ENVIRONMENTAL IMPACT ASSESSMENT GREENFIELD, TRELAWNY

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EXECUTIVE SUMMARY

Purpose

This document presents the findings of an Environmental Impact Assessment (EIA) conducted for the proposed development of the World Cup Cricket Site at the Trelawny Stadium, in Greenfield, Trelawny.

Jamaica Cricket 2007 Ltd., the project proponents, by letter dated November 30, 2004, commissioned Environmental Solutions Ltd. to conduct an Environmental Impact Assessment on the proposed development. This EIA forms part of the permit application submitted to NEPA.

The Proposed Development

Jamaica Cricket 2007 Ltd. proposes to construct a stadium with a permanent seating capacity of 10,000, and facilities for temporary seating of an additional 15,000 persons. The facility will be able to accommodate games of cricket, soccer, rugby and American football at the international level. This project is an initiative in support of Sports Tourism which has been articulated as a significant strategic consideration for tourism development in Jamaica. The proposed layout of the stadium is shown in Figure 1.1a

Methodology and Approach

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

Baseline data for the study area was collected using the following methods:

- Windshield Survey
- Site Reconnaissance
- Analysis of Maps and Plans
- Satellite imagery
- Review of Reports and background documents
- Field Studies
- Laboratory Analyses
- Public Consultations
- Charette Style Consultations

Proposed Project

Jamaica Cricket 2007 Ltd. proposes to construct a stadium with a permanent seating capacity of 10,000, and facilities for temporary seating of an additional 15,000 persons. The facility will be able to accommodate games of cricket, soccer, rugby and American football at the international level. This project is an initiative in support of Sports Tourism which has been articulated as a significant strategic consideration for tourism development in Jamaica.

Legislative Context

The proposed development will be executed within existing national policies, laws, regulations, standards and international protocol signed by GOJ must also be considered. Under the Natural Resources Conservation Authority Act (1991), the Natural Resources Conservation Authority (NRCA now the National Environment and Planning Agency, NEPA) is authorized to issue, suspend and revoke permits and licences. The Permit and Licence System was established in 1997 to ensure compliance with Sections 9 & 12 of the NRCA Act, which gives the NRCA the right to issue permits for new developments and request EIA studies where necessary.

Prescribed categories of projects requiring a permit have been listed by the NRCA/NEPA

and these include Development Projects. A Project Information Form (PIF) and a Permit Application (PA) were completed and submitted to NEPA with the requisite application fee in December 2004. NEPA subsequently requested and approved the Terms of Reference for conducting the EIA.

Existing Environment

Physical Aspects

The climate of the site, like the rest of Jamaica, is subtropical with gentle northeasterly prevailing winds and average daily temperatures varying from 23^{o}C in January to about 28^{o}C in July. Humidity ranges from 66% and 87% with a significant diurnal variation resulting in high morning humidity dropping off significantly in the afternoon. Rainfall data from the Meteorological Office over the period 1951- 1980 indicates mean monthly rainfall for Falmouth in the order of 85 mm with a high of 163 in November and 105 in May. There are two distinct periods of higher than average rainfall from October to January and during May.

The project site is located on a relatively flat elevated area that occurs as a break in slope where the central limestone plateau slopes downwards towards the northern coastline. The slope is a relatively uniform slope that extends from Grange to the south from an elevation of 120 meters down to the project site which is between 20 and 40 meters above sea level. From there the slope becomes steeper, especially to the west, and extends down to the coastline.

Air Quality and Noise

Respirable particulate levels measured at the sampling sites were less than 150µg/m^{3} the recommended national guideline. The levels, though within the standard are somewhat elevated; this is likely a result of the dry windy conditions on the site on the day of sampling.

The site is currently unoccupied with no activities and no noise being generated. It is located inland from the main road and is not impacted by noise from vehicular traffic. There are no communities near to the site. Noise levels are therefore not an issue at the time of EIA study. However, noise will be generated during the construction and operation phases. Construction monitoring is recommended and noise should be included as a parameter to be monitored, against the NEPA standard, to ensure that noise levels do not exceed the standard and no noise nuisance is being presented to any adjacent properties.

Ecological Aspects

The Greenfield lands can be described as secondary modified communities. The area proposed for the development has bee cleared and is dominated by a few mature trees. To the south and west of project area, the surrounding vegetation is dry limestone woodland.

Very little wildlife was observed on the property as it has been cleared. There are no rare or endangered animal species on the site.

Socio-economic Aspects

The socio economic setting of the project includes coastal and inland settlements, resort, agricultural and urban archaeological heritage and assets, significant resort developments and infrastructure. The project site lies within the major corridor of resort tourism development from Montego Bay tin the west to Ocho Rios on the east.

Five surrounding residential communities were assessed and they comprise a varying mix of low, middle income and upper income housing. Information is presented on demographics, land use and livelihoods, utilities (water electricity) and sewage and solid waste disposal. Developments underway and the cumulative impacts are also presented. The communities that were assessed were Martha Brae, Hague, Rock, Falmouth and Coopers Pen.

Water supply for the project will be through the National Water Commission and electricity will be supplied by the Jamaica Public Service Co. Ltd. During construction sewage treatment and disposal will likely be by means of portable chemical toilets managed by a contractor. During operation sewage treatment and disposal will be by means of a septic tank. Solid waste disposal will be handled through the Western Parks and Markets. The nearest approved dump site is the Retirement Dump in St. James.

The nearest health facilities available to the communities are in Falmouth, where a Type C Hospital is located. Falmouth also has a Type 4 Health Clinic, which is considered adequate for serving the needs in this area. Falmouth has the only fire station in the parish and this station has only one unit.

The preparation of an Emergency Response Plan has been recommended for this facility. The size of the Trelawny Stadium at Greenfield, with respect to height and area, and the maximum seating capacity (permanent and temporary) will determine the complexity of the Emergency Plan. An Emergency Response Plan should not be developed under the stress associated with an emergency that is already underway. Therefore planning, awareness training and periodic exercises introduced prior to an emergency are essential to improving building supervisory and occupant responses.

Potential Impacts, Cumulative Impacts and Mitigation Measures

Potential impacts on the physical aspects of the natural environment relate mainly to the potential for flooding if the dry gully, as a natural drainage line, is not kept open. It is recommended that this natural drainage line be maintained and kept free of debris, and a drainage plan is to be prepared by the developers.

Earth movement activities and stockpiles of fine materials during the construction phase may generate excessive levels of fugitive dust, particularly under dry and windy

conditions. Respirable particulates are a public health hazard and may otherwise create considerable nuisances to the public. Noise and dust nuisance are expected short term impacts during the construction phase, and should not be significant impacts, since there are currently no noise or dust issues on the site. Noise impacts elated to events are considered to be seasonal impacts.

No negative impacts are expected on flora or fauna. The land has been cleared and is dominated by new growth scrubland. Bird populations would remain in the dry limestone woodland surrounding the project site. A few large trees on the site (particularly the Red Birch) may attract some species of birds for feeding, and could be considered in landscaping.

It is expected that vehicular traffic will increase considerably during peak periods for stadium. The road conditions are relatively the same throughout all the communities. The design and location of access routes leading to and from the site must be carefully planned to facilitate peak flow. Most importantly, the design and location of parking facilities should not induce traffic congestion on the North Coast Highway.

Schedules for construction of the North Coast Highway should be ascertained as cumulative impacts related to construction could be realized. These would include increased levels of fugitive dust, increased noise, increased movement of earth materials, increased numbers of haulage vehicles, disruption to normal traffic flow and traffic patterns, and minor disruptions to communities. Mitigation measures for these cumulative impacts should included dialogue between the developer and the Northern Coastal Highway Improvement Project, dissemination of any required detours through the print and electronic media, and general public awareness as to the construction schedule.

The demand for housing solutions along the entire north coast and the northern coast of Trelawny in particular will increase persons who might elect to squat on prime land and

seek ownership at a later date, given the awareness of numerous projects underway. This cumulative impact may be mitigated with the intervention of the creation of suitable housing solutions by the relevant government agencies. The creation of suitable housing solutions is not the responsibility of the developer.

It is projected that the Stadium development will increase employment opportunities in the parish. Direct and indirect opportunities will be expected to occur for both skilled and unskilled labourers.

The mainly small size and demographic profile of the communities investigated suggests that a large visitor attraction will bring positive impacts. In turn their proximity as a labour source and their offering in micro-enterprise services to visitors may benefit the project though on a small scale.

Community members view the proposed development for the Greenfield site as a potentially important contributor to the development of the community. It was also felt that the community had the vision and capability of preparing itself to offer various visitor attractions to the surrounding hotels and enhance the interest of persons in light of the proposed stadium. Entertainment, rafting tours and restaurants were seen as the main vehicles for offering this. In essence the residents are aware that the employment generated for the majority will not be site specific.

Operational phase activities will need to be supported by an emergency evacuation procedure (for fire and earthquake) and take into account peak flow traffic, potential accidents and increased sewage discharge. An Outline Emergency Plan and an Outline Monitoring Plan are presented in the EIA report.

There are no listed heritage sites located within the area of the property proposed for development.

Positive Impacts

The Trelawny Stadium will make a significant contribution to the sporting facilities in Jamaica and to the tourism product in Jamaica in terms of the provision of a world class stadium able to accommodate various sporting activities. Spin-off benefits during the World Cup Cricket in 2007 as well as subsequent events thereafter, should be felt by large and small resort facilities, restaurants, car rental companies, taxi / limousine services, shops, craft stalls and various attractions, particularly between Ocho Rios and Montego Bay. A controlled and well-designed development with the attendant infrastructure to facilitate positive environmental impact should be major impact of this proposed development.

During design, site preparation and construction employment will be generated for several categories of workers including engineers, casual labourers, skilled and unskilled workers, as well as suppliers of goods and services. During the operation phase supplies of good and services will be required.

Public perception appears to indicate support for the new facility as it means an increase in job opportunities during both the construction and operation phases, the potential for improvement in living conditions over the long term, increase in tourism in the area, increase profile for Jamaica on the international sporting market.

Environmental Quality Objectives for the proposed development have been prepared to included aspects related to the physical environment, the biological environment, integrated water resource management, storm-water run-off control, energy efficiency, minimization of pollution and maintaining aesthetic appeal.

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1.0 INTRODUCTION

This document presents the findings of an Environmental Impact Assessment (EIA) conducted for the proposed development of the World Cup Cricket Site at the Trelawny Stadium, in Greenfield, Trelawny. Jamaica Cricket 2007 Ltd., the project proponents by letter dated November 30, 2004, commissioned Environmental Solutions Ltd. to conduct an Environmental Impact Assessment on the proposed development. This EIA report is submitted in support of the environmental permit application to the National Environment and Planning Agency (NEPA).

1.1 THE EIA REPORT

The EIA report represents the findings of an analysis of the proposed Trelawny Stadium development within the context of the existing characteristics of the project site as well as the salient features of the surrounding area.

The project site covers 40 acres within 120 acres of land owned by the National Housing Trust, at Greenfield (previously Florence Hall) near Falmouth in Trelawny (Figure 1.1a). The property is registered at Volume 1109 Folio 437.

1.2 THE PROJECT

Jamaica Cricket 2007 Ltd. proposes to construct a stadium with a permanent seating capacity of 10,000, and facilities for temporary seating of an additional 15,000 persons. The facility will be able to accommodate games of cricket, soccer, rugby and American football at the international level. This project is an initiative in support of Sports Tourism which has been articulated as a significant strategic consideration for tourism development in Jamaica. The proposed layout of the stadium is shown in Figure 1.1a.

A schematic layout of the Trelawny Stadium and its facilities is given in Figure 1.1c. Engineering drawings to facilitate construction have been prepared. Sewage treatment will be by means of a septic tank.

Figure 1.1a: Site Location Map

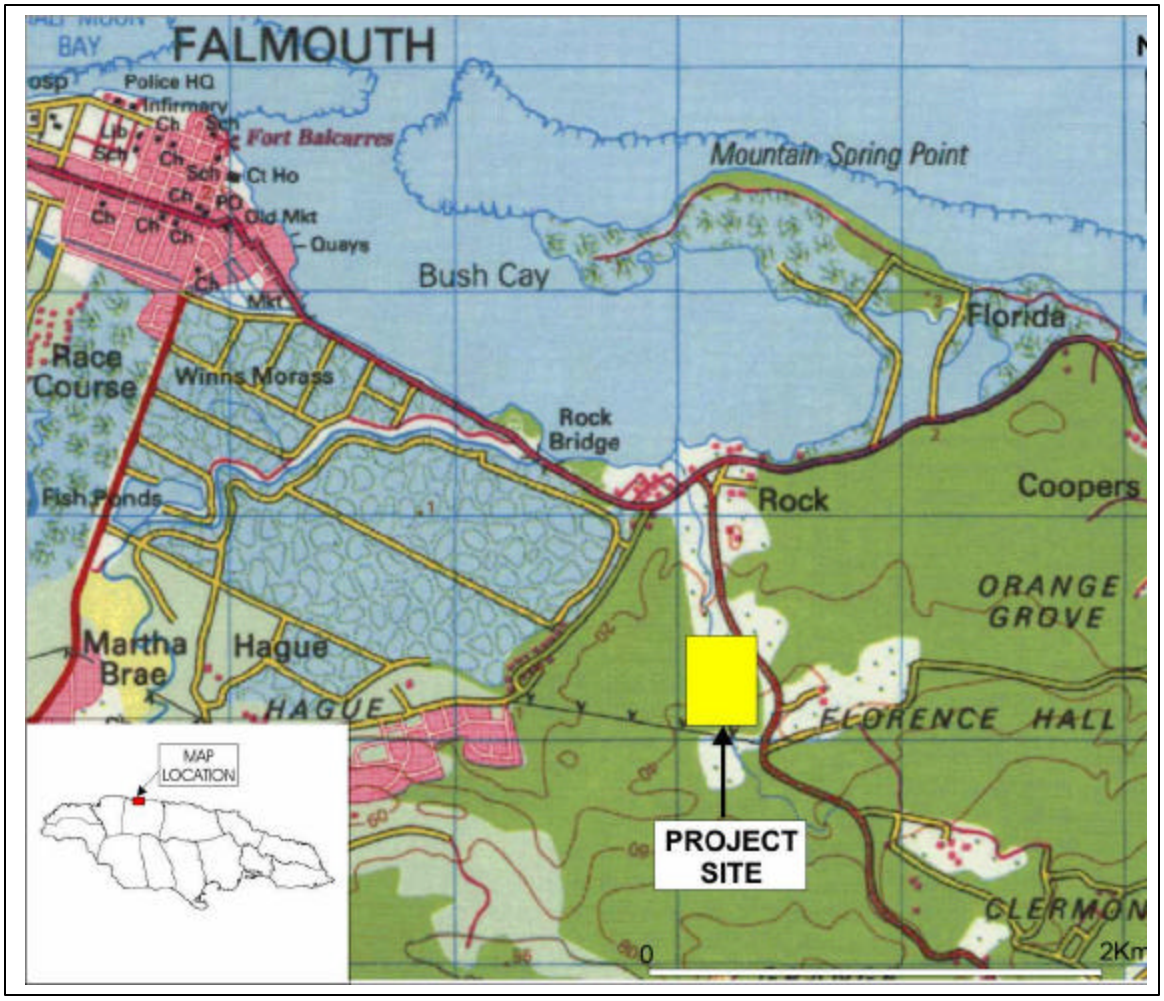
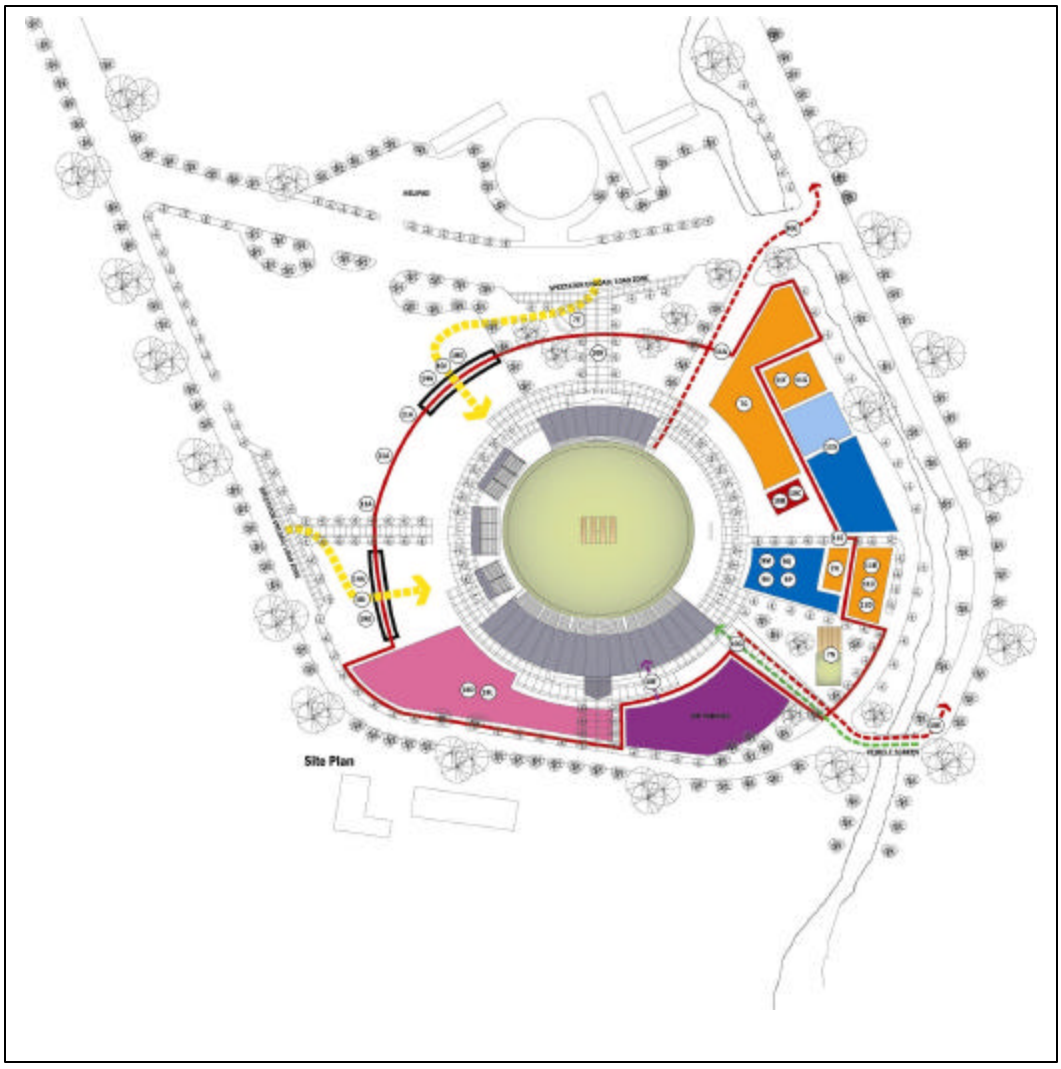


Figure 1.1b: Layout and Location of Trelawny Stadium (on IKONOS Imagery)

The overlay of the site plan on the Ikonos imagery indicates the areas of the development that will not be cleared for construction. However, to maintain aesthetic appeal these areas will have to be maintained in a visually pleasing manner.

The features of the proposed stadium and associated facilities are shown in Figure 1.1c.

Figure 1.1c: Schematic Layout of Trelawny Stadium and Facilities



KEY

Yellow dotted line	Spectator Access Route
Red dotted line	Emergency Vehicle Routes
Green dotted line	Teams & Officials Routes
Purple dotted line	VIP Access Route
Unbroken red line	Stadium Secure Perimeter
Orange	Operations Offices
Dark Blue	Media Operations Centre
Light Blue	Accreditation Centre
Light Purple	VIP Hospitality
Dark Purple	VIP Parking
Light Green	Playing and Practice Areas

1.2 Terms of reference

Based on the Generic Terms of Reference (TORs) provided by NEPA, and identifying site specific and project specific issues the Terms of Reference for conducting the EIA were submitted to NEPA and approved. These TORs are given below:

Terms of Reference
Trelawny Stadium at Greenfield, Trelawny

Prepared by Environmental Solutions Ltd.
on behalf of Jamaica Cricket 2007 Ltd.
and based on NEPA Generic Terms of Reference

The Environmental Impact Assessment will:

1) Provide a complete description of the existing site proposed for development, and detail the elements of the development, highlighting areas to be reserved for construction and the areas which are to be preserved) in their existing state

2) Identify the major environmental issues of concern through the presentation of baseline data which should include social and cultural considerations. Assess public perception of the proposed development.

3) Outline the Legislation and Regulations relevant to the project.

4) Predict the likely impacts of the development on the described environment including direct, indirect and cumulative impacts, and indicate their relative importance to the design of the development's facilities.

5) Identify mitigation action to be taken to minimise adverse impacts and quantify associated costs.

6) Design a Monitoring Plan which should ensure that the mitigation plan is adhered to.

7) Describe the alternatives to the project that could be considered at that site

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

Task #1. Description of the Project

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

Task #2. Description of the Environment

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

i) physical environment

ii) biological environment

iii) socio-economic and cultural constraints.

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

Baseline date will include:

(A) Physical

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

ii) Water quality of any existing wells, rivers, ponds, streams or coastal waters in the vicinity of the development. Quality indicators should include but not necessarily be limited to nitrates, phosphates, faecal coliform, and suspended solids.

Climatic conditions and air quality in the area of influence including particulate emissions from stationary or mobile sources, NOxs, SOxs, 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.

vi) Availability of solid waste management facilities.

(B) Biological

Present a detailed description of the terrestrial flora and relevant fauna of the area, with special emphasis on rare, endemic, protected or endangered species. Migratory species should also be considered. There may be the need to incorporate micro-organisms to obtain an accurate baseline assessment. Generally, species dependence, niche specificity, community structure and diversity ought to be considered.

(C) Socio-economic & cultural

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

Task #3- Legislative and Regulatory Considerations

Outline the pertinent regulations and standards governing environmental quality, safety and health, protection of sensitive areas, protection of endangered species, siting and land use control at the national and local levels. The examination of the legislation should include at minimum, legislation such as the NRCA Act, the Wildlife Protection Act, the Town and Country Planning Act, legislation and policies from the Forestry Department, Building Codes and Standards, Development Orders and Plans and the appropriate international convention/protocol/treaty where applicable.

Task #4- Identification of Potential Impacts

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

- change in drainage pattern
- flooding potential
- landscape impacts of excavation and construction
- loss of natural features, habitats and species by construction and operation
- pollution of potable, coastal, surface and ground water
- Air pollution

- capacity and design parameters of proposed sewage treatment facility.
- socio-economic and cultural impacts.
- risk assessment
- noise

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

Task #5 Mitigation

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

Task #6 - Monitoring

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

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

commencement of the development. At the minimum the monitoring programme and report should include:

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

The Monitoring report should also include, at minimum:

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

Task #7- Project Alternatives

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

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

As requested by NEPA special attention will be paid to the Cricket Environs and the Impact on the Environment from Increased Tourism.

2.0 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

The proposed development will be executed within existing national policies, laws, regulations, standards and international protocol signed by GOJ must also be considered.

2.1 PERMITTING

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

Prescribed categories of projects requiring a permit have been listed by the NRCA/NEPA and these include Development Projects. A Project Information Form (PIF) and a Permit Application (PA) were completed and submitted to NRCA/NEPA with the requisite application fee in December 2004.

2.2 NATIONAL LEGISLATIVE AND REGULATORY CONSIDERATIONS – NATURAL ENVIRONMENT

Several legal instruments are applicable to this proposed development in the context of environmental management. These are listed below.

2.2.1 Natural Resources Conservation Act (1991)

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

Impact Assessment (EIA) is required for new projects and existing projects undergoing expansion.

2.2.2 Wildlife Protection Act (1945)

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

Section 4.2 describes the fauna and habitats in the project area, while guidelines for development are given in the mitigation measures in Section 5.0.

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

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

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

The island of Jamaica and the Territorial Sea of Jamaica has been declared as a Prescribed Area. No person can undertake any enterprise, construction or development of a prescribed description of category except under and in accordance with a permit. The Natural Resources Conservation (Permits and Licenses) Regulations (1996) gives effect to the provisions of the Prescribed Areas Order.

2.2.5 Water Resources Act (1995)

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

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

Section 25 advises that the proposed user will still have to obtain planning permission, if this is a requirement, under the Town and Country Planning Act. In addition, Section 21 of the Act stipulates that if the water to be used will result in the discharge of effluents, an application for a license to discharge effluents will have to be made to the Natural Resources Conservation Authority or any other relevant body as indicated by the Minister.

The WRA is a member of the Technical Review Committee of NEPA and lends its expertise to the evaluation of the potential project impact on water resources in the project area.

2.2.6 Country Fires Act (1942)

Section 4 of the Country Fires Act of 1942 prohibits the setting of fire to trash without prior notice being given to the nearest police station and the occupiers of all adjoining lands. In addition, a space of at least fifteen feet in width must be cleared around all trash to be burnt and all inflammable material removed from the area. Section 6 of the Act empowers the Minister to prohibit, as may be necessary, the setting of fire to trash without a permit.

Offences against this Act include:

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

This consideration is significant in the light of the extensive losses suffered recently in several parts of the island as a consequence of bush fires illegally or inadvertently set. Site clearance should refrain from use of fire.

2.2.7 Quarries Control Act (1983)

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

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

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

2.3.8 The Pesticides (Amendment) Act (1996)

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

- Aerial application of pesticides;
- Supervision required for the use of pesticides, the prescribed protective clothing to be worn and other precautionary measures;
- The permissible levels of pesticides to be used;
- The periods during which particular pesticides may or may not be used on certain agricultural crops;
- The disposal of pesticides and packages.

2.2.9 Air Quality Standards

The Federal Clean Air Acts which came into force in the United States in 1990 established air quality standards for six pollutants: ozone (O_3), carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), respirable particulate matter (PM10) and lead (Pb). An allowable level for each of these pollutants has been set by the United States Environmental Protection Agency (US EPA) whose objective is to protect the public from exposure to dangerous levels. National standards, known as the National Ambient Air Quality Standards (NAAQS), were established and they were categorized into two groups. In one group, there are the primary standards, designed to protect human health and in the other, there are the secondary standards designed to protect the environment and limit property damage.

Baseline air quality conditions will be established as part of the environmental framework of the project.

2.2.10 Noise Standards

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

Baseline noise standards will be established as part of the environmental framework of the project and guidelines for reducing the occupational hazard on site and nuisance in surrounding area will be reviewed.

The draft guidelines are perimeter noise: 75 dBA – daytime; 70dBA – nighttime.

2.2.11 Water Quality NRCA Act (1990)

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

The tables below gives the relevant NRCA Interim Irrigation Standards and Sewage Effluent Standards.

Table 3.2.12a: Interim Irrigation Standards

Natural Resources Conservation Authority (NRCA) Interim Irrigation Standards	
Parameter	**Standard Limit**
Oil & Grease	10 mg/L
Total Suspended Solids (TSS)	15 mg/L
Residual Chlorine	0.5 mg/L
Biochemical Oxygen Demand (BOD)	15 mg/L
Chemical Oxygen Demand (COD)	<100 mg/L
Faecal Coliform	12 MPN/100mL

Table 3.2.12b: NRCA Sewage Effluent Standards

Immediate Technology Based Effluent Standards	
Parameter	**Effluent Limited**
BOD_5	20 mg/l
TSS	30 mg/l
Nitrates (as Nitrogen)	30 mg/
Phosphates	10 mg/l
COD	100 mg/l
pH	6-9
Faecal Coliform	1000 MPN/100ml
Residual Chlorine	1.5 mg/l
Proposed Sewage Effluent Standards	

BOD_5	20 mg/l
TSS	20 mg/l
Total Nitrogen	10 mg/l
Phosphates	4 mg/l
COD	100 mg/l
pH	6-9
Faecal Coliform	1000 MPN/100ml
Residual Chlorine	1.5 mg/l

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

2.3.1 Town And Country Planning Act (1958)

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

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

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

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

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

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

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

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

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

The tree preservation order is not applicable to the cutting down of trees which were already dead, dying or had become dangerous and the order can take effect only after it has been confirmed by the Minister.

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

2.3.2 Land Development and Utilization Act (1966)

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

Section 14 of the Act is its responsibility to ensure that agricultural land is "as far as possible, properly developed and utilized".

2.3.3 The National Solid Waste Management Authority Act (2001)

The National Solid Waste Management Authority Act (2001) is “an act to provide for the regulation and management of solid waste; to establish a body to be called the National Solid Waste Management Authority (NSWMA) and for matters connected therewith or incidental thereto”. The National Solid Waste Management Authority is to take all steps as necessary for the effective management of solid waste in Jamaica in order to safeguard public health, ensure that waste is collected, sorted, transported, recycled, reused or disposed of, in an environmentally sound manner and to promote safety standards in relation to such waste. The NSWMA also has responsibility for the promotion of public awareness of the importance of efficient solid waste management, to advise the Minister on matters of general policy and to perform other functions pertaining to solid waste management.

NSWMA operates collection, disposal and management of disposal sites. Site applicable to Trelawny would be the Retirement Site in St. James. The responsible agency would be the Western Parks and Markets.

2.3.4 Jamaica National Heritage Trust Act (1985)

The Jamaica National Heritage Trust Act of 1985 established the Jamaica National Heritage Trust (JNHT). The Trust's functions outlined in Section 4 include the following responsibilities:

- To promote the preservation of national monuments and anything designated as protected national heritage for the benefit of the Island;
- To carry out such development as it considers necessary for the preservation of any national monument or anything designated as protected national heritage;
- To record any precious objects or works of art to be preserved and to identify and record any species of botanical or animal life to be protected.

Section 17 further states that it is an offence for any individual to:

- wilfully deface, damage or destroy any national monument or protected national heritage or to deface, damage, destroy, conceal or remove any mark affixed to a national monument or protected national heritage;
- alter any national monument or mark without the written permission of the Trust;
- remove or cause to be removed any national monument or protected national heritage to a place outside of Jamaica.

It is unlikely that the site itself has artefacts, but Falmouth is a known heritage area with listed sites, and the areas in close proximity should be regarded with care.

2.3.5 Registration of Titles Act (1989)

The Registration of Titles Act of 1989 is the legal basis for land registration in Jamaica, which is carried out using a modified Torrens System (Centre for Property Studies, 1998). Under this system, land registration is not compulsory, although once a property is entered in the registry system the title is continued through any transfer of ownership.

2.3.6 Public Health Act (1985)

The Public Health Act 1985, provides protection for Jamaica's flora from imported diseases or pests transported via plant products and soil or via other means as well as the course of action to be taken when these are discovered within the island. The Public Health Act allows for the establishment of Local Boards to regulate activities carried out in private or public buildings or properties where such activities prove injurious to health.

<u>Establishment of a Central Health Committee:</u>

The role and function of the Central Health Committee is to advise the Minister and the Local Board on matters concerned with public health as they see fit or advised by the Minister.

Establishment of a Local Board:

There must be a Local Board of Health for each parish

The Local Board has the power to divide their respective parishes into sanitary districts.

The Local Board may carry out activities that are advantageous or convenient in the interest of public health

A Local Board from time to time and if directed by the Minister, may make regulations relating to:

- The Overcrowding of buildings
- Provision, use and maintenance of public sanitary conveniences
- Closure of buildings dangerous to the inhabitants thereof to public health

The Minister may prohibit the assembly of persons

Minister may order closure of public places or schools

2.3.7 Office of Disaster Preparedness and Emergency Management (ODPEM) FIRE MANAGEMENT PLAN

There are numerous organizations involved in the Fire Management Plan.

The Jamaica Fire Brigade is the primary agency for response to fires. ODPEM is a coordination/ support organization for Fire Management.

ODPEM:

- Will be responsible for consultation with the commissioner of the Jamaica Fire Brigade for the activation of the plan and overall coordination of all mitigation, preparedness, response and rehabilitation activities under the National Plan. The Parish Disaster Committees assume direct responsibility for parish activities reporting to ODPEM as required.
- ODPEM is also responsible for activating the National Emergency Operation Centre (NEOC)
- Ensuring Media Management of the NEOC
- Facilitating Fire Response coordination

These procedures relate specifically to Fire Response:

STANDARD OPERATING PROCEDURES

AGENCY	**ACTIVITIES**
JDF	The JDF Air Wing will provide aircraft for aerial reconnaissance and fire fighting support.
JDF Coast Guard	**T**he Jamaica Defense Force Coast Guard will provide boats for marine reconnaissance
JFB	**T**he JFB will assume on scene coordination at the scene of the fire

The following organizations will comprise the rapid aerial reconnaissance team where possible as stated in the National Damage Assessment Plan these include representatives from: JFB, ODPEM, NEPA, JPS, Ministry of Works.

JFB/ ODPEM	**D**epending on the size of the aircraft and the type of fire standard core, JFB, ODPEM and any other agency affected will comprise the aerial reconnaissance team. The Commissioner of the JFB will collaborate with the Director General of the ODPEM to determine if the Fire Management Plan should be activated.
NEOC	**I**n the event of any crisis or emergency situation, which may occur as a result of the Fire Hazard, the NEOC will activate the necessary plans. These include the Relief Plan, Civil Unrest Plan, Traffic Management Plan and the Hazardous Material Plan. The National Disaster Executive must always be updated on the current situation.
JIS	**A**ccurate information must always be given to the public on actual problems and situation related to the fire. This information will also include protective and precautionary measures.

ALL AGENCIES **T**he Emergency Operations Group comprising representatives of JFB, ODPEM, JDF, JCF, and MOH along with other responding agencies will report to the NEOC.

RESPONSE COORDINATION

The response to a 'major' fire can be broken down into four operational phases.

Phase 1: Warning and call Procedure and Notification

Phase 2: Alert at the NEOC and Incident Site.

Phase 3: Plan Activation

Phase 4: Debriefing, Analysis and Deactivation.

2.3.8 ODPEM Draft National Transportation Plan

Scope of work:

The Plan will detail preparedness in response measures relating to steps to be taken at the National level to access transportation in times during and after disaster occurrences.

The purpose of the plan will be to:

- Identify transportation resources
- Assign specific responsibility for dispatch of transportation resources
- Coordinate national transport response
- Detail and coordinate preparedness activities

Disaster requiring transport activities will include: for fire

- Transportation of victims to medical care facilities
- Clearance of debris
- Evacuation of victims to shelters/ safe areas
- Rescue trapped victims
- Assisting in the welfare of victims
- Movement of response teams and relief items

Duty of coordinators:

Maintain resources

Manage a Communication Center

ODPEM Transportation Plan:

Provision of Air travel where necessary.

2.4 INTERNATIONAL LEGISLATIVE AND REGULATORY CONSIDERATIONS

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

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

Ratified by twenty countries, the Cartagena Convention is a framework agreement which sets out the political and legal foundations for actions to be developed. The operational Protocols, which direct these actions, are designed to address special issues and to initiate concrete actions. The Convention is currently supported by three Protocols. These are:

- *The Protocol Concerning Co-operation in Combating Oil Spills in the Wider Caribbean Region* (The Oil Spills Protocol), which was adopted and entered into force at the same time as the Cartagena Convention;
- *The Protocol Concerning Specially Protected Areas and Wildlife in the Wider Caribbean Region* (The SPAW Protocol), which was adopted in two stages, the text in January, 1990 and its Annexes in June, 1991. The Protocol entered into force in 2000;

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

This latter protocol is relevant to Greenfield in terms of run off from site to bay and coastal waters.

2.4.2 Biodiversity Convention

The objectives of the Convention on Biological Diversity are "the conservation of biological diversity, sustainable use of its components and the fair equitable sharing of the benefits arising out of the utilization of genetic resources". This is the first global, comprehensive agreement which has as its focus all aspects of biological diversity: genetic resources, species and ecosystems. The Convention acknowledges that the "conservation of biological diversity is a common concern of humankind and an integral part of the development process". In order to achieve its goals, the signatories are required to:

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

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

3.0 METHODOLOGY AND APPROACH

3.1 General Approach

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

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

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

- Windshield Survey
- Site Reconnaissance
- Analysis of Maps and Plans
- Satellite imagery
- Review of Reports and background documents
- Public Consultations
- Field Studies
- Laboratory Analyses
- Charette Style Consultations

3.2 Physical Environment

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

3.2.1 Geology, Topography, Soils and Hazard Vulnerability

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

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

3.2.2 Hydrology and Drainage

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

3.2.3 Air Quality

Particulate measurements (PM 10 - non settleable dust smaller than 10 microns in diameter) were taken at three stations (Figure 3.2.3) over an eight hour period. Sensidyne BDX 530^{CFT} personal high flow portable vacuum pumps were used to collect the respirable particulates. These pumps were calibrated to a suction rate of approximately 2.5 litres/minute using Sensidyne EZ Cal 1 Primary Flow Calibrator. The calibrated pumps were attached to pre-weighed filters fitted to cyclones. The cyclones separate the respirable from the non- respirable particulate by centrifugal forces. Air drawn into the cyclone is accelerated by a circular motion allowing the lighter particles to separate from the heavier ones, which are then collected unto the filters.

Figure 3.2.3: Air Quality Stations

The pumps with the cyclones were placed at the respiratory height of pedestrians for approximately eight hours running time after which the pumps were turned off, the filters removed, stabilized and re-weighed to determine a Time Weighted Average (TWA) value for the particulates. Respiratory height is the approximate height at which someone conducting his normal daily activity breathes. Weighing of the filters was done at the Jamaica Bureau of Standards, Kingston.

3.3 Biological Environment

The status of the flora and fauna of the study area were determined by a review of literature relevant to the area and field investigations.

3.3.1 Flora

The vegetative communities were identified using the method of Grossman *et al* (1991) and classified into community types. Detailed transects were not sampled as the land had been cleared and is dominated by new growth scrub. Identification was carried out of dominant tree species on the property, within the area of the proposed development.

3.3.2 Fauna

Information on birds and other animals was gathered from existing literature on reported species as well as observations in the field. Transects for bird counts were not employed as very few bird species were observed on the site during the reconnaissance. Vegetative cover is sparse and is dominated by a few isolated mature trees, as the lad has been cleared. The habitat was open with new growth scrubland.

3.4 Socio-economic Environment

Rapid appraisal techniques were used for 5 communities in close proximity to the project, in order to identify relevant environmental issues. The process involved windscreen observations, in depth structured interviews as well as non structured *ad hoc* discussions with individuals and groups, and information as obtained on the following aspects:

- typology (urban, rural, unplanned residential, housing scheme, etc.)
- land use and livelihoods
- developments underway
- community facilities
- water supply and other utilities
- waste management practices
- recreational activities

Government agencies and private sector enterprises were canvassed. Population and demographic data was sourced from STATIN and water resources data from the Water Resources Authority.

4.0 DESCRIPTION OF EXISTING ENVIRONMENT

4.1 Climate

The climate of the site, like the rest of Jamaica, is subtropical with gentle northeasterly prevailing winds and average daily temperatures varying from 23^{o}C in January to about 28^{o}C in July. Humidity ranges from 66% and 87% with a significant diurnal variation resulting in high morning humidity dropping off significantly in the afternoon. Rainfall data from the Meteorological Office over the period 1951- 1980 indicates mean monthly rainfall for Falmouth in the order of 85 mm with a high of 163 in November and 105 in May. There are two distinct periods of higher than average rainfall from October to January and during May.

During the period June to November each year extreme weather conditions are produced by tropical systems that develop in the north Atlantic and Caribbean basins. These systems move westwards through the Caribbean region and generate intense rainfall of long duration and when tropical storms or hurricanes develop high velocity winds accompany the rainfall. Northers that form over the North American continent produce slow moving cold fonts that approach the island from the north and bring with them rainfall that can persist for days.

4.2 Topography and Drainage

The project site is located on a relatively flat elevated area that occurs as a break in slope where the central limestone plateau slopes downwards towards the northern coastline, (Figure 4.2). The slope is a relatively uniform slope that extends from Grange to the south from an elevation of 120 meters down to the project site which is between 20 and 40 meters above sea level. From there the slope becomes steeper, especially to the west, and extends down to the coastline.

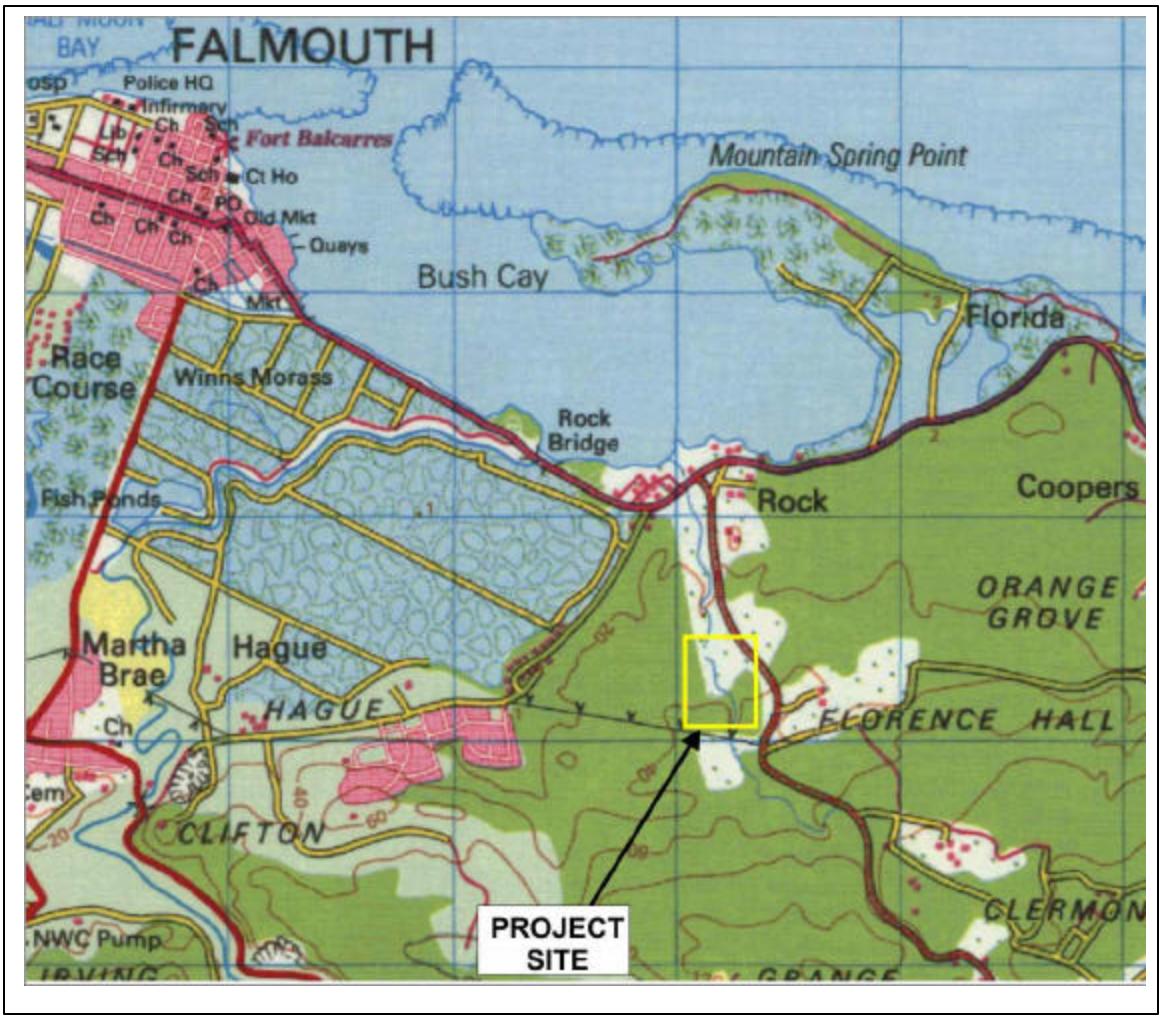


Figure 4.2: Topographical Features of the area

The topographic map of the site (Figure 4.3 – Insert in back pocket) shows that the project site is relatively flat with a gentle downward slope towards the north. Undulations of the land surface create relief in the order of 3 meters. The only significant drainage feature is a dry drainage channel that runs north / south along the eastern side of the site. While this stream flows intermittently the size of the channel and the existence of large boulders within it, suggest that large quantities of runoff occur through the channel after heavy rainfall.

4.3 Geology and Soils

The project site is underlain by the Montpelier Limestone Formation that belongs to the White Limestone Group which is of Miocene age. These rocks are exposed in numerous outcrops on the site as a white hard highly weathered rock. The Montpelier Limestone consists of a sequence of well-bedded to massive hard and chalky limestone that contains numerous fossils and occasional clay partings. The limestone is referred to as bioclastic because it consists mainly of calcium carbonate shell fragments and fine grained calcareous mud. The lithological characteristic of the limestone is highly variable with significant changes over short distances. In general the limestone exposed on the site is hard and massive with no large scale structural features. Soils overlying the limestone bedrock consist of a reddish brown, gravely clay, residual soil. This soil occurs as a thin veneer over the limestone typically less than a meter thick. In depressions within the limestone the soils are deeper occasionally in excess of 5 meters. The soils are relatively impermeable and highly erodible.

Plate 4.3a: Limestone outcrops

Plate 4.3 b: Limestone outcrops and shallow soil

4.4 Hydrology

The porosity of the underlying limestone rock is low, however the rock is highly fractured and contains numerous interconnected solution features which create secondary porosity and therefore fairly high permeability rates. Rainfall occurring on the limestone percolates rapidly downwards through the fractures, solution features and other discontinuities. Where depressions within the limestone are covered by the clay soils found on the site, ponding is likely to occur.

4.5 Natural Hazards

4.5.1 Meteorological Events

The proposed stadium site is located along the north coast of Jamaica which is exposed to the potential storm surge associated with hurricanes. However, the site itself is elevated at 40 meters above sea level and is approximately 1 km inland from the embayed shoreline at Rock.

Hurricanes passing directly over Jamaica or close to the northern coastline will generate high velocity winds and produce intense long duration rainfall. The north facing slope which has the highest site elevation (40m) will be most exposed. There will be minimal acceleration of hurricane force winds at the project site due to topographic effects.

Flooding due to heavy rainfall will not pose a serious threat though due consideration should be paid to storm water runoff to prevent ponding, street flow and accelerated erosion. In this regard special attention should be paid to the controlled runoff of storm water through the natural drainage channel on the site.

High intensity rain from other tropical systems can induce flooding from stormwater runoff. No history of flooding as been reported on the site but the depth of the dry gully at the eastern entrance to the property suggests high volume runoff during heavy rainfall events.

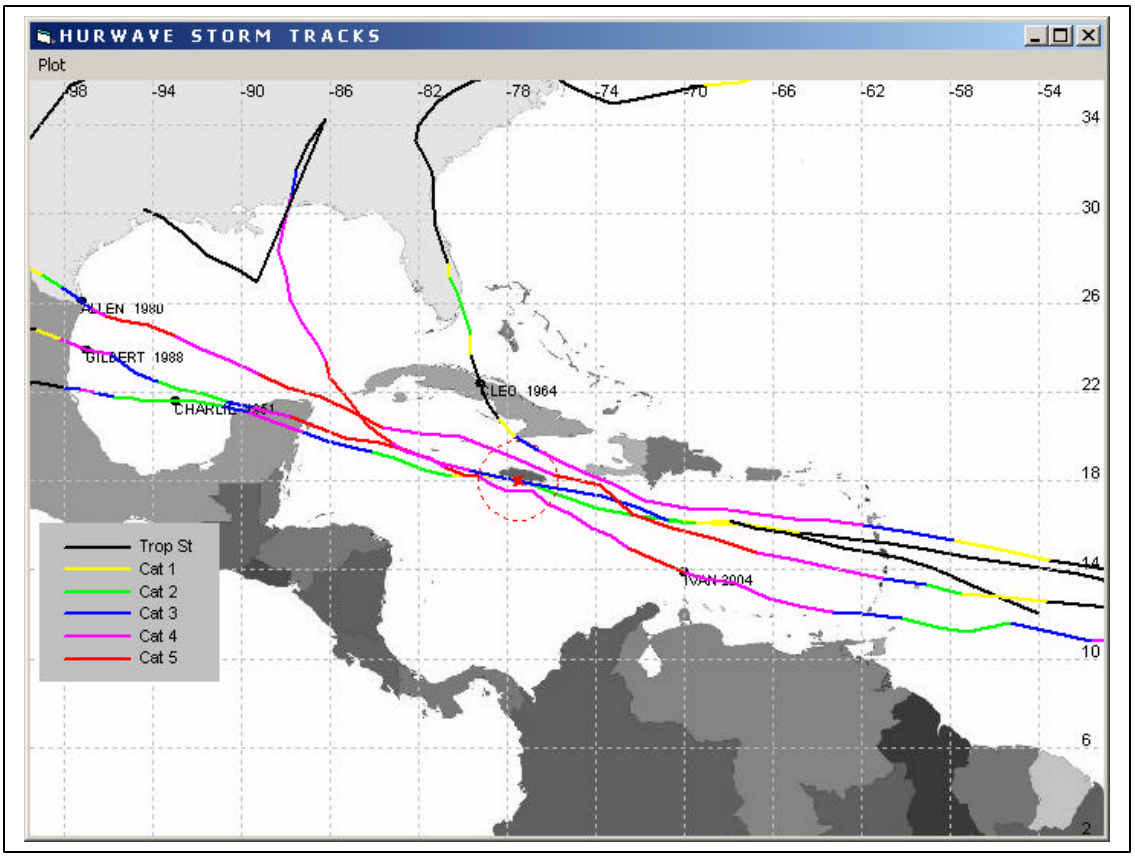
4.5.2 Seismicity

Jamaica lies in a seismically active area close to the northern boundary of the Caribbean tectonic plate and is therefore susceptible to earthquakes. The island has experienced destructive earthquakes generated offshore and on land associated with active geological features. Probabalistic analysis of historic seismic activity in Jamaica has been carried out by Periera *et al* (1986). The seismic hazard map of Jamaica shown as Figure 4.5.1

indicates the number of earthquakes, with an intensity VI, that have occurred throughout the island since 1874. The project site lies in an area of relatively low activity but is still susceptible to damaging ground shaking from earthquakes intensities of VI on the Mercalli Scale. Probability of intensity VI event has been calculated at .71 (Figure 4.5.1).

Tsunamis may be associated with seismic activity, but the site is not likely to be susceptible based on its elevation and setback from the coastline.

Figure 4.5: Historic Hurricane Tracks Across Jamaica – 1880-1988



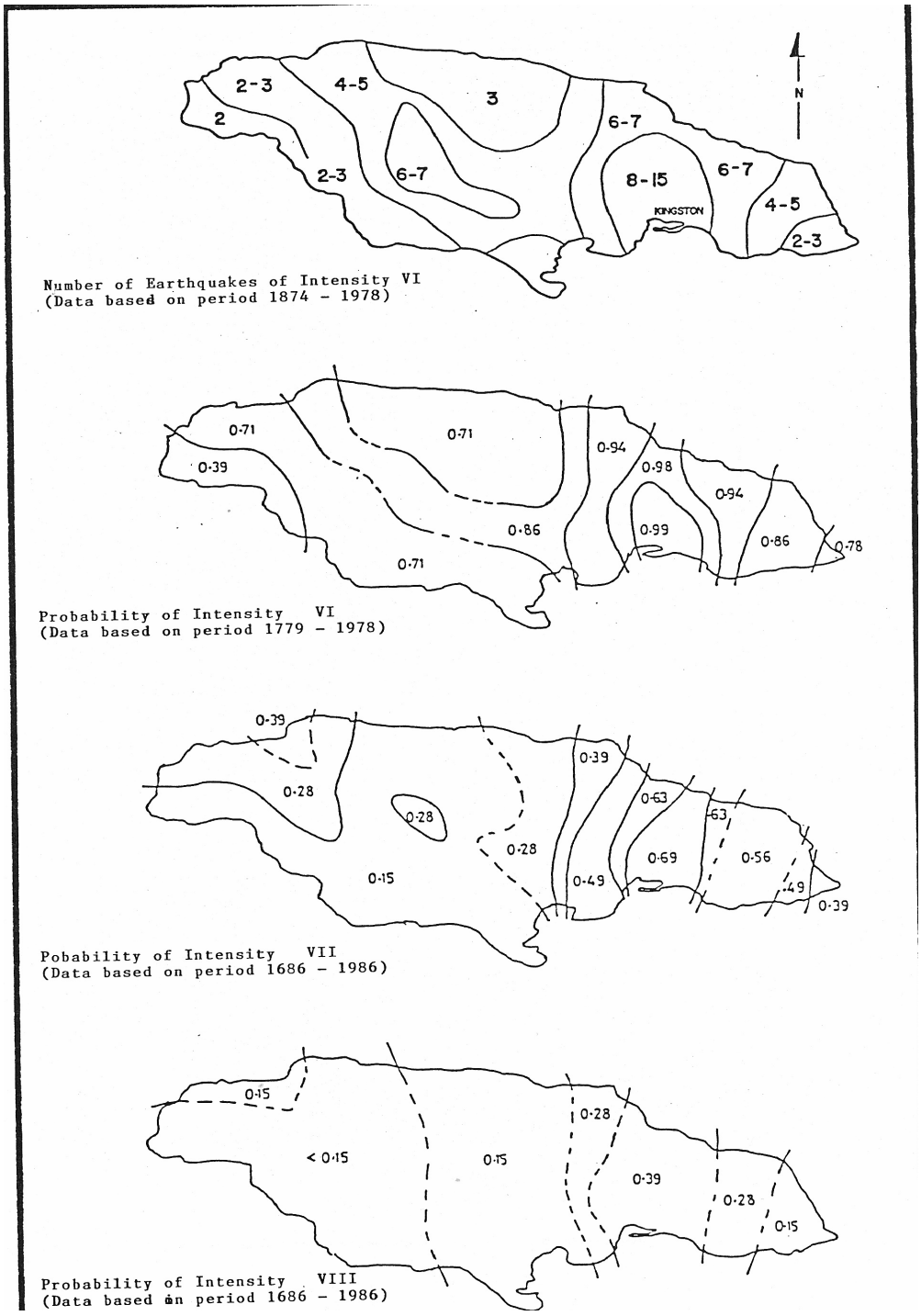


Figure 4.5.1: Earthquake intensity distribution and probabilities for Jamaica
(Source: Pereira, 1982, 1987)

4.6 Air Quality and Noise

The results of the respirable air quality sampling exercise conducted on February 3, 2005 are presented below.

Table 4.6: Respirable Air Quality Data, Greenfield, Trelawny

LOCATION	Station Number	Results 8 hr monitoring µg/m^3	NEPA 24 Hr Guide Line µg/m^3
West end of the property	GF1	86.3	150
Middle of the property	GF2	120.0	
East end of the property	GF3	76.7	

Respirable particulate levels measured at the sampling sites were less than 150µg/m^3 the recommended national guideline. The levels, though within the standard are somewhat elevated; this is likely a result of the dry windy conditions on the site on the day of sampling.

Ambient part matter (PM) levels provide an indication of baseline levels which should be maintained during construction and operation of any proposed development(s).

Atmospheric particulate matter concentrations in ambient air can influence both human health, and flora and fauna. It is the effects however, on human health that evokes the greatest concern. Exposure to fine airborne particulates has been linked to increased respiratory illness, decreased lung function, and premature death.

The site is currently unoccupied with no activities and no noise being generated. It is located inland from the main road and is not impacted by noise from vehicular traffic. There are no communities near to the site. Noise levels are therefore not an issue at the time of EIA study. However, noise will be generated during the construction and operation phases. Construction monitoring is recommended and noise should be included

as a parameter to be monitored, against the NEPA standard, to ensure that noise levels do not exceed the standard and no noise nuisance is being presented to any adjacent properties.

4.7 Biological Environment

4.7.1 Vegetation

Based on the classification by Grossman *et al* (1991) the Greenfield lands can be described as secondary modified communities. To the south and west of the Greenfield land, the boundaries are dominated by dry limestone woodland (Plate 4.7.1 a) and stands of Red Birch trees. (Plate 4.7.1 b).

Plate 4.7.1 a: Dry limestone woodland to the south and west of the property

Plate 4.7.1 b: Stand of Red Birch *(Bursera simaruba)*

The eastern boundary of the property is demarcated by the main road to Clark's Town. To the north the woodland is not as dense and the Caribbean Sea is visible (Plate 4.7.1 c).

Plate 4.7.1 c: Existing access road on the site, view of Caribbean sea to the north

The land has been cleared, as evidenced by several tree stumps, and is now overgrown/grassy scrubland (Plate 4.7.1 d), which is dominated by several specimens of the Red Birch (*Bursera simaruba*) (Plate 4.7.1 e).

Plate 4.7.1 d: Grassland, Red Birch trees and limestone outcrops

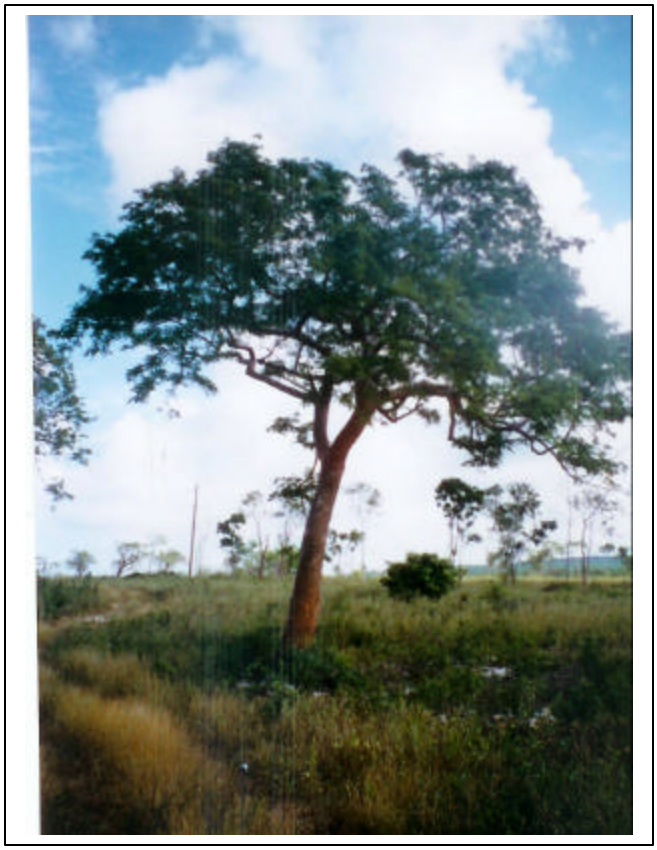


Plate 4.7.1 e: Individual Red Birch Tree

A list of the dominant trees on the site, with ecological information, is given in Table 4.7.1.

There are no rare, threatened or endangered plant species on the site, and the dominant trees recorded are common to secondary woodlands and thickets, and with a wide distribution, regionally and/or globally.

Table 4.7.1: Dominant Trees Identified on the Greenfield Site

Scientific Name	Common Name	Habitat	Status and Distribution
Bursera simaruba	Red Birch	Common in woodland on limestone mostly in arid areas near the sea and on the cays	Florida, Mexico to Venezuela and he Guiana, West Indies, Grand Cayman
Melicoccus bijugatus	Guinep	Common along roadsides and in secondary thickets and woodlands	Native of tropical America, cultivated and naturalized in the West Indies, Grand Cayman
Piscidia piscipula	Dogwood	Common, mostly in arid areas on sand or gravel o in woodlands on limestone, also on some cays	Florida, Mexico, Bahamas, Antilles, Trinidad
Pimenta dioica	Pimento	Common on wooded hillsides and in upland pastures	Mexico, C. America, Cuba, Hispaniola, introduce in Puerto Rico, Barbados and elsewhere in the tropics
Haematoxylum campechianum	Logwood	Common on exposed limestone hillsides in dry secondary thickets and planted in fences	Native of C. America, introduced and widely naturalized in the Caribbean and some parts of the Old World tropics
Tamarindus indica	Tamarind	Cultivated and naturalized	Probably native to tropical Africa, now cultivated and naturalized throughout the tropics and subtropics of both hemispheres

4.7.2 Fauna

Very few birds were observed on the site during site reconnaissance as the site is quite open, and is dominated by grassy scrubland, with few large trees. Several species of birds are likely to inhabit the secondary limestone woodland which lies beyond the western and southern boundaries of the property. A recent study of the site at Florida Lands/Bush Cay across the Oyster Bay (Environmental Solutions Ltd., 2005) and within the Martha Brae Estuary (Webber *et al*, 1998) showed several species of terrestrial birds and shore birds inhabiting these areas. These species are given in Appendix I to indicate the possible species that are likely to occur in the surrounding areas.

Several species of butterfly were observed feeding from flowering shrubs. These were mostly dominated by large and small sulphurs (*Phoebis sp*.) which occupy a range of habitats, from gardens and fields to disturbed areas. The Citrus Swallowtail (*Papilio sp*.) was also observed on the site.

There are no rare, threatened or endangered bird species occurring on the project site.

4.7.3 Coastal Considerations

The ecological sensitivity of Oyster Bay, down-slope from the site is of consideration. However, runoff from site will be improved considerably. Minimum land-based sources of pollution are expected to be generated from the site. The Martha Brae River is already depositing significant volumes of silt to the coastal area and the Oyster Bay and the Greenfield Stadium is not expected to have any significant impacts in this respect.

4.8 SOCIO ECONOMIC ENVIRONMENT

The socio economic setting of the project includes coastal and inland settlements, resort, agricultural and urban archaeological heritage and assets, significant resort developments and infrastructure. The project site lies within the major corridor of resort tourism development from Montego Bay tin the west to Ocho Rios on the east (Figure 1).

Five surrounding residential communities were assessed and they comprise a varying mix of low, middle income and upper income housing. Information is presented on demographics, land use and livelihoods, utilities (water electricity) and sewage and solid waste disposal. Developments underway and the cumulative impacts are also presented.

4.8.1 Demographics, Land Use and Livelihoods

COOPERS PEN:

Coopers Pen located less than two miles east of the Greenfield site is a seaside village which comprises an older fishing beach and a newer unplanned community. More recently the impetus to its growth has come from the presence of the 350-room Starfish Trelawny hotel, originally Trelawny Beach Hotel which stands in sharp contrast to the surrounding substandard residential dwellings.

From observation and information offered by residents, the population is about 600 with about 65% under the age of 40. The average size household is estimated at 6 persons and females are estimated to head 65% of households. The dependency ratio is likely to reflect that 6-7 persons out of every 10 are economically dependent on the rest. This would still be lower than the parish actual of 75%.

Livelihoods come mainly from a mix of poorly constructed corner shops, entertainment venues and eateries. Unemployment and underemployment are reported as being very high throughout the community and the main occupation of residents is in the hotel industry and construction.

The profile therefore, of Coopers Pen is of a relatively poor, lower income coastal community, with a high proportion of youth and female-headed households. This demographic profile is generally representative of the coastal communities found in the Parish.

ROCK:

This unplanned community (Unplanned community means that the community may have originated from a squatter settlement where the residents acquired tenure over the years) lies less than one mile NNE of the Greenfield Site. Formerly an important port, it now supports a number of small and micro businesses, and a small fishing beach, but is essentially a "residential" dormitory of Falmouth. The community lies along the original main road, with a ramp up onto the North Coast Highway. Like Coopers Pen, the village comprises a mix of poorly presented shops, entertainment venues and eateries, but also including auto repair shops, barbering and hair dressing establishments. In all about 200 structures were counted.

From observation and information offered by residents, the community has approximately 512 residents, although the STATIN data puts the 2001 population of the three Electoral Divisions containing the entire strip as well as Hague and Martha Brae at 1,600. The population has a high percentage of females, who in turn head the majority of households. It can be inferred that a similar dependency ratio applies. It is important to point out that 69% of female residents in the Rock Community are unemployed.

The fishing beach, which community memory puts at over 100 years of age, comprises a small sandy beach. About 10 fishing boats are berthed on a daily basis, several giving the appearance of being un-seaworthy. There are about 15 regular fishers and residents estimated that about 60% of the community relied on fishing for some part of their income. Fishing, construction work and tourism were given as the main sources of income but unemployment and underemployment were reported as being relatively high.

HAGUE:

This residential community lies approximately two miles WSW of the Greenfield site, on the road to Martha Brae. The community is centered on the Hague Housing Scheme, which comprises about 200 lower middle-income units. The community is a dormitory community of Falmouth on which it relies for nearly all social services. It is best known for its annual Agricultural Show, which in recent years has been trying to recover its former status as a showcase for agricultural produce in the western parishes.

There are two important manufacturing entities located in the community. The largest is Windmill Garment Manufacturers & King Pepper Products a food-processing establishment. However, employment in these companies is mainly drawn from the parish and not the community (the skilled labour required to sustain the productivity of the manufacturing entities is found lacking in the Hague Community.

Unemployment is not considered high, since most housing scheme residents are employed outside of the community. However there is a growing pool of unemployed youth, centered mainly on Hague Settlement, a once Operation Pride Project, which lies just Southwest of the housing scheme. This comprises a population of about 250 low-income residents in an upgraded squatter community.

The population of this community is an estimated 236 persons. The average size household is reported to be about 6 persons, and females are estimated to head 60% of these. Demographically, the profile of Hague is one of a relatively under serviced lower middle-income community, with pockets of low-income residences.

MARTHA BRAE:

Martha Brae is another dormitory residential community to Falmouth and lies about 6 miles southwest of the Project area. The community is historically significant and once the north coast highway is completed, the traveling time between the Project area and Martha Brae will be under 5 minutes. The historic Good Hope Estate, water wheel and rafting on the Martha Brae form part of the significance of this settlement.

The population of this community is about 1,000. The average size household is reported to be about 5 persons, and females are estimated to head 60% of households. Members report the population, to comprise mainly the middle aged and the very young. Most of the young adults commonly migrate to urban centres.

There are no important manufacturing entities located in the community and only a few small, sole proprietor service type businesses. Falmouth, Duncan's and Montego Bay are cited as the locations in which community members seek work. However, unemployment is reported to be high among the labouring class, which comprises mainly construction and domestic type skills and other hustling occupations.

FALMOUTH:

Falmouth is the parish capital, and as its administrative and commercial centre it will probably be the community most positively involved with the Greenfield project despite its "geographical distance" from the site.

The population of Falmouth was 8,188 at the time of the 2001 Census. Between 1991 and 2001 its population had grown by only 1.85 %. This compares with a 51 % change in the population of Ocho Rios over the same period and a 13% change in the population of Montego Bay. Growth in population, even allowing for the redefinition of some boundaries, must be viewed as relatively slow, when compared with Jamaica's overall rate of growth of 5%. It is likely that population growth will increase more rapidly with increased tourism development.

It is an important market centre for produce distributed throughout the parish, and as earlier mentioned is the administrative capital of the parish. Employment covers the full spectrum of large town occupations. Tourism though present is not the main source of its revenues, since most tourist traffic transits the town on the way to Ocho Rios or Montego Bay. With the completion of the Highway, which bypasses the town, this trend is likely to be intensified.

The Greenfield project is likely to draw on the pool of construction, administrative, technical and managerial resources that are associated with any large town of this size, if not for its full needs, certainly for some proportion of it.

4.8.3 INFRASTRUCTURE

Water Supply

Water is supplied to the Greenfield area and surrounding communities by National Water Commission (NWC); the service is regarded as adequate. Most dwellings are metered. Trelawny is regarded as having more than adequate water resources. These resources exist in the Martha Brae River Basin, from which the parish satisfies its needs but also exports water. The following figures are based on the 1990 Master Plan of the Water Resources Authority of Jamaica.

Table 4.8.3: Water Availability Martha Brae Basin MCM/Year

Martha Brae River Basin	Supply: Average Yield	Supply: Reliable or Safe Yield	Consumption:	Unused: Reliable or Safe Yield
Surface Water	279.4	19.7	1.4	18.3
Ground Water	202.1	150.6	22.6	128.0
Total	481.5	170.3	24.0	146.3

The NWC maintains two main treatment plants. Treatment Plant #1 (as it is referred to) is located on the Martha Brae to Perth Town Road. It is responsible for supplying treated water from Coopers Pen in the East to Wiltshire in the West (near Greenwood in St. James). The Project will be supplied from this plant.

In recognition of the tourism development that has taken place and is planned for the Parish. Treatment Plant # 1 at Martha Brae is to be refurbished to restore it to its design

capacity of 6M gallons per day. Up from the roughly 4M gallons that it can treat currently. Upon completion, it is expected that the 3M gallons currently exported to St. James will continue, and the remaining 3M gallons will serve increased demand eastwards to Braco. Treatment Plant #2 located just west of Falmouth, currently exports most of its water to St. James.

However, the larger hotel properties neighbouring the Greenfield area, report problems with inconsistent water pressure. Starfish had to resort to putting in a tank to maintain a dependable supply. This is obviously a distribution problem, which the refurbishing of the treatment plant and associated pumping works is designed to alleviate.

Solid and Sewage Waste Disposal

Garbage collection in most of the communities is undertaken regularly by Western Parks & Markets. Hague Settlement reported that irregular scheduling led to frequent burning by residents.

Sanitary conveniences are mainly a combination of pit latrines and flush toilets shared between households, although none of the residents in the communities felt that human waste was entering the lagoon or sea via gullies or waterways. Nevertheless, the low water table characteristic of the coastal strip serving the Project, along with the contribution of the Martha Brae River, means that faecal content is reaching the sea. In Coopers Pen, for example, the juxtaposition of the squatter community which slopes towards the sea, the decaying wetlands and the degraded algae covered fringing reef as reported by the fishermen, suggests the impacts of nutrient loading of that bay.

In Rock where 100% of toilet facilities run to pits, the degraded wetlands bordering the area, which might otherwise have offered some filtration, suggests that the marine ecosystems are being polluted.

There is one sewage treatment plant in Falmouth, which was built to serve Falmouth Gardens (a housing scheme of about 150 units) but to which the hospital and food market

have also been connected. The remainder of the town uses flush toilets linked to run-off pits. Again, because Falmouth itself is at sea level (some anecdotal reports place sections of the town below sea level), serving the town is an urgent public health priority.

Electricity

Electricity supply is considered adequate and available, although current proposals to have major new power consumers purchase their own transformers is likely to meet considerable resistance.

Telephone services

Telephone services particularly to large users such as the existing hotels, is considered very inadequate. Cable & Wireless appears unable or unwilling to provide the level of service.

4.8.4 Civic Amenities

Health Facilities

The nearest health facilities available to the communities are in Falmouth, where a Type C Hospital is located. Falmouth also has a Type 4 Health Clinic, which is considered adequate for serving the needs in this area. Falmouth has the only fire station in the parish and this station has only one unit.

Fire Services

Fire services must be considered totally inadequate in the event of a significant occurrence, not to mention a multiple event. Considering Falmouth's heritage assets, this situation is deplorable. However, because of pending tourism and sports developments in the parish, plans are underway for a new station in Falmouth. With respect to both police and postal services for the communities, these are centred in Falmouth.

4.8.5 Developments Underway

The Northern Coastal corridor indicated in Section 44 has several major developments planned or underway. In addition, the US$20M-US$35M development for Greenfield is to be on approximately 40 acres. This development may also facilitate other sporting activities that are community based. The communities are aware of the development but not in detail.

Segment 2 of the Northern Coastal Improvement Project, Montego Bay to Ocho Rios Highway is nearing completion. It is expected that the highway will reduce the distance in time between the major town centres. This will in essence promote the growth of tourism and other business ventures along the corridor.

The Rose Hall Estates Condominiums, new hotels, a convention centre and sewage treatment facility are planned, there is a current PRIDE project underway at Cave Island, south and east of the Hague Housing Scheme. When completed it will provide just under 400 upgraded lots. To date it has handed over 286 titles. This initiative will contribute to upgrading housing conditions in the wider Project area.

Infrastructure planning with respect to housing opportunities and support services are outside the scope of the Greenfield project, but the Parish Council and relevant national development agencies should be seeking to address projected demand. Although the Greenfield Project may not be a direct pull factor for the influx of migrants, due to the temporal nature of activities at the stadium the development will spur other developments and engender perceived opportunities that will attract migrants.

The Oyster Bay Hotel Resort and the flagship Harmony Cove Developments north east of Duncans and other planned resort developments and attractions are major undertakings close to Greenfield that will play a major role in boosting the economic growth of the corridor and will enhance the existing tourism products within and the wider Jamaica.

5.0 POTENTIAL IMPACTS, CUMULATIVE IMPACTS AND MITIGATION MEASURES

This section of the EIA report identifies the potential impacts, including cumulative impacts, and suggested mitigation measures, as related to the proposed development of the Trelawny Stadium. Impacts have been identified for construction and operation phases and where necessary as significant positive or negative impacts. Mitigation measures have been proposed to minimize potential negative impacts. Tables 5.1 and 5.2 summarize the impacts and mitigation measures. Positive Impacts are presented in Section 6.0.

5.1 Natural Environment

5.1.1 Physical Aspects

Potential impacts on the physical aspects of the natural environment relate mainly to the potential for flooding if the dry gully, as a natural drainage line, is not kept open. A drainage plan should be prepared by the developers for approval by the National Works Agency.

Earth movement activities and stockpiles of fine materials during the construction phase may generate excessive levels of fugitive dust, particularly under dry and windy conditions. Respirable particulates are a public health hazard and may otherwise create considerable nuisances to the public. However, impacts related to increased generation of dust and noise, during the construction phase are expected to be short term impacts and should not be significant, since no issues related to noise or dust currently pertain.

5.1.2 Biological Aspects

Populations of birds are not expected to be impacted by the development as no significant numbers were observed on the site. The land has been cleared and is dominated by new growth scrubland. Bird populations would remain in the dry limestone woodland

surrounding the project site. A few large trees on the site (particularly the Red Birch) may attract some species of birds for feeding.

5.2 Socioeconomic Environment

5.2.1 Landuse

Montego Bay has a vibrant tourist community surrounded by slums and squatter/informal communities which have mushroomed over time to meet demand for housing. Ocho Rios has also experienced phenomenal growth in informal settlements. Tourism developments in northern Trelawny are experiencing steady growth in size and numbers. Projection of commercial and residential growth suggests that developments in north Trelawny may face similar impacts if not controlled.

Many persons desiring land may purchase or squat in surrounding communities which occupy strategic locations. They offer excellent views of the plains of northern Trelawny and communities such as Samuels Prospect, Stewart Castle and Spicy Hill may attract upper and middle class residents who are employed by coastal developers.

It is important to note that the numerous developments existing and proposed for Northern Trelawny is likely to transform the character of the entire parish. These developments can be viewed as engines of growth for population, employment and tourism enterprise. Parishes such as St. Ann and St. James have benefited from tourism growth, which has led to expansion in other sectors.

5.2.2 Transportation

The main mode of transport in the project area for the communities is public transportation via buses and public taxis. All communities are easily accessible due to the interconnectivity of the road network. The existing network in the parish is being enhanced by the development of the Northern Coastal Highway Improvement Project

(NCHiP) which will reduce distance in time between communities within the project's sphere of influence. Though this may be positive in some sense, greater accessibility to communities with low densities may attract squatters.

It is expected that vehicular traffic will increase considerably during peak periods for stadium. The road conditions are relatively the same throughout all the communities. The design and location of access routes leading to and from the site must be carefully planned to facilitate peak flow. Most importantly, the design and location of parking facilities should not induce traffic congestion on the North Coast Highway.

Continued and increased traffic throughout some communities will inevitably change or distort the characteristics of the community and also create nuisances for residents. Some residents will "welcome the change" as the thoroughfare may create avenues for increased entrepreneurship.

Many of the communities lack recreational facilities and the children resort to playing in the streets or on pockets of vacant land throughout their communities. Although such practices are not encouraged and should not be accommodated, increased traffic through the communities may pose a safety hazard to residents unless alternatives are provided.

5.2.3 Housing

The new Cricket Stadium that is proposed for completion by 2007 will adversely affect some communities and bring benefit to others. Communities such as Rock perceive a threat from squatting and overcrowding by migrants. The majority of these new settlers will not be hotel workers seeking accommodation, but persons seeking income-earning opportunities associated with major tourism infrastructure, such sale of craft items and other entrepreneurship ventures.

An indirect but real threat that the development of the Greenfield site poses for many communities is the risk of outside settlers further burdening the inadequate housing and

social infrastructure in the communities. These communities lack adequate infrastructure to supply the needs of existing residents and massive increase in population numbers will only magnify the problem. For instance the Zion community is a large and growing squatter community lying just west of the Martha Brae community, which is in close proximity to the Greenfield site.

The challenge posed by the squatting phenomenon is that it continues to develop alongside and then often outpaces the low income housing solutions provided by governmental agencies in response to demand. The resulting unplanned sprawl destroys the physical environment and this in turn compromises the sustainability of the existing and future developments.

The negative impacts mentioned above in regards to housing are lingering long-term effects that affect the communities, and some communities have taken positive proactive measures to protect their community. For example, Rock being closest to the Greenfield Site has already had several discussions, under the leadership of the Rock Citizens Association and the Parish Councilor of the division on strategies for resisting the anticipated incursions of squatting.

The demand for housing solutions along the entire north coast and the northern coast of Trelawny in particular will increase persons who might elect to squat on prime land and seek ownership at a later date, given the awareness of numerous projects underway. Some residents have begun designing their homes to accommodate people in need of housing. Others are anticipating the demand for land and are prepared to sell their property.

5.2.4 Employment

It is projected that the Stadium development will increase employment opportunities in the parish. Direct and indirect opportunities will be expected to occur for both skilled and unskilled labourers.

The mainly small size and demographic profile of the communities investigated suggests that a large visitor attraction will bring positive impacts. In turn their proximity as a labour source and their offering in micro-enterprise services to visitors may benefit the project though on a small scale.

Community members view the proposed development for the Greenfield site as a potentially important contributor to the development of the community. It was also felt that the community had the vision and capability of preparing itself to offer various visitor attractions to the surrounding hotels and enhance the interest of persons in light of the proposed stadium. Entertainment, rafting tours and restaurants were seen as the main vehicles for offering this. In essence the residents are aware that the employment generated for the majority will not be site specific.

In some instances, larger attractions such as Martha Brae rafting will be a focal point of this exchange. Other communities will reap benefit from the thoroughfares through their community. For some there is potential for the development of craft shops, food stalls and other ventures along the transportation routes to and from the Greenfield site.

Although it is being emphasized that the Greenfield site offers limited direct project employment, it can be seen as a nucleus for the development and promotion of other attractions in and around the sporting facility.

"A 30,000 - 35,000 seat complex developed for the Cricket World Cup 2007 can easily be converted for the popular sport of football, which gives the JFF another option when hosting international games. Traditionally, the western belt provides phenomenal support for football at the school, club, and international level", (Article written by Paulton Gordon: Jamaica Observer December 24, 2003).

Lying east of the community, are a number of hospitality properties, the best known of these being Fisherman's Inn and Glistening Waters. These properties offer visitors a mixture of accommodation, boating and fishing, and dining. These properties are expected to benefit directly from development.

Two HEART programs are offered in Falmouth. HEART VTC offers training in construction and hospitality skills. They graduate approximately 150 students per year. The Kelly Lawson Skill Training Center offers training in other hospitality skills. It graduates about 60 students annually. Both institutions should serve as a source of trained workers for the construction and operational phases of the project.

5.2.5 Heritage

It is anticipated that the heritage assets within the surrounding communities will be developed to add to the menu of attractions in Trelawny. Greenfield should serve as a catalyst. There are no listed heritage sites located within the area of the property proposed for development.

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

Environmental Aspect	Potential Impacts	Mitigation Measures
Hydrology and Drainage	***Site Preparation & Construction*** Paving of open green space will reduce percolation and may increase surface run off following rainfall events. This is a permanent irreversible impact which could be potentially negative.	1. Storm water drains will be designed to prevent ponding and flooding of the property as well as sheet flow across the site. 2. All existing drainage lines, and specifically the dry gully, must be kept open with no obstructions built within these lines. Culverts and drains should be designed to channel surface run-off into existing drainage lines. 3. A drainage plan should be prepared for submission the National Woks Agency for approval (Cost to be determined). **These mitigation measures are the responsibility of the developer.** ***Operation Phase*** During the operation phase the mitigation measures incorporated in the engineering design should prevent problems of ponding, and facilitate surface run-off. Scheduled inspections and maintenance of drainage channels is critical.

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

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

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

Environmental Aspect	Potential Impacts	Mitigation Measures
	Health and safety aspects must be considered with respect to workers during both the Construction and the Operation Phases.	
	Operation Phase	
	During the operation phase the mitigation measures incorporated in the engineering design should prevent flooding or ponding on the site and surroundings. Hurricane force winds can affect utility lines.	Appropriate design will minimize damage to structures. Utility lines should be buried as far as possible. 1. An Evacuation Plan must be developed in the event of fire, earthquake or other similar hazard. 2. Adequate Entrance / Exit facilities must be maintained. 3. An Emergency Vehicle Entrance / Exit must also be available for use by ambulance, police or fire vehicles.

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

Environmental Aspect	Potential Impacts	Mitigation Measures
Air Quality	***Site Preparation and Construction Phase*** Movement of trucks and heavy-duty equipment to and from the project area, as well as construction work and stockpiling of earth material, will contribute to dust emissions. Construction activities will also result in the removal of vegetation that will expose and loosen soil which can become airborne with medium to strong winds. This would add fugitive dust to the area, which is already dust prone because of previous land clearance. The transport of aggregate for road and drainage culvert construction will also contribute to the fugitive dust levels. Construction vehicles will emit air contaminants such as nitrogen and sulphur oxides as well as particulates. ***Operation Phase***	1. Watering of un-vegetated areas and stripped road surfaces along which construction vehicles and trucks travel will control dust emissions by up to 70%. A full-time watering truck should be maintained on site for watering road surfaces as needed to minimize fugitive dust emissions. Over-saturated conditions, which would cause outgoing trucks to track mud onto public streets, should be avoided. Watering would not be necessary on days when rainfall exceeds 2.5 mm (0.01 inch). 2. Stock piling of earth materials for construction should be carried out within temporarily constructed enclosures to limit fugitive dust. Vehicles transporting earth materials should be covered *en route.* Mixing equipment should be sealed properly and vibrating equipment should be equipped with dust removing devices. Stockpiles of fines should be covered on windy days. 3. A monitoring program for dust is recommended to

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

Environmental Aspect	Potential Impacts	Mitigation Measures
	The main air impacts during the operational phase will be from vehicular emissions. These are not expected to be high as vehicles will be entering the facility to park. There are currently no vehicular emissions standards for Jamaica. However, vegetative buffers which are proposed for the development will help to reduce negative impacts of vehicular emissions within the development area.	assess the effectiveness of control measures in meeting ambient air quality standards. 4. Provide dust masks and ear muffs to operators in order to protect them from dust impacts. **The above mitigation measures are the ultimate responsibility of the developer, working with contractors and subcontractors.**

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

Environmental Aspect	Potential Impacts	Mitigation Measures
Noise	*Site Preparation and Construction Phase* The noise level is expected to increase during site preparation and construction with the use of heavy machinery and earth moving equipment.	***Site Preparation and Construction Phase*** 1. Although not expected to create a significant negative impact, noise impacting on the existing components of the development from construction activities can be minimized by limiting noisy construction activities to the hours between 7 am and 6 pm, where any construction activities may be in close proximity to residential areas. Construction machinery and vehicles should be serviced at regular intervals in order to keep noise to a minimum. 2. A monitoring programme to include noise measurements should be implemented. ***Operation Phase*** 3. The use of vegetative barriers can significantly reduce roadside noise. **Responsibility of the developer as determined.**

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

Environmental Aspect	Potential Impacts	Mitigation Measures
Coastal Water Quality	***Construction Phase*** No major construction phase impacts are anticipated on coastal water quality. ***Operation Phase*** The most important indirect impacts relate to increased nutrient loading in the coastal environment from the potential use of fertilisers on the grounds. Runoff from parking areas may also transport oil and grease to Oyster Bay.	1. Provision of portable chemical toilets at all work sites, with appropriate sanitary arrangements for disposal of the contents. 2. Oil and grease which may be generated from construction equipment should not be allowed to run overland, where it may eventually be washed into the sea. All oil and grease should be properly stored and disposed of, off site, to prevent washdown in terrestrial run-off during rainfall events. **The above mitigation measures are the ultimate responsibility of the developer, working with contractors and subcontractors.** 3. Durng the operation phase the approved sewage treatment and disposal system should prevent disposal of untreated sewage effluent to the coatal waters. 4. Engineering considerations should take into account peak periods for the stadium.

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

Environmental Aspect	Potential Impacts	Mitigation Measures
		5. The services of a reliable, certified contractor must be engaged for the timely and efficient removal of solid waste to an approved site. Collection bins must be adequate in number and appropriately spaced throughout the site. **These mitigation measures are the responsibility of the management entity for the development.**

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

Environmental Aspect	Potential Impacts	Mitigation Measures
Vegetation	***Site Preparation and Construction Phase*** Site preparation and construction activities will remove several acres of grassy scrubland vegetation.. Vegetation will have to be cleared. However, the existing vegetation is mostly scrubland with a few mature trees. Loss of vegetation will also increase surface run-off and sheet flow after heavy rainfall events. Percolation into the limestone can be increased with the removal of vegetation. Isolated trees are on the property and the predominant bird habitats are not on the project site but in the woodland surrounding the project site.	1. Landscaping should replace vegetative cover and add to airshed purification functions. 2. Selection of plants for landscaping should consider the following: habitat suitability, feeding trees, trees of national interest, flowering trees and shrubs. 3. Clearance of vegetation should be done in accordance with the Terms and Conditions specified in any permit from NEPA. 4. Any trees recommended by NEPA to be retained should be 'red-flagged' to alert contractors. 5. Construction monitoring is recommended. 6. Vegetation planted for landscaping buffers and for aesthetic appeal should be maintained, and a maintenance programme should be established and implemented. The requirement for construction monitoring and the establishment of Permit Conditions are **the responsibility of NEPA.** Other mitigation measures are ultimately **the responsibility of the**

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

Environmental Aspect	Potential Impacts	Mitigation Measures
		developer and any **contractors** or **subcontractors.**
Birds	***Site Preparation and Construction*** The site is not heavily vegetated, and is mostly open scrubland, previously cleared. Any birds currently utilising the site will likely relocate to the surrounding dry limestone forest and adjacent open areas.	1. Landscaping and vegetation buffers, will result in the replacement of some habitat for selected species. 2. Selective vegetation clearance could be exercised, as appropriate to the footprint of the development, to ensure that some feeding trees are retained, to encourage bird populations. These mitigation measures are the **responsibility of the developer and the design engineers.**

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

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

ENVIRONMENTAL ASPECT	POTENTIAL IMPACTS	MITIGATION MEASURES
	Operation Phase Disruption to traffic is not anticipated during the operation phase. Exit ramps from the main road to access both sides of the property should be considered.	4. Discussion should be had with the National Works Agency regarding the provision of underpasses and exit ramps. 5. Provision should be made for handling peak flows. ***The mitigation measures are the responsibility of the developer and the contractors in consultation with the National Works Agency***

ENVIRONMENTAL ASPECT	POTENTIAL IMPACTS	MITIGATION MEASURES
Business Enterprises	C***onstruction and Operational Phases*** No business enterprises will be disrupted since any construction or post construction access roads travel the parochial road that skirts the Rock Community.	The TCPA through Parish Council should enforce planning regulations regarding opportunistic enterprise in the vicinity of the development.
Employment	***Site Preparation, Construction and Operational Phases*** Employment opportunities will be created during the site preparation and construction phases. Large numbers of both skilled and unskilled labour will be required for the duration of the construction activities. Additionally, economic opportunities will involve the sourcing of construction material and linkages created with local and regional suppliers and industries.	1. Both skilled and casual labour will find employment and this is expected to be a positive impact for surrounding communities. 2. Workers should be briefed on traffic management, solid and liquid waste disposal, dust management, parking, idling of equipment and oil spill control 3. The "politicization" of employment opportunities often poses some challenge to contractors, and the need for security and relevant dialogue have to be factored

ENVIRONMENTAL ASPECT	POTENTIAL IMPACTS	MITIGATION MEASURES
		into construction planning 4. HEART and other skills training institutions can be consulted as a source for required skills. ***The mitigation measures are the responsibility of the developer or contractor.***
Solid Waste Management	***Site Preparation and Construction Phase*** Solid waste generated from the site preparation and construction activities will include construction debris, vegetation, and solid waste generated at the construction camp.	1. Construction sites generate considerable waste and provision must be made for suitable separation and storage of waste in designated and labelled areas throughout the site and the site camp. 2. Collection of waste by certified contractors and disposal at an approved site, as recommended and approved by the National Solid Waste Management Authority. Site closest to Falmouth area is the Retirement Site in St. James.

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

ENVIRONMENTAL ASPECT	POTENTIAL IMPACTS	MITIGATION MEASURES
		The mitigation measures are the responsibility of the developer.
Proposed Developments	Many large developments are proposed within the surrounding area of Greenfield. These include the Oyster Bay Resort Development at Florida/Bush Cay, and the Harmony Cove Resort Development, in Trelawny, as well as the Bahia Hotel at Pear Tree Bottom and the Royal Georgian Resort, Spa and Golf Course in St. Ann.	***1.*** Cumulative impacts related to traffic management may occur if construction schedules overlap. The mitigation measures as described under traffic management would need to be applied by other developers. ***The mitigation measures are the responsibility of the developer***

ENVIRONMENTAL ASPECT	POTENTIAL IMPACTS	MITIGATION MEASURES
Public Health and Safety	***Site Preparation and Construction Phase*** Site preparation and construction will involve transportation and storage of significant volumes of construction material, and proper disposal of construction spoil and any hazardous waste. Increased human activity in the areas could result in an increase in the demands on an already diminished Fire Services Department. Operational phase activities will need to be supported by an emergency evacuation procedure (for fire and earthquake) and take into account peak flow traffic, potential accidents and increased sewage discharge.	1. To minimize risk to the public the construction activities, which will directly affect the movement of traffic and pedestrians, should be properly scheduled and standard construction techniques for sign posting and flagging should be adhered to. 2. Dust control be wetting is essential. 3. Unnecessary idling of construction related vehicles should be discouraged 4. Proper sign posting of speed limits and entrances and exits. 5. Discussions should be held with the relevant authorities regarding facilities for fire protection and health and safety. ***These mitigation measures are the responsibility of the developer.***

ENVIRONMENTAL ASPECT	POTENTIAL IMPACTS	MITIGATION MEASURES
Sewage Treatment	***Operation Phase*** The development proposes in excess of 25,000 patrons at full capacity. Sewage that is untreated or poorly treated contains high levels of nutrients that can cause the contamination of ground water systems.	1. Raw sewage must not be pumped into the sea. 2. NEPA Sewage Irrigation Standards must be met for sewage effluent if treated effluent is to be used for irrigation of the grounds. 3. A license for sewage treatment must be applied for. 4. Engineering design for the septic tank must have capacity for peak events. 5. Engineering plans for septic tank are under preparation. ***The mitigation measures are the responsibility of the developer.***

ENVIRONMENTAL ASPECT	POTENTIAL IMPACTS	MITIGATION MEASURES
UTILITIES	***Construction and Operation Phase*** 1. Increased demand on water supply	1. Discussions should be held with the National Water Commission regarding the supply of potable water, with peak period demands discussed. ***The mitigation measures are the responsibility of the developer in consultation with the National Water Commission.***

5.3 Cumulative Impacts

In addition to the potential site specific impacts on the natural and socio-economic environments, cumulative impacts have also been identified for the area. These are given in Table 5.3.

TABLE 5.3: SOCIAL ENVIRONMENT – CUMULATIVE IMPACTS FOR GREENFIELD AND THE SURROUNDING COMMUNITIES

LAND USE	**Change of Use**
	• Northern Trelawny is experiencing a boost in tourism along the coastal corridor. It is projected that the expansion of tourism will gradually change the social and economic character of the entire parish as heritage attractions and other developments are added to the product. • The interrelation between the Stadium, communities and hotels will contribute to the cumulative economic and social enhancement of the parish.
	Sprawl of Existing Communities
	• Northern Trelawny shows evidence of sprawl. Uncontrolled growth will exceed the carrying capacity of the infrastructure.
TRANSPOR-TATION	**Accessibility**
	• The existing road networks in the parish of Trelawny are being enhanced by the improvement of the North Coast Highway. Lands that were deemed unsuitable for development now have value because of improved accessibility. Most of the communities in close proximity to Greenfield are easily accessible due to the interconnectivity of the existing road networks, which is further

	enhanced by the highway, which reduces the travel distance in time. In some respects, greater accessibility poses a threat to some communities. Communities with low densities may attract squatters seeking an advantageous proximity to Greenfield and other developments. • The new and improved road network will bring positive impacts to the Greenfield development. The stadium will be built in compliance with international standards, and the events are expected to occur all year round. The strategic and highly functional road network endorsing the location of the stadium making it easier to commute persons to and from the site without adversely impacting the synergy of the transportation system.
	Implications of Air Traffic during Peak
	The existing transportation system will allow for easy transfer of air passengers from the Sangster International Airport to the places of hotel accommodation and land transport to the Greenfield Site.
	Implications of Land Traffic during Peak
	• The design and location of access routes leading to and from the Greenfield Site must be carefully planned so as to avoid potential threat of 'bottle necks' leading from the major hotel developments to the Greenfield Site during the peak of World Cup Cricket 2007 and other international sport events. Potential travel routes of congestion begin in Montego Bay and Ocho Rios. These two major resort towns are densely populated and a major influx of vehicular traffic is expected from these zones. The aim is to reduce the time spent in accessing the site but more importantly, restricting traffic congestion along the highway. • Some communities will experience traffic congestion as they

	serve as thoroughfares for traffic leading to various destination points (Greenfield will become one of those attractions). Continued traffic congestion threatens the layout and functionality of communities and may promote migration, deterioration of roads and a lack of privacy to residents. Some communities however will benefit from a thoroughfare, as it will create avenues for increased income-generation. The sporting activities ongoing at the Greenfield site will be continuous throughout the year. People strategically located along the travel corridor will benefit from income generation, whether directly or indirectly. • The NWA has simulation software that creates a virtual animation of the flow of traffic. The simulation would clearly indicate sections of the road network prone to congestion. The simulation can then be manipulated to create the most suitable network design or alternate routes encouraging the steady flow of traffic; the corrective design in then implemented. With the developments taking place along the north coast, monitoring of the road network is necessary to maintain a viable transportation system.
HOUSING	**Housing Demand and Supply**
	• The demand for housing along the northern coast of Trelawny is an indicator of future housing developments that will be spurred due to the continuous and rapid growth of tourism developments.
	Squatting and Overcrowding
	• Large developments drive the expansion of existing low-income communities making them geographically closer to the development and in some cases spawn new squatting communities. The survey revealed that these communities lack adequate infrastructure to supply the needs of existing residents. Massive increase in the

	community will stimulate overcrowding, as the community cannot manage or adequately serve the influx of persons.

Water	
	• Trelawny is the second smallest parish in the country with an installed water distribution capacity of 80 mega litres per day (source NWC). The parish is using a considerably minute proportion of the full water capacity. There is, however, inadequate transfer facilities to sections of the parish resulting in these areas being poorly served; this is especially so in southern Trelawny. There are 19 water sources used by the NWC – 9 wells, 6 springs and 4 rivers. These sources supply 25 systems of varying sizes. The Martha Brae Water Treatment Plant is a major facility in the parish. However it primarily serves sections of the tourism area in St. James, producing some 6mgd (26MLD). • The communities are supplied by NWC and in each community the service is regarded as adequate. Most dwellings are metered. Trelawny is regarded as having more than adequate water resources. These resources exist in the Martha Brae River Basin, from which the parish satisfies its needs but also exports water. • The NWC maintains two main treatment plants. Treatment Plant #1 (as it refers to) is located on the Martha Brae to Perth Town Road. It is responsible for supplying treated water from Coopers Pen in the east to Wiltshire in the west (near Greenwood in St. James). Any NWC water supplying Greenfield will be from this plant. • In recognition of the tourism development that has taken place and is planned for the parish. Treatment Plant #1 at Martha Brae is to be refurbished to restore it to its designed capacity of 6M gallons per day. Up from the roughly 4M gallons that it can treat

	currently. Upon completion, it is expected that the 3M gallons currently exported to St. James will continue, and the remaining 3M gallons will serve increased demand eastwards to Braco. Treatment Plant #2 is located just outside of Falmouth. Currently most of its water is exported to St. James. • The larger hotel properties neighbouring the Greenfield area, report problems with inconsistent water pressure. Starfish had to resort to putting in a tank to maintain a dependable supply. This is obviously a distribution problem, which the refurbishing of the treatment plant and associated pumping works is designed to alleviate.
SOLID WASTE	**Solid Waste Generation Disposal**
	• Peak activity at the Trelawny Stadium will result in an increase in the production of solid waste for collection and disposal by Western Parks and Markets.
SEWAGE WASTE	**Type of sewage waste disposal and adequacy during Peak**
	• Sanitary conveniences are mainly a combination of pit latrines and flush toilets shared between households. The low water table characteristic of the coastal strip serving the major hotel developments, along with the contribution of the Martha Brae River, suggests that fecal content is reaching the sea. • In Rock 100% of the toilet facilities run to pits. This is most likely contributing to the pollution of marine ecosystems in the bay. • Sewage treatment for the proposed Trelawny Stadium must take into account peak periods and off-peak periods.

ELECTRICITY	**Demand and Supply**
	JPSCo. Will be providing electricity to the new facility during peak and off-peak periods.
EMERGENCY ACTION	**Hazard Vulnerability**
	The nearest health facilities available to the communities are in Falmouth, where a Type C Hospital is located. Falmouth also has a Type 4 Health Clinic, which is considered adequate for serving the needs in this area. Falmouth has the only fire station in the parish and this station has only one unit. Fire services must be considered totally inadequate in the event of a significant occurrence, or a multiple event. Considering Falmouth's heritage assets, and the potential for growth in light of several proposed developments, this situation is considered inadequate. However, because of pending tourism and sports developments in the parish, plans are underway for a new station in Falmouth. With respect to both police and postal services for the communities, these are centered in Falmouth. Special consideration must be given to emergency management during events.
EMPLOYMENT	**Outward and Inward Migration in the Parish**
	• Outward and inward migrations throughout the parish, as persons aim at accessing employment opportunities. • Sustainable development however, is unlikely to parallel the population growth for several reasons. The population characteristics described above, if they do not change, will mean that the labour force will remain marginalized within the labouring, artisan, and domestic and hustling type occupations. (Expand this section)

	Limitations and Benefits
	• Direct and indirect employment opportunities will occur.
COMMUNITY DEVELOPMENT	**Existing and Potential Sports Development in the Communities**
	• Presently the Elleson Wakeland Community Centre located in Falmouth facilitates basketball, cricket and football. Football is the main sport played at the facility. There are pending developments such as the Bounty Hall Community Centre and the basketball court to be constructed at the Albert Town High School. • The Greenfield development, will inevitably spur the development of other local sport facilities, as large developments are usually surrounded by similar connecting developments. It is not projected that the Trelawny Stadium at Greenfield will be open to the agenda of local events. The stadium will be used all year round to host international games and is essentially for the promotion of sport tourism. The local communities may however have access (paid entry or booking) to the facility but not exclusively or on a regular basis. Communities will therefore support their own sport events. This will encourage the development of local facilities within communities.
	Community Tourism
	• In some instances, larger attractions such as Martha Brae rafting will be a focal point of this exchange of indirect benefits from the international events at the stadium. Other communities will benefit from the thoroughfares through their community. For some there is potential for the development of craft shops, food stalls and other ventures along the transportation routes to and from the Greenfield Site.

	• The community members of Rock were not as vocal in their concern for the protection of the natural flora and fauna found on the site. They regard the development proposed for the Greenfield site as harmonious to the surrounding environment, seeing that the Project promotes large green spaces. • Lying east of the community, are a number of hospitality properties, the best known of these being Fisherman's Inn and Glistening Waters. These properties offer visitors a mixture of accommodation, boating, fishing and dining. Therefore properties of such are expected to benefit from developments in and around them.
	Community Response
	• The Rock Community being closest to the Greenfield Site has already had several discussions, under the leadership of the Rock Citizens Association and the Parish Councillor of the division on strategies for resisting the anticipated incursions of squatting. • As mentioned earlier some residents welcome the rapid growth of tourism developments in the parish and are ready to sell their property persons seeking land for commercial or residential use. • Many residents have begun entrepreneurial ventures to benefit from existing and future developments.

5.4 Mitigation Measures for Cumulative Impacts

5.4.1 LAND USE

Change of Use:

The Zoning Regulations for Northern Trelawny should be reviewed and the necessary changes made to ensure the compatibility of land uses. The rapid growth of hotel developments in the parish require consistent monitoring of the adherence to existing regulatory laws and new regulations can be imposed to control developments that do not fall under the jurisdiction of the law. The Parish Council should carry out the monitoring of zoning regulations to maintain the compatibility of land uses.

Sprawl of Communities:

The creation of buffer zones or green spaces is also a part of protecting the zonal integrity of the parish. Buffer zones and strategic green spaces will contribute to the management of sprawl in town centers and communities. Penalties should be incurred for the avoidance of zoning regulations and development orders.

5.4.2 Transportation

Accessibility:

The existing transportation network is undergoing improvement brought about by the Highway 2000 entourage. This development is driving the expansion and development of roads throughout the network. Subdivision application of lands for development should provide clear and concise layouts of access and egress routes. The access and egress of the Greenfield development should not dissolve the symmetry of mobility along the corridor.

Implications of Traffic Congestion:

The improved transportation network is expected to reduce the travel time in distance from one point to the next. One potential issue that must be addressed is the influx of travelers from overseas for the World Cup Cricket events that is expected to take place at

Greenfield and Sabina Park respectively. The mode of transport for these travelers should be carefully planned. Many visitors will travel before the commencement of the events however it is anticipated that many visitors will return overseas immediately after the event. The movement of travelers whether through the airports (Alfred Sangster International or Norman Manley International) or intra-island can be adversely impacted if 'bottle necks' and traffic congestion retards the efficiency of the transportation network.

The Transport Authority in collaboration with the Jamaica Urban Transit Company (JUTC) in Kingston monitors the operation of public transit throughout the city. There will be a greater need for monitoring during peak events as commuters may experience delay in travel time because of traffic congestion. Traffic congestion will be prevalent during peak events at Sabina Park and proactive measures should be taken to relieve the congestion along travel routes. It is important to note that the World Cup Cricket event will be hosted by Greenfield and Sabina Park and the correlation of transporting visitors should be carefully organized, providing alternative routes to travelers not arriving at the stadium. It is anticipated that the Greenfield Stadium will generate traffic that will be relieved via access routes to the site parallel the North Coast Highway.

The Jamaica Constabulary Traffic Division in Kingston regulates traffic flow during peak events at Sabina Park. Usually traffic not destined for the cricket stadium is diverted to alternative routes. The only concern for the traffic police during peak events is the availability and functionality of parking facilities. The Falmouth Police Station also has a Traffic Division that assists in regulating traffic flow along transportation routes. The Greenfield Stadium will require monitoring of traffic flow during peak events and the division can provide assistance in maintaining symmetry along the travel corridor leading to and from the stadium. The aim is to reduce traffic congestion along sections of the North Coast Highway.

5.4.3 HOUSING

Housing Demand and Supply:

The Greenfield development will spur the indirect growth of other commercial entities that will in turn increase the demand for housing within the parish. In responding to housing needs suppliers should ensure that lands subdivided for housing have adequate infrastructure such as water, electricity, proper solid and sewage waste disposal. Other supporting amenities should be in proximity to the housing developments, such as schools, churches, health facilities.

Housing developments should be constructed in suitable locations that are not prone to flooding, landslides etc. Proper building codes should be adhered to for minimizing the impacts incurred by earthquakes, hurricanes and other natural hazards. The wastewater and sewage effluent from these housing developments should also be adequately disposed of in suitable locations.

Squatting and Overcrowding:

Squatting is prevalent in volatile areas especially those surrounded by economic developments and also those prone to economic developments. It is fair to say that squatting and overcrowding goes hand in hand. To reduce the effects of squatting and overcrowding, record keeping of land ownership in communities can contribute to the tracing and notification of trespassers. Strict penalties should be incurred to squatters who not only occupy privately owned land but also create a nuisance by conducting unsustainable practices on the land such as improper solid and sewage waste disposal.

Adaptive Reuse and Change of Use:

There is evidence of adaptive reuse in some communities as the physical structures of some historical buildings are being preserved but there is a change of use inside the buildings. To carry out a change of use of a building, an application must be made to the

relevant authority requesting approval. In regards to the expansion of an existing building, request for approval should be made to the Parish Council. All buildings including the development of the Greenfield Stadium should adhere to the provisions of the Development Order of the parish. The issuing of Stop Orders and Enforcement Notices is relevant for the dismissal of illegal building construction. Demolition of illegal buildings that pose a threat to the development is advised. There should also be a review of the existing Development Order to include areas of increased and potential growth of tourism development that is not covered by the Development Order that is expected to adversely affect the developments along the corridor.

5.4.4 Water Supply

The Greenfield Stadium will source water from one of two treatment plants maintained by the National Water Commission (NWC). It is expected that the Treatment Plant located at Martha Brae will supply the Stadium. This Treatment Plant has the capacity to adequately supply the Stadium with water as its current distribution for the parish is 4 million gallons and will be upgraded to 6 million gallons per day. The main demand for water by the Stadium will occur during peak sporting events where the Stadium will be filled to capacity.

5.4.5 Solid Waste Disposal

Western Parks and Markets conduct regular garbage collection throughout the parishes of Trelawny, St. James, Westmoreland and Hanover. The stadium will not require regular garbage collection, as it will only be used to host scheduled sport events.

Discussions should be made between the Developer for Greenfield and Manager of Western Parks and Market regarding the collection of solid waste generated at the stadium. The Construction Phase of the development will require regular collection of waste building materials and household waste generated by the construction workers and labourers.

The Operation Phase is a continuous phase that will require collection during and after peak events. The Developer should advise Western Parks and Markets concerning the anticipated volume of waste and provide the company with a scheduling of the events to allow for regulated and timely collection and transport of waste for disposal. Scheduling will be important so as not to disrupt existing collection for the surrounding communities.

The collectors must ensure that the storage of waste collected is enclosed to minimize pollution and nuisance for communities along the travel routes from the stadium to the Retirement Dumpsite located in Montego Bay. An alternate location for the disposal of solid waste during peaks is the Haddon Dumpsite located in Ocho Rios.

5.4.6 Sewage Disposal

The Developer should also ensure that provisions are made for the disposal of sewage waste generated by workers for the duration of the construction phase. This should be by means of portable chemical toilets (port-a-loos) supplied, maintained and collected by a certified contractor.

5.4.7 Employment

Training Opportunities:

Two HEART programs are offered in Falmouth. HEART VTC offers training in construction skills and hospitality skills. They graduate approximately 150 students per year. The Kelly Skill Training Center offers training in other hospitality skills. It graduates about 60 students annually. The institutions should provide an important if not adequate source of trained workers for the construction and operation phase of the project.

It is encouraged that developers train their staff to ensure efficiency and productivity, especially when workers are sourced from neighbouring communities. Workers from the vicinity are usually more cost efficient than outside workers. This may benefit the developer, as workers in close proximity are familiar with the characteristics of the area

and are more flexible than workers from outside who will need accommodation and socialization.

The training is also regarded as vital as workers should be sensitized to work in compliance with international standards during the sports events. The training should include the management of visitation during the peak of events.

5.4.8 Community Development

Public Awareness:

The sensitization of residents in neighbouring communities is an important step to reducing the outbreak of dissent due to the lack of awareness and involvement in the Trelawny Stadium project. As mentioned earlier the operational phase of the development will not require a large staff, and persons may sabotage the advancement of the development. It is anticipated that some persons will see the development as a threat to their livelihood, if there is a sense of detachment from the project. It is advised that the Developer has community meetings where possible to highlight the benefits of the project to the community and also offer opportunities that support the interrelation between the community and the development.

6.0 POSITIVE IMPACTS

Socio-economic Environment

The Trelawny Stadium will make a significant contribution to the sporting facilities in Jamaica and to the tourism product in Jamaica in terms of the provision of a world class stadium able to accommodate various sporting activities. Spin-off benefits during the World Cup Cricket in 2007 as well as subsequent events thereafter, should be felt by large and small resort facilities, restaurants, car rental companies, taxi / limousine services, shops, craft stalls and various attractions, particularly between Ocho Rios and Montego Bay. A controlled and well-designed development with the attendant infrastructure to facilitate positive environmental impact should be major impact of this proposed development.

During design, site preparation and construction employment will be generated for several categories of workers including engineers, casual labourers, skilled and unskilled workers, as well as suppliers of goods and services. During the operation phase supplies of good and services will be required.

The proposed stadium to host the World Cup Cricket 2007 has been brought to the public attention through the pint and electronic media. Public perception appears to indicate support for the new facility as it means an increase in job opportunities during both the construction and operation phases, the potential for improvement in living conditions over the long term, increase in tourism in the area, increase profile for Jamaica on the international sporting market.

7.0 CONSIDERATION OF ALTERNATIVES

7.1 Location

In Jamaica's bid to host matches for the World Cup Cricket 2007 the north coast was highlighted as a potential area for the development of additional facilities for hosting cricket. The land at Greenfield, already in the ownership of the Government of Jamaica (through the national Housing Trust) was identified and proposed, and was considered the best option sue to its proximity to proposed developments in the tourism marketplace. These developments included the harmony Cove Resort and Oyster Bay Resort Developments. No other north coast site was considered.

7.2 Design

The design for the Trelawny Stadium went out to tender as a Design and Build contract. Approximately ten expressions of interest were received, but only two bids were actually submitted. One was by an international entity and the other by an international company with offices in Jamaica for over thirty years. The recommendations of Jamaica Cricket 2007 ltd. were sent to the Contracts Commission, which accepted the recommendations before submission to Cabinet was approved.

Design was driven by the specification as determined by the International Cricket Council (ICC). Some amount of flexibility was requested in order to allow the facility to be suitable for use for other types of sporting events.

7.3 Capacity

The capacity for the Trelawny Stadium at 10,000 permanent seats with the capacity for 15,000 temporary seats is the minimum seating for package requirements for first round matches as set by the International Cricket Council.

8.0 OUTLINE EMERGENCY RESPONSE PLAN (ERP)

Panic is a common reaction when a disaster finds people crowded in an enclosed space. In some cases instructions given over a loudspeaker may calm persons down and reduce confusion.

Emergency Response Plans are designed to address a particular situation and need arising at a given location. All offer different challenges based on varying factors specific to their occupancy. The number of hours per day it is occupied, occupant load, building height security levels, building contents, and nature of activities are all examples of varying factors that must be taken into consideration when developing the Emergency Response Plan.

The size of the Trelawny Stadium at Greenfield, with respect to height and area, and the maximum seating capacity (permanent and temporary) will determine the complexity of the Emergency Plan. Preparation is the key to an effective response to any emergency.

An Emergency Response Plan should not be developed under the stress associated with an emergency that is already underway. Therefore planning, awareness training and periodic exercises introduced prior to an emergency are essential to improving building supervisory and occupant responses.

Services provided by local emergency responders are determined by the government that employs them. It is the responsibility of the developer and/or manager, along with professional assistance to determine the type of emergency plans needed for the Stadium and to assign staff or hire consultants to develop the Emergency Response Plan. It is also the responsibility of the developer to ensure public safety within the stadium in response to all types of risks and occurrences. Key steps in developing an Emergency Response Plan include the following:

Step 1:	Establish an Emergency Management Team and establish a link with Parish Disaster committee, Parish Disaster Coordinator
Step 2:	Analyze Risks and Response Capabilities
Step 3:	Develop the Emergency Response Plan
Step 4:	Prepare for the implementation of the plan through drills
Step 5:	Test, Evaluate and Modify the Plan

9.0 OUTLINE MONITORING PLAN

If a permit is granted for the proposed development, and before site preparation and construction activities begin, a Monitoring Plan should be prepared for submission to NEPA for their approval and implementation. The aim of the Monitoring Plan is to ensure the following:

- ✓ compliance with relevant legislation
- ✓ implementation of the mitigation measures provided
- ✓ conformance with any General or Specific Conditions as outlined in the permit
- ✓ long-term minimization of negative environmental impacts.

The Monitoring Plan should include the following components:

- Inspection protocol
- Parameters to be monitored, which should include
  - Ambient air quality
  - Perimeter noise
- Construction monitoring
  - Worker health and safety
  - Disposal of solid waste
  - Disposal of hazardous material
  - Disposal of sewage
- Materials handling and storage
- Covering of haulage vehicles
- Transportation of construction materials
- Deployment of flaggers
- Storage of fines and earth materials.

The duration of the monitoring plan should be for the entire construction period, with monthly reporting. Estimated cost of monthly monitoring is approximately US$ 2,200.

Implementation of mitigation measures

- To reduce airborne particulates
- To protect worker health and safety
- To protect public health and safety

The Monitoring Plan cannot be prepared before the permit is received from NEPA as Terms and Conditions of the permit must be taken into consideration.

10 CONCLUSIONS AND RECOMMENDATIONS

10.1 Natural Environment

Consideration must be given to the mitigation measures to prevent flooding on the site, and in particular to maintain the existing natural drainage feature on the site. Bird populations in the surrounding dry limestone woodland are not expected to be negatively impacted by the development and subsequent activities. Air quality considerations must be taken into account particularly during the construction phase when large quantities of fugitive dust may be generated. Sewage treatment options must be clearly identified and approved by NEPA in order to prevent contamination of the nearby coastal waters.

10.2 Socio-economic Environment

Corporate interests in tourism, export manufacturing and those who see sports, as a "fit" with their target markets would have an opportunity to get involved in a mega event while extending their visibility beyond 2007.

The twin issues of unmet housing needs and inadequate social infrastructure (both features of main tourism centers) are also reasons why growth may not translate into development. The rapid expansion of the very large unplanned communities of Flankers and Lilliput, among others, in the Montego Bay area, are partly attributable to growth in tourism without supporting infrastructure. The Greenfield project will probably result in an intensification of sub-standard housing in the surrounding communities. This outcome is not solely a consequence of the housing demand generated by direct project employment, but from job seeking emigrants and entrepreneurial skills attracted by the project. Both groups however, will gravitate towards unplanned residential accommodation wherever it exists or will construct it if it does not exist. This process is already at work in Coopers Pen to the east of the project site.

Proper planning for large projects require integrated solutions for skills upgrading, housing needs and social services for which these projects are catalysts. It is the

responsibility of the government to provide the planning solutions. It is in the interest of the project that these solutions are found. No requirements exist in law or planning codes for hotel developments to provide worker housing.

The alignment of the new highway now bypasses two communities, Coopers Pen and Rock although access is relatively easy. Vendors, fishers and other small entrepreneurial activities are feeling the impact of reduced traffic flows through the community. The project will present an opportunity to capitalize on their advantageous location along this 'strip' of coastline.

Regardless of the nature of the site, it is important to require skilled and qualified workers to minimize confusion and error. Unfortunately, if the residents are not equipped with the necessary training, they will not benefit from the limited and short-term employment the Greenfield project has to offer. More so, without proper training and suitable qualification, residents might not wholesomely benefit from the long-term indirect positive impacts that the project will create.

The Project should be creative in allowing opportunities to emerge for the interaction between communities and the site rather than creating an isolated environment. One strategy could be through its concessionaire arrangements by encouraging the carrying of local produce where necessary

Similarly several good local examples exist of pre-project manpower training needs assessments being followed by training programs that support community directed project employment opportunities. The project is encouraged to partake in the development of such outreach programs which will contribute to the prosperity of the development in the long-term

The developer must ensure that the parking facilities are strategically located to minimize traffic congestion at the access and egresses of the facility especially the main facility leading to and from the North Coast.

An Emergency Response Plan should be prepared to cover aspects related to emergency evacuation during fire, earthquake of other catastrophic event.

11.0 ENVIRONMENTAL QUALITY OBJECTIVES

Environmental Quality Objectives have been identified for the proposed development to highlight the following aspects:

Physical Environment

An integrated water management approach should be considered to facilitate consideration of water consumption, sewage disposal, recycling and reuse as part of water use efficiency and pollution prevention in the project area. It is expected that nutrient loading and the effects of eutrophication in coastal waters will be minimized and should be considered and Environmental Quality Objective.

Biological Environment

Landscaping and the retention of feeding tress for birds will provide aesthetic appeal and some habitat on the site, minimized and should be considered an Environmental Quality Objective.

Integrated Water Resource Management

The use of potable water, treatment of waste water and irrigation systems should be considered to encourage reuse and recycling, as detailed in the proposed sewage treatment facility.

Stormwater Run-off Control

Stormwater run-off must be controlled so as to prevent flooding and deposition of sand and gravel on the roadway. Runoff also has the potential to carry large volumes of sediment and agricultural chemicals (particularly fertilizers) to the coastal waters.

Energy Efficiency

Energy efficiency is essential to sustainable development and to operating cost management. The integration of energy efficient systems should be part of all aspects of the development.

Minimization of Pollution

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

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

Aesthetic Appeal

Landscaping attributes should be included to maintain aesthetic appeal within this coastal environment.

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APPENDICES

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APPENDIX I

BIRDS REPORTED FROM THE OYSTER BAY SITE AND THE MARTHA BRAE ESTUARY AREA
(Environmental Solutions Ltd. (2005) and Webber *et al* (1998)

Scientific Name	Common Name	Habitat	Range and Status
Caladris spp.	Sand Pipers	Several species common on mudflats and beaches, some uncommon winter visitors and transients	Several species throughout C. and S. America and the West Indies
Himantopus mexicanus	Common Stilts	Common resident in fresh and saline ponds	Bahamas, Greater Antilles, northern Lesser Antilles, N., C. and S. America. Large flocks of visitors and transients from N. America increase Jamaican populations in winter
Tachornis phoenicobia	Antillean Palm Swift	Lowlands, common near human habitations, over golf courses, dry swamps and canefields	Very common resident
Loxipasser anoxanthus	Yellow-shouldered Grassquit	Common in hills and mountains	Locally common resident, An endemic genus and species
Tyrannus dominicensis	Gray Kingbird	Open wooded areas, cultivations and gardens	North America, Bahamas, West Indies and mainland coasts around the Caribbean
Columbina passerina	Common Ground Dove	Dry limestone forest edges and clearings, in the plains and foothills, but less common in the mountains	Very common and widespread resident. Jamaica. *C.p. jamaicensis* is an endemic subspecies.

Scientific Name	Common Name	Habitat	Range and Status
Bubulcus ibis	Cattle Egret	Pastures and open areas	Very common resident. Worldwide
Egretta thula	Snowy Egret	Common resident in wetlands	N. America and the West Indies. Local populations are increased by migrants in the winter
Quiscalus niger	Greater Antillean Grackle	Cow pastures, cultivated land and around human habitations especially where they are fed.	Jamaica. *Q.n. crassinostris* is an endemic subspecies.
Vireo modestus**	Jamaican Vireo	Bushy areas, forest edges and roadsides at all elevations	Very common. Jamaica. An endemic species
Columba leucocephala	Saffron Finch	Open grassy areas, gardens, from sea level to the mountains (except the highest). Often seen on roads, near cattle ponds at feeding stations and chicken farms	Common resident. S. America and introduced to the Hawaiian islands, panama, Puerto Rico and Jamaica
Coerebo flaveola	Bananaquit	Ubiquitous. Found wherever flowering plants occur	Abundant and widespread resident. Jamaica. *C.f. flaveola* is an endemic subspecies.
Tringa flavipes	Lesser Yellow Legs	Beaches, Salinas or mudflats	Fairly common winter visitor. N. America wintering south to S. America
Dendrocygna arborea	West Indian Whistling duck	Mangrove swaps at Parottee, Black River Lower Morass, Negril morass, Falmouth Swamp, Salt Island lagoon, Grant's en, Caymanas Dam	Resident, probably locally common but extremely shy and rarely seen. Bahamas, G. Antilles and northern W.I. islands
Mimus Polyglottus	Northern Mocking Bird	Found in winter up to about 600 m, but goes to higher	Very common resident. *M.p. Orpheus* Bahamas and G. Antilles, also N.

Scientific Name	Common Name	Habitat	Range and Status
		elevations in the summer	America
Pelecanus occidentalis	Brown Pelican	In coastal waters, on reservoirs, fish farms and marshy areas	*P.o. occidentalis* West Indies. Also n, C and s America
Ardea herodias	Great Blue heron	Common winter visitor in wetlands, a few may spend the summer	N. America, wintering in W. I. and C. America south to northern S. America
Tyrannus dominicensis	Loggerhead Kingbird	Open wooded areas, cultivations and gardens	N. America, Bahamas, W. I. and mainland coasts around the Caribbean
Tiaris bicolor	Black faced Grassquit	Gardens and open situations	*T.b. marchii* Jamaica, Hispaniola and adjacent island. Other subspecies throughout the Caribbean except mainland Cuba
Egretta caerulea	Little Blue Heron	Wetlands	Common resident. Bahamas, W.I. and the Americas.

Ecological information taken from Downer and Sutton, 1990

Appendix II Study Team

A multidisciplinary team was identified to conduct the study and comprised the following persons:

Mrs. Eleanor Jones, MSc – Environmental Management Specialist and Team Leader

Mrs. Jones has over twenty-five experience in the areas of environmental management systems, environmental risk assessment, disaster prevention planning, environmental and social impact assessments, watershed management and community consultations and participatory planning. Mrs. Jones lectured in the Department of Geography of the University of the West Indies for 13 years, and has been consulting for fifteen years as President of Caritech Associates Ltd. and Managing Director/Founding Partner of Environmental Solutions Ltd. Mrs. Jones has much experience in road development projects including work on the North Coast Highway, the Kingston Coast Road Upgrade, the Jamaica Bridges Development Program, and was extensively involved in the SEA for Highway 2000. Mrs. Jones was responsible for overall management of the project including client liaison and consultations/dialogue with the NRCA/NEPA, as well as the social assessments, community consultations, hazard management, analysis of impacts and recommendation of mitigation measures.

George A. Campbell, M.Sc., - Resource Economist & Management Consultant

George Campbell is an experienced consultant and serves as an economist and management consultant with experience in environmental sciences including social surveys, economic studies, and financial services. He has provided a comprehensive range of social surveys, economic studies and financial services to numerous governmental, quasi- governmental and private sector organisations as well as international agencies. He has conducted studies in such diverse fields as agriculture, economic development, housing and tourism, manufacture and commerce, manpower training and education, transport and telecommunications, and more recently, through

Environmental Solutions Limited (ESL), he has been associated with socio-economic studies in the environment.

Mr. Campbell's work includes project evaluations in tourism development, management services in developing operational strategies and project finance including, the provision of project management services. He has also been responsible for designing several technical assistance programs in training and education. His substantive field is economics and he has provided several consultancies throughout the Caribbean on macro economic and related policy issues. Projects worked on include those commissioned by the principal multilateral agencies, regional governments and development institutions, private sector organizations, firms and individuals. He is a founding Partner and Director at ESL.

DR. MARGARET JONES WILLIAMS, PHD – ECOLOGIST AND DEPUTY TEM LEADER

Dr. Jones Williams is an Environmental Scientist with over thirteen years experience in terrestrial and marine ecology, coastal pollution studies, environmental impact assessments and natural resources inventory. Educated in Jamaica, Canada and the United Kingdom, she has worked at the Conservation Data Centre-Jamaica, a biodiversity unit, where she did extensive field work and mapping of Jamaica's endemic and endangered fauna as part of a Rapid Ecological Assessment of the island and to assist in the establishment of Jamaica's national parks. Dr. Jones Williams has been involved in several road development projects including the Kingston Coast Road Upgrade, the Jamaica Bridges Development Program, the Highway 2000, as well as housing development projects such as Bogue Village in Montego Bay. Dr. Jones Williams was responsible for liaison with NEPA and the client, the ecological assessments and identification of impacts and recommendation of mitigation measures.

Mrs. Sharonmae Shirley, BSc, MPhil – Environmental Chemist

Mrs. Shirley is an Environmental Chemist and has over five years experience in environmental chemistry, including water and solid waste studies, planning and execution of environmental monitoring programmes, occupational health and safety programmes and environmental audits. She has had years of practical experience in designing and implementing environmental monitoring programmes in Jamaica and Belize. Mrs. Shirley was responsible for analysis of air quality and water quality, as well as preparation of the recommendations for the development of a monitoring plan.

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

Mr. Earle is an earth scientist who specializes in Geographic Information System applications and Natural Hazard Mapping and project management. His specialty areas include GIS application in natural resource assessments and hazard mapping; natural hazard mapping, mitigation and risk analysis; geological studies; terrain analysis; geotechnical investigations; environmental impact assessments; project conception and implementation; and application of GPS and remote sensing. He has worked at Environmental Solutions Ltd. as Project Officer, at the National Water Commission as GIS Coordinator, at the Jamaica Bauxite Institute as Project Manager and in the British Virgin Islands implementing a multi-hazard mapping and risk assessment project of the British Virgin Islands. Mr. Earle was responsible for the physical aspects and hazards, including the description of the existing environment, and identification of impacts and mitigation measures.

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