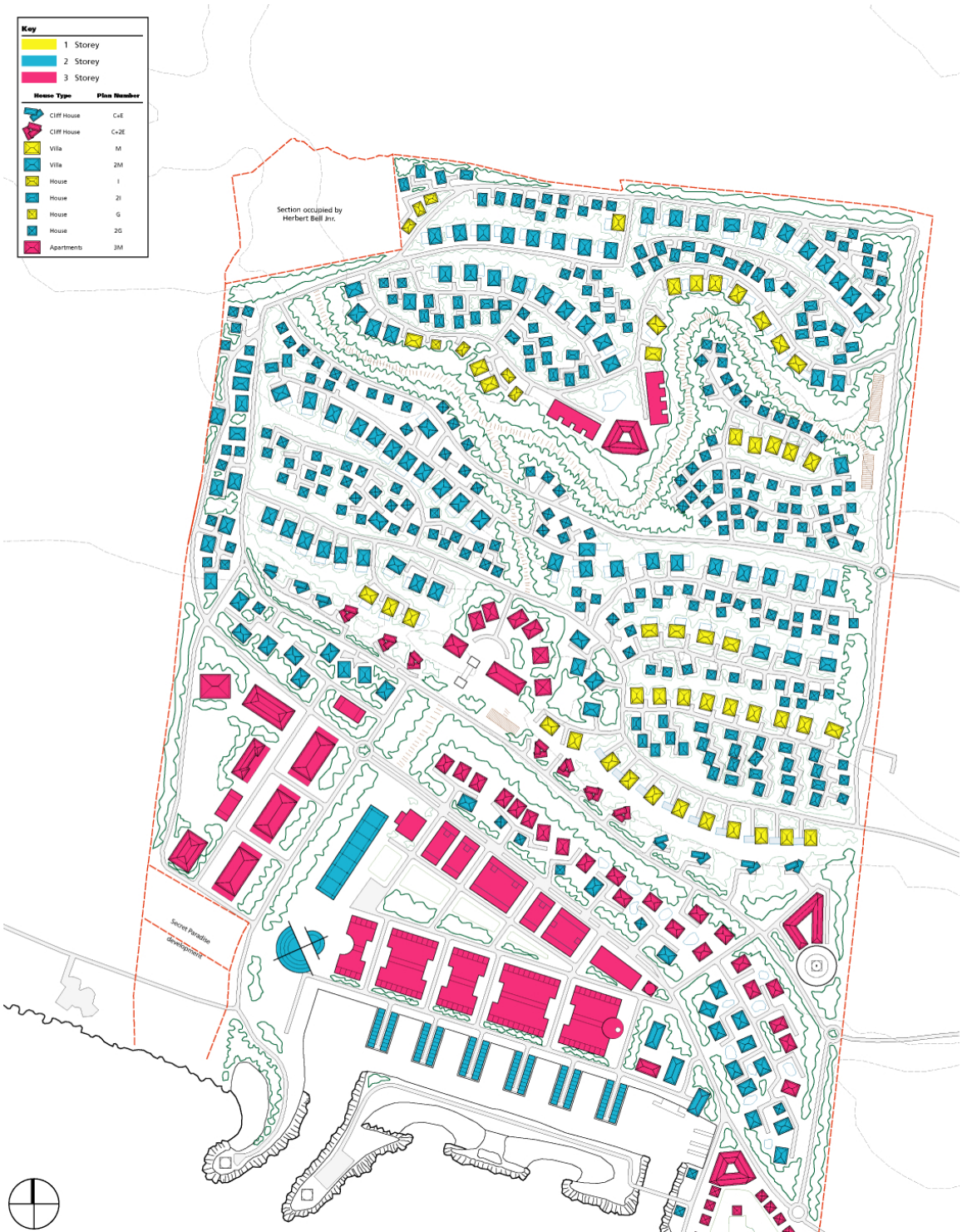
0 100 200 300 400 500m

Harper_Downie
design architecture



Negril Peninsula
Wedderburn -Land Use Zoning
P215A.-S.03 Rev G
A1 - 1:2500 A3 - 1:5000
Oct 2006

Harper_Downie
design architecture



Negril Peninsula
Wedderburn - Storey Height/Density Plan
P215A.-S.04 Rev G
A1 - 1:2500 A3 - 1:5000
Oct 2006

Harper_Downie
design architecture

APPENDIX XV1
BIBLIOGRAPHY

BIBLIOGRAPHY

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