PROPOSED RESIDENTIAL DEVELOPMENT FOR MORANT FARMS ESTATES ST. THOMAS

Environmental Impact Assessment Study

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INTRODUCTION

The Housing market in an emerging economy such as ours, is characterized by a few elaborate ones for the affluent, multitudes of shacks for the poor and not nearly enough in between. Escalating urbanization always presents a problem because it presents the government and planners with the daunting task of accommodating in-migrators with housing accommodation which must meet standards far higher than those they were used to in the rural areas, or wherever they are coming from.

There is the view that the private sector will take care of housing for the rich and the public sector must look after the poor. Realistically however, there is no way the public sector can solve the housing problem of the poor. The primary function of the public sector it must be impressed, with respect to urbanization and housing, is to create an enabling environment.

An important aspect of the demand for housing is often overlooked; it is income-inelastic. That is to say that as family income rises, expenditure on housing does not increase proportionally.

This is particularly true for the lowest income strata where demand for food and clothing are sometimes reduced below normally acceptable levels in order to secure a roof over one's head.

But also at higher income levels, housing demand is inelastic. To ignore this fact by defining 'affordability' as 25-30 per cent of income, is therefore to do injustice to the poor who already spend more than that on housing.

Another relevant fact about the housing market is that demand for rental units particularly in urban centers, is as high as 50 per cent of total demand, and of

these about 35 per cent constitute single-room dwellings. This is not necessarily the situation.

The major issue contributing to the housing dilemma is the issue of 'affordability'. This is due highly to the fact that the market for housing finance is imperfect. It is what one refers to as a 'sellers market' where the terms and conditions are 'take it or leave it'. But let us examine the very current scenario where our policy is trying to aim for housing solutions that are affordable for all. If one take a look at the building codes that are used to enforce this policy initiative one might realize the contradiction often found between policy and implementation. Granted, administrators and bureaucrats have other concerns which speak less to housing affordability and more to such issues such as the environment. However the interconnections between shelter policies and environmental policies are not always clear, namely that of standards are set too high in one area, they lead to disastrous standards in another. Given high construction costs to meet excessive building and environmental standards, a poor person cannot afford even the most modest of dwelling in these cases.

EXECUTIVE SUMMARY

This Environmental Impact Assessment (EIA) study has been prepared consistent with the Terms of Reference (TOR) set out by the National Environment and Planning Agency (NEPA). The study aims to assess the impact of the proposed Morant Lands residential development project on the built and natural environment. There are nine (9) sections in the study, namely Physical Environment, Biological, Sewage, Socio-Economics, Potential Environmental Impacts, Disaster Vulnerability, Mitigation Measures, Disaster Mitigation and Management, Environmental Monitoring Plan. The methodology used for each section is based on the guidelines provided by the TOR.

The project seeks to provide 300 Residential service lots with Level 1 Type infrastructure, inclusive of marled roads, electricity, sewage collection network, and water mains and laterals. The proposed development consists of a mix of residential and agricultural lots. Eighty (80) of the residential lots are an average of 750 square meters, 227 residential lots are an average of 630 square meters and 14 agricultural lots are an average of 4 acres each. Road construction and other infrastructure development should be completed in a 4 weeks projected time frame.

Physical Environment

Morant Farms is located on the main road from Morant Bay to York. It is approximately 2.5 km northwest of the capital town center of Morant Bay in the parish of St. Thomas. The property is generally flat and low-lying except on the northern boundary, where the land gradually rises to form low hills. The soil underlying the proposed development consists of silt and sandy soil with layers of gravel and cobblestones. The site is geologically stable and assessed as suitable for housing development.

Biological

Birds are a good indicator of environmental quality. Fifteen (15) different species were observed during the 'walk through' surveys. Avifauna on the proposed site consisting of 17 different species were observed; 1 endemic species and 3 endemic subspecies. Mitigation measures to preserve habitat should include preserving woody phanerophytic (over 3 metres tall) and large trees, as well as reduced pollution due to dust and noise.

Sewage

Sewage disposal design will incorporate septic tanks with a leaching field. The necessary approvals of the sewage proposal has been granted by the Water Resources Authority (WRA). The treatment provided by the septic tank is the reduction and stabilization of solids. Septic tanks and the leaching fields should be de-sludged once every 1-5-years. The minimum lot sizes of 550 metres required by the National Environment and Planning Agency (NEPA), has been met by the project proponent.

Socio-Economic Impact

The proposed development is expected to provide 200 jobs in the infrastructure development phase and an additional 500 jobs in the housing construction phases. It will generate income in excess of $50 million over a 2-year period. The parish although predominantly rural since 1970, has been exhibiting signs of increased urbanization. The project will meet increasing housing demand in the vicinity of the proposed site and dampen the tendency toward illegal occupancy of Government owned lands.

Potential Environmental Impacts

The subdivision is situated in the flood plain of the Morant River. There is the potential for flooding during high flows, particularly on the southwestern boundary of the property. Additionally, during high flows in the Morant River, backflows in the gullies may be created when run-off from the hills is backed up at the confluence of the gully and Morant River when the river is in spate. Proposed mitigation measures to reduce the possibility of flooding include, improvement works to the gully channels and controlled sand mining activities in the Morant River channel to lower the said channel.

Mitigation Measures

Location of agricultural lots near the Morant River is recommended, with the residential lots located on higher elevation on the northern section of the property. For the minor gullies, redirecting flows into kerbs and channel structures would control minor gullies. Further, allowance for drainage easement between lots where necessary to direct flows into main gullies. A minimum of 1.5m high berm along the lands bordering the Morant River should be constructed as an out growth of the mining activities. The wingwall of the bridge on the main road needs to be stabilized using gabion structures.

For the expressed purpose of providing housing lots to a growing population demanding these solutions, the project is well intended. With the propensity towards informal settlements, pro-active measures are always recommended. The project as proposed must in all stages take account of the environmental problems that already exist namely the potential for flooding. The recommended remedial measures must be implemented as part of the development process. Regarding potential sewage disposal concerns, the septic tank and tile fields, is adequate but maintenance will be critical to the long-term functioning of such systems. Should the developers adhere to the enclosed recommendations for development, the project should meet the stated objectives.

POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

St. Thomas Parish Council

The St. Thomas Parish Council has portfolio responsibility for the provision of public services such as public health, fire protection, street cleaning and maintenance of recreational areas such as parks and play fields. The parish council's portfolio of solid waste collection and management of public markets was taken over by Eastern Parks and Markets. The government have however, more recently established the National Solid Waste Agency which will be given overall responsibility of managing national solid waste.

It must be noted that one of the Parish Council's key responsibility is development control. This very important function serves to not just guide development but to shape and influence the pattern of development in any parish and or region. As a direct result development proposals have to be sent to the local parish council for development approval.

National Water Commission

The National Water Commission's chief portfolio responsibility in the land development process is to provide potable water and sewage services. Each proposal to develop land needs information and advice from the NWC as to whether or not the agency will be able to provide potable water. The issue of sewage is also important especially in the instances where central sewage plants are being used. The NWC is also the responsible body to comment and advice (approve or disprove) sewage proposals put forward by the project proponents.

Water Resources Authority

The Water Resources Authority was established to ensure the proper use of surface and ground water. This agency comments on proposed methods of sewage solutions in so much as it affects ground water contamination.

Environmental Health Unit (Ministry of Health)

The Environmental Health Unit of the Ministry of Health also comments proposed the methods of sewage disposal facilities. The agency is concerned about environmental degradation and human health, and ensures that sewage proposals are not designed to impact negatively on any of the two. (i.e the environment and human health).

National Works Agency (NWA)

The National Works Agency focuses on the designs of drains and road network (layout).

National Environment and Planning Agency (NEPA)

This Executive agency is an amalgamation of three agencies, the Town Planning Department, The Land Development and Utilization Commission and the Natural Resources Conservation Authority. The National Environment and Planning Agency seeks to ensure that proposed developments do not have adverse negative impacts on the environment. To ensure this, proposed developments are submitted to NEPA for a permit and or license to develop.

The agency's mission, is to ensure protection of the environment and orderly development locally and nationally.

The Natural Resources Conservation Authority Act (1991)

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

Under this Act, the NRCA was mandated to effectively manage the physical and natural resources of Jamaica so as to ensure their conservation, protection and proper use; promote public awareness on Jamaica's ecological systems and their importance to the social and economic life of Jamaica; manage national parks, marine parks, protected areas, public recreational facilities; and advise the Minister on general policies relevant to the management, development, conservation and care of the environment.

The Town and Country Planning Act (1948)

This Act was enacted in 1948. There have been substantial amendments to the Act in 1999 to provide for effective enforcement of development controls. The major objectives of this Act are to control the orderly development of lands comprised within the established development orders (now outdated), protecting amenities, and conserving and developing the resources of the area as prescribed.

This Act also provides for the making of Tree Preservation Orders whereby a local authority may seek to preserve trees or woodlands in their area and prohibit the lopping or willful destruction of trees or securing the replanting of trees.

The Land Development and Utilization Act

This Act speaks to the usage of agricultural land. This Act tries to prevent Individual land owners and the state from having land, particularly good

agricultural land idle. It aims to have good agricultural land be kept in production.

Water Resources Act (1995)

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

The Housing Act (1963)

Under the provisions of this Act, The Minister is declared 'Corporation Sole' and thus has the power of perpetual succession with the capacity to acquire, hold and dispose of land and other property of whatever kind. The Minister, after considering the housing conditions and needs of an area may cause the area to be declared a housing area. Within nine months after the coming in force of such an order, the Minister shall cause to be prepared a housing scheme in the area. However, the Minister before approving a scheme must provide notice to the public, which must be gazetted, consider all objections and representations made with respect to the scheme, and afford opportunity for the objections to be heard.

The Act also provides for the Minister to (order the) 'layout and construct public streets or roads and open spaces on the land, erect dwellings and convert buildings on the land into dwellings, and execute such works ... as may be necessary for the perfecting of such a (housing) scheme.' The proposed Morant Estates is being declared under the Housing Act.

The Public Health Act (1974)

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

The Litter Act (1986)

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

The Industrial and Provident Societies Act (1975)

The community organization which manages the distribution and sale of lots is required to be registered under this Act. The Society which may be registered under this Act (herein called an Industrial and Provident Society) is a Society for carrying on any industries, business or trades specified in or authorized by its rules, whether wholesale or retail and including dealings of any description in land provided that –

a. No member other than a registered Society will have or claim any interest in the shares of the Society exceeding $400.00
b. In regards to the business of banking, the society will be subject to the provisions herein contained.

The Management Committee for the project will operate under this Act. It will be responsible for the sale, distribution and monitoring of the development of the lots.

PROJECT DESCRIPTION

This proposed development involves the development of approximately 70 acres of land into three hundred residential units and fourteen agricultural lots. Eighty of the residential lots are at a average of 750 square metres, 227 are at an average of 630 square meters and the agricultural lots are an average of 4 acres each (see appendix 1).

This parcel of land is registered at volume 315 and folio 20 and registered in the name of the commissioner of lands. The entire area, a flood plain, has been created by deposits from the river and the project area is sitting in the alluvium caused by the Morant River.
The water table in this area is 3 - 4 feet below ground and information from the Water Resources Authority revealed that there exist approximately 10 wells downstream the proposed development

The proposed development includes the construction of roads, installation of water supply, sewage and electricity along with the construction of approximately 297 units.

As a matter of policy, the National Housing Development Corporation, through Operation PRIDE has returned to its core concept of level one infrastructure. By level one infrastructure, this implies the scribing and marling of roads, provision of potable water supply, electricity and sewage. The concept of PRIDE speaks to incremental development which is carried out at pace based on the level of affordability of the Provident Societies.

DEVELOPERS

Like several projects of this nature, the National Housing Development Corporation (incorporating Operation PRIDE) is the project proponent. Operation PRIDE will seek to undertake:

1. All preliminary development work
    - Preparation of subdivision layout and project information forms for submission to the National Environment and Planning Agency for approval
2. Preparation and submission of engineering designs to the National Works Agency for comments and approval
3. Seek approval for sewage design and water supply systems
4. Contractual services – Construction of roads and infrastructure.

The related professionals engaged by the National Housing Development corporation in the execution if this proposed development are:

1. Urban Planner
2. Land Surveyor
3. Engineer
4. Quantity Surveyor
5. Contractor

ADJACENT COMMUNITIES

Morant Estates is bounded by Seaforth to the west, Cottage Pen to the east, Belvedere to the south and Spring Gardens further North.

SCOPE OF WORKS

1. Subdivision of the property into 300 residential lots and 14 agricultural lots and the preparation of splinter titles
2. Installation of water mains and laterals
3. Installation of sewage collection network
4. Installation of electricity
5. Construction of drainage system – based on the topography and drainage of the land.
6. Obtain all relevant and necessary statutory approvals

ROAD NETWORK

Road network of 10 metre wide roadways designed to accommodate normal loaded trucks. Twenty (20) feet wide paved carriage ways will be constructed consisting of 30 cm (1.2 inch) asphalt. Cement concrete kerbs and channels will be constructed on both sides of the roads. Pavement to accommodate rainwater run-off. River shingles will be used on the road surface before it is marled. This process will take care of serious earth movement.

WATER SUPPLY

Assuming a per capita consumption of 50 Imperial Gallons per day (igpd) and five (5) persons per family, the average daily demand for the development is approximately 12, 500 igpd.

SEWAGE SYSTEM

Information coming out of the Water Resources Authority is that the water table is too high and there exist underground water wells that cannot facilitate contamination.

The proposed method of sewage disposal therefore is that of Septic tank and tile fields. This is already approved by the Water Resources Authority (see appendix 2).

ELECTRICITY

The Rural Electrification Programme of the JPS will be engaged to install electricity and wire the proposed development to provide power to each lot.

TIME FRAME

- Surveying, preparation of subdivision plan and drainage plan – Complete
- Submission for statutory approval – Four weeks
- Road construction and other infrastructure – Four weeks

CHAPTER ONE

PHYSICAL ENVIRONMENT

LOCATION

Morant Farms is located on the main road from Morant Bay to York, approximately 2.5 km northwest of the capital town center of Morant Bay. It is bordered on the southwest by Morant River, on the south by the road intersection to York and Spring Gardens and to the northwest by the small community of Lower York. The northern boundary extends to the foot of the limestone hills.

PHYSICAL DESCRIPTION OF SITE

Geomorphology

The Operation Pride subdivision forms part of the alluvial flood plain of the Morant River. The flood plain was formed from the deposition of sediments consisting of sand, silt, gravel and boulders brought down from the Blue Mountain during heavy rainfall and flood events over the past 10,000 years. Small drainage features are found within the alluvium, breaking the monotony of the alluvial landscape.

The alluvium is nestled between limestone hills to the northeast and southwest, giving the landscape a poorly defined U-shaped valley.

Limestone hills on the north and northeastern boundary consist of moderate to low ridges and elongated hills aligned in a northwest – south east direction. These hills are dissected by drainage features, which drain through the site and are aligned in a general north south direction. Approximately 500 metres to the

southeast is a large limestone hill consisting of high ridges and semi –conical shaped landforms.

Topography

The property is generally flat and low-lying except on the northern boundary, where the land gradually rises to form low hills. The area of land between the main road and Morant River is flat, having slopes calculated at 0.6 degree to a little over 2 degrees.

On the opposite side of the road, i.e. towards the north, the site is flat to gentle sloping, consisting of slope gradients from a low of 2 degrees to a little less than 10 degrees on the northern boundary. Further north, the limestone hills rise moderately with maximum slope gradients of 26 degrees (Plate 1). There is a shallow depression on the northwest, which is earmarked for community open space and playfield.

Surface Soil

Essentially, soil underlying the proposed development consists of silt and sandy soil interbedded with layers of gravel and cobblestones. The fine sand and silt constitute the upper soil horizon in some exposed areas, while gravelly sand is dominant in other sections of the site. Below this area is often found gravel and cobble layers varying in thickness and depth below surface (Plate 2). This description is based entirely on subdivided land between the main road and Morant River.

Also found are boulder size material strewn across the surface, particularly on the property between the main road and the Morant River.

On the opposite side of the main road i.e. with increasing distance from Morant River, the soil type in the alluvium gradually changes from gravel, cobble and

sand to more fine grain soil consisting of sand, silt and clay. Permeability in the soil is generally high but is expected to decrease gradually towards the north and northeast.

Near the northern boundary, the soil type gradually changes to silt and clay containing of limestone gravel on the foothills of the slope.

Drainage

The project site can be considered to be well drained. There are two main drainage channels or gullies draining the site, emanating from the limestone hills in the north and eventually emptying into the Morant River. The drainage channel near the northwestern border meanders as it flows south outside the boundary of the site. It is then joined by a west east draining gully on the northwestern boundary on a major bend where flow changes to an easterly direction.

The main gullies draining the site become joined on the southeastern section before it empties into the Morant River. Additionally, three minor waterways originate on the property in the north, flow into the major gullies and contribute to drainage on site (see appendix 3).

There is usually an overflow at the major bend during heavy rainfall, leading to storm water being channeled along a minor road, and onto the main road where it is channeled across the road via is a culvert.

This overland flow follows the road for about 150 metres before confluencing with the meandering gully on another bend across the main road. The gullies cross the main road at three points via culverts and a bridge. The two culverts and bridge are partially blocked by tree trunk and other debris from recent heavy rains in May 2002 (Plate 3).

On the southwestern boundary is the Morant River, which flows from north west – south east and is the main drainage feature likely to have a significant impact on the site. All storm water from the proposed development drains directly into the Morant River.

The river channel is currently elevated as a result of heavy deposition of sediments brought down from the Blue Mountains during recent flood rains. At moderate flows, the river is estimated at 0.5 metre below the riverbank at some areas of the subdivision (Plate 4).

Earth drains/ditches are also drainage features observed mainly on the south west of the property were probably used for irrigation purposes when the land was fully utilized for agriculture.

GEOLOGY

Lithology

The dominant geological material is alluvium consisting of silt and sand interbedded gravel and cobblestones. Near the northern boundary is the Gibralter – Bonnygate Formation and to the south is the Montpelier Limestone, all of the White Limestone Group. (See Geology Map – appendix 4).

Available data taken from the 1:50,000 Morant Bay Geological Sheet 19 produced by Mines and Geology Division (MGD) suggests that the alluvium is deposited on the limestone basement rock as the river cuts through the limestone valley.

Hydrogeology

The alluvial deposits and Gibralter/Bonnygate Limestone are classified as aquifers and therefore has the potential for the abstraction of groundwater. Information from Water Resources Authority (WRA) shows that there are three alluvial wells on the site but are currently non-production wells. Down gradient of the subdivision are alluvial wells, some of which are in production.

The gullies and streams, which flow through the property, are normally fed by springs emanating from the Gibralter-Bonnygate Limestone in Spring Gardens and Stony Gut localities in the north.

Based on well data, groundwater level is estimated at 3 metres to 4 metres, below surface based on observation from an abandoned well on the site.
Two aquifers occur with the boundary of the site; the Morant River Alluvial Aquifer and the Limestone Aquifer (Map 1 – Hydrostratigraphy – see appendix 5).

Majority of the site is underlain by alluvial material deposited by the Morant River. The alluvial deposit consists of a mixture of clay, sand, gravel and boulders and the formation functions as an aquifer. There are three wells within the project area all of which tap the alluvium aquifer (Table 1, Map 2 – see appendix 6). None of these wells are however presently operational. The depth to groundwater in the alluvial aquifer is approximately 3.0 m and the groundwater flow direction is south along the path of the Morant River.

Table 1: Well Location - Morant Farms

WELL NAME	GRID	STATE	OWNER
Morant #2	E7460 N 3653	Non-Pumping	Morant Estate
Morant #3	E7452 N 3666	Non-Pumping	Morant Estate
Morant #4	E7435 N3682	Non-Pumping	Morant Estate

There are other wells tapping the alluvium aquifer located south of the project site, including the NWC Springfield Well (Figure 1). These latter wells are down-gradient (hydraulic) of the site and therefore contamination of groundwater below the site could result in contamination of these wells.

There is no recent data on groundwater quality from the wells at the site. The available data is over 30 years old (Table2). The groundwater is typically calcium-bicarbonate type, calcium and bicarbonate being the dominant ions. A review of more recent water quality data from wells south of the site shows similar values to that available for the Morant Farms Well. This implies there has not been a significant change in the groundwater quality below the site with respect to the major ions. In general, the groundwater is of excellent quality and suitable for potable use.

Table 2: Water Quality - Morant Farms

PARAMETER	MORANT #2	MORANT #3	MORANT 4
Sample Date	6/17/69	6/17/69	6/17/69
EC	455	455	495
PH	7.6	7.5	7.4
Colour	4	4	4
Turbidity	4	4	4
TDS	233	245	239
Hardness	194	182	176
Alkalinity	-	166	-
Calcium	59	63	56
Magnesium	11	5.8	9.2
Potassium	0.5	-	0.3
Sodium	8.8	-	7.3
Chloride	17.6	15.4	12.5
Sulphate	11	-	7.6
Nitrate	1.3	0.3	4.3
Bicarbonate	209	-	179

Note: EC -micromhos/cm, Colour- Hazen Units, Turbidity - NTU, All other - mg/l

The slopes on the northern section of the property are underlain by the Gibraltor/Bonnygate Limestone Formation that also function as an aquifer. There are no wells tapping the limestone aquifer at this location and therefore there is no data on groundwater level, flow direction or quality. By comparison with the limestone aquifer at other locations, the groundwater is expected to be calcium bicarbonate type, of excellent quality and suitable for potable use.

It is possible therefore to develop groundwater resources at the site to satisfy the domestic water demand of the development in the event that the National Water Commission were unable to provide the quantity of water required.

Geology Structure

Information from Morant Bay Geology Map indicates that there is a geological fault, which passes through the southeastern boundary of the property, but is probably buried by the alluvium at that location. The limestone hills in the north and northeast are extensively faulted, but do not have a direct impact on the housing site.

Approximately 4 km away, is the Plantain Garden Fault, which is a major structural feature on the eastern section of the island. Recent seismic hazard assessment studies carried out under the USAID/OAS Kingston Multi Hazard Assessment Project (1999) have correlated seismic activity on known major active faults in nearby Hispaniola with the Plantain Garden Fault, strongly suggesting that there is the likelihood of activity on the Plantain Garden Fault.

Geotechnical Aspects

Soil investigation conducted for Morant Farms by Hill Betty Engineers, reveals that the coarse grain soils underlying the site are essentially well graded, compact to very dense sand and gravel, which indicates that the soils are suitable for building foundations at shallow depths.

CHAPTER TWO

BIOLOGICAL ENVIRONMENT

VEGETATION ASSESSMENT:

In view of the existing flora at the site, it was determined that line transects or quadrants would prove to be ineffective in sampling a representative portion of the vegetation present. This is due to the fact that the entire area is disturbed (more in some parts that in others), with changes in species according to the nature of the disturbance. Instead a "walk-through" of the property was conducted where, arboreal and herbaceous species were identified on site. Unidentified species were collected, pressed and taken to the University of the West Indies' Herbarium for classification. Each species was then checked against known Jamaican plant taxonomy literature for any important characteristics, such as endemism and rarity.

The level of species presence was estimated using a *DAFOR* rating system (**D**ominant, **A**bundance, **F**requent, **O**ccasion and **R**are occurrences), which although subjective, visualizes the level or extent of land covered by plant species. General notes were made about the current and apparent past vegetation type of the land. Notes were made with respect to vegetation types of the surrounding properties during a walk-through and "window" survey.

THE AFFECTED ENVIRONMENT:

The assessment of the vegetation on the development sites will be divided into two parts:

- Vegetation comprising the Southern section
  - Vegetation comprising the Southeastern section

- Vegetation comprising the Southwestern section

o Vegetation comprising the Northern section

The vegetation map shows the classification of the different types of the vegetation found on the proposed development site i.e. the northern as well as the southern portions.

VEGETATION COMPRISING THE SOUTHERN SECTION

The species found in this section of the proposed development site are listed in Table 1 below.

Table 1 Showing the species present in the Southern Portion of the Proposed Development Site

SCIENTIFIC NAME	COMMON NAME	PRESENCE
Cecropia peltata	Trumpet tree	R
Cordia gerascanthus	Panchallon	R
Terminalia catappa	Almond	O
Guazuma ulmifolia	Bastard cedar	O
Sterculia apetala	French peanut	R
Annona squamosa	Sweetsop	R
Amaranthus spinosus	Prickly calalu	F
Ricinus communis	Oilnut	O
Euphorbia	Milkweed	O

prostrata		
Jathropa gossypiifolia	Belly-ache bush	F
Solanum torvum	Susumber	R
Sida acuta	Broomweed	F
Cynodon dactylon	Bahama grass	D
Blighia sapida	Ackee	O
Mimosa pudica	Shame weed	F
Prosopis juliflora	Cashaw	A
Samanea saman	Guango	O
Inga vera	River Koko	O
Leucaena leucocephala	Lead tree	O
Urechites lutea	Night shade	O
Sansevieria trifasciata	Tiger cat	R
Gynerium sagittatum	Wild cane	R
Axonopus compressus	Carpet grass	D
Mucuna pruriens	Cowitch	R
Abrus precatorius	Red bead vine	O
Nectandra antillana	Long-leaved sweetwood	R
Lantana camara	White sage	O
Lantana urticifolia	Black sage	O
Commelina diffusa	Water grass	R
Ruellia tuberosa	Duppy gun	O

Cocos nucifera L.	Coconut	O
Comocladia pinnatifolia	Maiden plum	O
Magnifera indica	Mango	R
Acacia tortuosa	Wild poponax	O
Spathodea campanulata	African tulip tree	R
Ehretia tinifolia	Bastard cherry	R
Bumelia nigra *	Red Bullet	R

KEY
* *Endemic species*

Vegetation in the Southwestern Section

The vegetation occurring in the southwestern section of the property can be classified as terrestrial herbaceous community. Here grasses, graminoid and other herbaceous plants are predominant in the cover, but woody plants are sparingly present (not covering more than 30%).

The vegetation is dominated by grasses interspersed with some woody species (such as *Guazuma ulmifolia*, *Samanea saman*, *Cecropia peltata*, *Cordia gerascanthus* and *Terminalia catappa*) as well as food trees (such as *Blighia sapida*, *Annona squamosa* and *Magnifera indica*). The species *Prosopis juliflora* and *Acacia tortuosa* were frequently seen in this area and a few weed species were also observed (such as *Commelina diffusa*, *Euphorbia prostrata*, *Sida acuta*, *Jathropa gossypiifolia*) (see Appendix 12).

The vegetation close to the banks of the Morant River consisted of large trees and generally woody and herbaceous vegetation (such as *Urechites lutea*, *Bumelia nigra*- endemic, *Terminalia catappa*, *Abrus precatorius*, *Nectandra antillana*, *Sansevieria trifasciata*). Alongside the river were large woody

phanerophytic trees which served to stabilize the banks of the river (e.g. *Guazuma ulmifolia*, *Samanea saman*, *Terminalia catappa* and *Inga vera*).

Vegetation in the Southeastern Section

The vegetation here can be classified as a partially deciduous thorn thicket system. This type of system is dominated by thorny leguminous phanerophytes ranging in height from 3 – 10 metres tall. The leaves are mostly microphylls, and often show additional adaptations for decreasing transpiration.

On this part of the property, the diversity of species is not high with the dominant species being *Prosopis juliflora* (comprising approximately 75% of the vegetation cover). Other species found in this area are *Acacia tortuosa*, *Spathodea campanulata*, *Sida acuta*, and *Ehretia tinifolia*. Species of weeds that were observed include *Euphorbia prostrata*, *Sida acuta* and *Jathropa gossypiifolia*.

There was little evidence of vegetation stabilizing the banks of the Morant River in this section. In a section approximately 3 m in length, the riverbank was supported by *Gynerium sagittatum*. However most of the vegetation that was previously found on the banks of the river was observed to be severely eroded (see Appendix). The banks of the two ravines which traverse first, the northern section of the property then this southeastern section, is lined by large trees (such as *Samanea saman*, *Terminalia catappa* and *Inga vera*) which, as previously mentioned, serve to stabilize these areas by the binding effect of the roots of these trees and shrubs on the soil.

VEGETATION COMPRISING THE NORTHERN SECTION

The species found in this section of the proposed development site are listed in Table 2. The vegetation in the northern section of the property can be classified as:

1. Terrestrial herbaceous vegetation
    - ***Tall herbaceous commercial crop- Banana plantation***. Here the area is dominated exclusively by *Musa spp*. The species *Gliricidia sepium*, *Spondias mombin* and *Bursera simaruba* are also present owing to their use as live fences.

    - ***Short-herb savanna- Pastures.*** These pastures are used for grazing cattle, as indicated by the presence of cows in this area, and are generally dominated by grasses such as *Cynodon dactylon*, *Setaria barbata*, *Digitaria decumbens*, *Panicum maximum*. Trees of secondary formation that were present include *Samanea saman*, *Magnifera indica*, *Cordia gerascanthus*, *Bauhinia purpurea* L. and *Bumelia nigra*- endemic.

2. Scrubs
    - ***Mixed subsistence farming***. This commonly has the physiognomy of a scrub formation. It encompasses herb-dominated areas as well as scattered trees. The common non-farm trees that were observed are *Gliricidia sepium*, *Spathodea campanulata*, *Spondias mombin*, *Samanea saman* and *Bursera simaruba*. Among the more common farmed trees observed were *Magnifera indica* and

Table 2 Showing the species present in the Northern Portion of the Proposed Development Site

SCIENTIFIC NAME	COMMON NAME	PRESENCE
Musa	Banana	F
Cecropia peltata	Trumpet tree	F
Cordia gerascanthus	Panchallon	O
Cordia collococca	Clammy cherry	O
Ehretia tinifolia	Bastard cherry	O
Haematoxylum campechianum	Logwood	R
Bauhinia purpurea L.	Poor man's orchid	R
Spathodea campanulata	African tulip tree	R
Crescentia cujete	Calabash tree	R
Terminalia catappa	Almond	R
Guazuma ulmifolia	Bastard cedar	O
Amaranthus spinosus	Prickly calalu	O
Citrullus lanatus	Water melon	O
Cucurbita pepo	Field pumpkin	O
Abelmoschus esculentus	Okra	O
Sida acuta	Broomweed	O
Blighia sapida	Ackee	R
Mimosa pudica	Shame weed	F
Prosopis juliflora	Cashaw	O
Samanea saman	Guango	F

Inga vera	River Koko	O
Urechites lutea	Night shade	O
Bursera simaruba	Red birch	O
Carica papaya	Papaya	R
Panicum maximum	Guinea grass	O
Andropogon glomeratus	-	F
Axonopus compressus	Carpet grass	A
Cynodon dactylon	Bahama grass	A
Zea mays	Indian corn	O
Digitaria decumbens	Pangola	O
Bambusa vulgaris	Common bamboo	O
Chusquea abietifolia	Climbing bamboo	R
Cajanus cajan	Gungo pea	O
Gliricidia sepium	Quick stick	O
Lantana camara	White sage	F
Lantana urticifolia	Black sage	F
Commelina diffusa	Water grass	R
Ruellia tuberosa	Duppy gun	R
Xanthosoma sagittifolium	Coco	R
Comocladia pinnatifolia	Maiden plum	O
Magnifera indica	Mango	R
Spondias mombin	Hog Plum	O
Setaria barbata	Corn grass	F

Cocos nucifera L.	Coconut	R
Bumelia nigra *	Red Bullet	R

KEY

** Endemic Species*

Cocos nucifera L. The shrubs and herbs include *Cajanus cajan*, *Xanthosoma sagittifolium*, *Citrullus lanatus*, *Cucurbita pepo* and *Abelmoschus esculentus*.

The vegetation lining the banks of the two ravines that traverse this part of the property consist of large trees such as *Terminalia catappa*, *Samanea saman*, *Igna vera*, *Comocladia pinnatifolia*, *Bauhinia purpurea* L., and *Bambusa vulgaris*. These natural waterways are reinforced with concrete only where they become subterranean.

TERRESTRIAL FAUNA

SURVEY METHODOLOGY

Faunal community composition was recorded under the following headings: AVIFAUNA and OTHER TERRESTRIAL FAUNA.

Five 'walk through'-type avifauna survey were conducted throughout the proposed site to obtain an indication of species diversity and individual abundance through listing and counting the number of species observed and heard during the walks.

In the Southern Section of the proposed development site, a preliminary survey was carried out between the hours of 4:00 pm and 5:00 pm on June 13, 2002; a three hour survey was conducted between the hours of 8:00 am and 11:00 am

on June 20, 2002; and a final survey was conducted between the hours of 11:00 am and 12:00 pm. The weather was generally sunny on all sampling occasions. A one hour survey was conducted in the Northern Section of the proposed development sit between 11:00 am and 12:00 pm on June 20, 2002 and a final survey was then conducted between 9:00 am and 11:00 am on June 23, 2002. the weather was sunny, with 20 minutes of rain, on the first sampling occasion and generally sunny on the second occasion.

Avifauna was sought by direct observation or by searching for indicators such as nest.
Physical description and vocal peculiarities of any bird that could not be immediately identified were noted and later verified with field guides. This method is only capable of identifying the most common birds found in an area. Rare, migratory or cryptic species can be under represented by this technique. The Point Count Method (without distance estimates) was used to sample the bird population. This method produce data that reveal the bird species present, their abundance and habitat preferences. It does not permit estimates of the total population size in the area.

Insects and other macofauna utilizing the resources of the proposed development site was recorded as encountered. No special searches were carried out. These macrofauna were surveyed and qualitatively recorded during the 'walk through'- type surveys conducted in the proposed development site.

AVIFAUNA

Birds are good indicators of environmental quality. Species diversity (the relative numbers of different species) is dependent upon the diversity of habitats available for roosting , foraging and feeding in an area. In general high species

diversity and high numbers of individuals. (i.e. individual abundance) are indicative of a healthy and diverse ecosystem.

Details of the Avifauna in the Southern Section of the Proposed Development Site

Fifteen (15) different species were observed for the duration of the 'walk through' surveys in which bird counts were made (*Table 1*) Sixty (60) individuals were observed for all species combined, however, a number of these individuals are believed to be residents on the site and were therefore surveyed more than once during the three-day survey period.

The vegetation forming the avifauna habitats, in this section of the proposed development site, can be classified as

- **terrestrial herbaceous vegetation** with a domination of grasses and other herbaceous plants but woody plants are sparingly present; and also as
- **partially deciduous thorn thicket system** dominated by the species *Prosopis juliflora*.

The species resident on the site are believed to include *Mimus poyglottos* (Northern Mockingbird), *Icterus l. leucopteryx* (Jamaica Oriole- endemic subspecies), Vireo altiloquus (Black-whiskered Vireo) and *Tiaras olivacea* (Yellow-faced Grassquit). This inference is based on the observation of the nest belonging to these species of birds and also the observation of certain characteristic social behaviour of nesting birds.

Details of the Avifauna in the Northern Section of the Proposed Development Site

Eleven (11) different species were observed for the duration of the 'walk through' surveys in which bird counts were made. Forty (40) individuals were observed *(Table 2).*

The vegetation forming the avifauna habitats, in this section of the proposed development site, can be classified as terrestrial herbaceous vegetation consisting of

- **Tall herbaceous commercial crop** (Banana plantation) where the area is dominated exclusively by *Musa spp;*

- **Short-herb savanna** (Pastures). Which are generally dominated by grasses such as *Cynodon dyctylon, Setaria barbata, Digitaria decumbens, Panicum maximum;*

- **Scrubs** (Mixed subsistence farming with dwellings) which encompasses herb-dominated areas as well as scattered trees.

The speces resident on this site are believed to include *Vireo altiloquus* (Black whiskered Vireo), *Zenaida spp*. (Doves), *Coereba f. flaveola* (Bananaquit-endemic subspecies) and *Tiaras olivacea* (Yellow-faced Grassquit). This inference is also based on the observation of nests belonging to these species and certain charaterstic social behaviour of nesting birds.

General Description

There is characteristic low species diversity with respect to the avifauna at the proposed development site. Only seventeen (17) different species were observed within the entire area; one (1) endemic species and three (3) endemic subspecies (Table 3). This low species diversity, however, is typical of areas of this similitude comprised of severely disturbed vegetation types on a property which has been stripped of most (if not all) of its naturally occurring forested areas. Habitats diversity is low, corresponding with a low species diversity with respect to existing vegetation and as a result wit respect to the avifauna. The vegetation consists mostly of woody (phanerophytic) trees with little or no understorey vegetation.

Low habitat diversity is partially responsible for the low species diversity of avifauna observed. There were few available habitats for concealment, foraging and nesting other than within the tree canopy itself or in the areas supporting heavy understorey vegetation. It is therefore noteworthy that nests belonging to the species *Coereba f. flaveola* (Bananaquit-endemic subspecies), *Tiaras olivacea* (Yellow-faced Grassquit) and *Zenaida spp.* (doves) were observed in areas supporting heavy understorey vegetation in both the northern and southern section of the proposed development site.

The vegetation types that these avifaunal habitats are located in the areas which are classified as terrestrial herbaceous vegetation. These areas of high species abundance coincide with:

- Areas consisting of woody (phanerophytic) vegetation which are found mostly on the steeper gradients and along the water channels in the northern portion of the development site.

- The general wooded areas in the southern portion of the property, observed to be bordering the Morant River as well the natural water channels.

Here heavy understorey were often present which resulted in greater (avifaunal) species numbers being supported by these areas as opposed to the clear grassy areas. Therefore due to the limitations in habitats diversity discussed previously, the site is less than ideal for supporting large and diverse bird populations.

OTHER TERRESTRIAL FAUNA

In addition to the avifauna eight (8) different species of Butterflies were observed and believed to frequently inhabit the proposed development sit. These include:

- *Danaus plexippus* (The Monarch)
- *Dryas iulia delila* (Julia)
- *Eurytides marcellinus* (Blue Swallowtail or Jamaica Kite Swallowtail). This species is endemic and St. Thomas was reported to be the only known breeding site (Jamaica Naturalist Vol 4 Dec 1994).
- *Precis evarete zonalis* (The West Indian Buckeye)
- *Anteos maerula maerula* (Maerula)
- *Euptoieta hrgesia* (The Tropical Fritillary)

These are important to the ecosystem as they are agents of pollination and form an important component in the reproductive development of plants and eventually of the animals which depend upon them for their provision of food as well as habitat.

Small fishes, dragon flies (Order: Odonata) and snails (Class: Gastropoda) were found associated with the habitats created by the water flowing through the natural gullies on the property.

With regards to reptiles two (2) endemic species were observed. At least six (6) individuals of the endemic species *Anolis lineatopus* were observed on the proposed development site. This species is characterized by the males having a large yellow dewlap or throat-fan with an orange center and the general body colour being light brown with dark brown horizontal stripes. At least four (4) individuals of the endemic green lizard *Anolis garmani* were observed in the northern portion of the proposed development site. This species is characterized by its bright green colour and saw-toothed ridged back.

CHAPTER THREE

THE SOCIO- ECONOMIC ENVIRONMENT

POPULATION

Demography

In the April 1991 census, the population of St. Thomas was estimated as 83,700, representing an overall increase of 3,300 since the previous census of 1982. The annual growth rate for the 11-year period since 1982 has been 0.5%. Approximately 19% of the population of St. Thomas lives in areas designated as urban.

The parish, although predominantly rural has prior to 1970, exhibited signs of increasing urbanization. In the 1970 census, 14.3% of the population was found in urban areas. As at census 1991, the urban population has increased by 50% (Table 1).

Table: Urban/Rural Distribution of the Population of St. Thomas

AREA	1970		1982		1991		% CHANGE 1970-1991
	#	%	#	%	#	%	#
URBAN	14,600	21.0	20,800	25.8	21,700	25.9	21,700
RURAL	54,800	79.9	59,600	74.2	62,000	74.1	62,000

Source:

Population Census 1991. Statistical Institute of Jamaica - Kingston, Jamaica.

The parish capital of Morant Bay exhibited the most impressive growth in population, showing a rise in population from about 3,500 in 1970to9,600 in 1991, an almost 3-fold increase of the population in 20 years. The annual growth rate for the Morant Bay population for the period 1970 – 1991 was 5%. The areas of Easington and Yallahs had a fair amount of growth in the period, with growth rates of 2.3% and 2% annually.

It is difficult to estimate the population in the Morant Lands area, as the cenusus data was not disaggregated based on communities. A best estimate of the population in the vicinity of the proposed project was based on 6 outlying Enumeration Districts (EDs) (see appendix 7). The population in the surrounding EDs, was estimated at 1993, as at 1991 (Refer to St. Thomas West - 1991 Enumeration Districts Map). As beneficiaries of housing units will be drawn from other areas the population would be expected to increase substantially.

Employment

Based on the Labour Force Survey of 2001, person employed in the parish of St. Thomas in April 2001 was 40,300, an increase of 8,300 (26%) over the April 2000 employed populace of 32,000. The unemployed in St. Thomas was detailed as 8,000 in April 2001, an increase of 800 (11%) over the April unemployed populace of 7,200 in April 2000 (Table 2).

Table 1: Labour Force - All Parishes and St. Thomas

	April 2000			April 2001		
	Employed	Unemployed	Total	Employed	Unemployed	Total
All Parishes	924,900	170,000	1,094,900	942,300	169,500	1,111,8(
St. Thomas	32,000	7,200	40,300	32,300	8,000	40,300

Source: The Labour Force 2001. Statistical Institute of Jamaica, Kingston, Jamaica.

The project as planned is estimated to generate 200 jobs in the infrastructure development stage and an additional 500 jobs in the housing construction phase. As much of the population is currently involved in subsistence agriculture, the project over a 2-year period is expected to generate income of $50million. The areas to directly benefit include Morant Bay, Seaforth, Belvedere, Citron Valley, Hall Head, Creighton Hall, Burrowfield and Rozelle.

Table 2: Population of Special Areas in St. Thomas

SPECIAL AREAS	1970	1982	19991	ANNUA; GROWTH RATE 1970-1991
Morant Bay	3,482	8,823	9,602	4.95
Yallahs	4,396	6,835	6,902	2.17
Easington	1,485	2,052	2,378	2.27
Seaforth	3,285	4,163	4,108	1.07
Golden Grove	2,520			

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

ECONOMIC ACTIVITIES

Agriculture

The main banana estate, Eastern Banana, was for many years the major exporter of bananas in the island. Although, production levels have fallen such properties have helped to raise the level of small farmer banana production

through technology transfer. Subsistence farming is the major agriculture activity in the parish, beyond the estates. In subsistence agriculture the farmer is incapable of earning enough from the farmer to meet his basic economic needs.

The demised of the coconut industry with the closure of major processing concerns such as Seprod has affected the viability of large coconut estates in the parish. Additionally, the “Lethal Yellow” disease is threatening to wipeout the entire coconut industry. Notwithstanding these setbacks, new agriculture processing plants for ackee and calallo offer much hope for recovery in the agriculture sector in St. Thomas.

Suggested crops for agricultural lots:

Corn

Tomato

Lettuce

Cabbage

Ginger

Manufacturing

The main manufacturing activity in St. Thomas was the former Goodyear factory. With the closure of the factory, manufacturing in St. Thomas is on the decline considerably. The expected opening of a Call Center in the former Goodyear premises has been promised, albeit overdue. Former light industry centres in Yallahs and Lysons, have largely closed. The Serge Island dairy processing plant, once a major processor has reduced output, inimical of the decline in the dairy industry island-wide. Without additional incentives, above incentives previously offered to Goodyear, it is doubtful that manufacturing of a large scale will return to St. Thomas over the next 10 years.

Commerce

Much of the commercial activities in the parish of St. Thomas is concentrated in the parish capital of Morant Bay. In Morant Bay can be found the Banks, Shopping Centres, Hardwares, Bakeries and Utility Companies. Commercial activity has also benefited from over 2,000 “returning residents” especially from England, who through their investments in construction and pensions give substantial support to the local St. Thomas economy.

Tourism

The parish of St. Thomas has a number of historical sites and archeologically valuable locations. The Morant Bay rebellion gave Jamaica one of its national heroes. The Morant Point Lighthouse fashioned in London in 1841 is of considerable interest to historians of industrial technology. The Bath Botanical Garden, established in 1779, was the first in Jamaica. The Bath Fountain & Mineral Spa is world famous for its legendary healing waters.

The Parish Development Committee under the auspices of the Ministry of Local Government seeks to encourage the preservation and unearthing of historical sites throughout the parish. Much activity occurs at the “Hillside” waterfalls, which is being upgraded with the assistance of the Tourism Product Development Company (TPDCo). With the growth of Heritage Tourism and Spa Facilities globally, St. Thomas has much to offer in supporting the Tourism industry of Jamaica.

LAND USE

Morant Lands is owned by the Commissioner of Lands. The current agricultural activities (subsistent agriculture) are conducted through lease agreements with the said Commissioner of Lands. Informal farming activities exist in sections of the lands. Land lease beneficiaries are aware of the proposed development and

are prepared to re-locate their farming activities with proper notice (see appendix 8).

Housing

The proposed development is expected to add approximately 300 housing units. In the 1991 census there were 20,774 housing units, 23,474 private dwellings and 24,270 households in St. Thomas. There exists an average number of dwellings in each housing unit of 1.1, with the average number of households to each dwelling being 1.0. The average household size being 3.4 persons (Source: Population Census 1991. Statistical Institute of Jamaica - Kingston, Jamaica. pp 21-22).

Public Amenities

- Cemetery

The public cemetery in Yallahs and Morant Bay is at its capacity. There is urgent need for a new site. Indications are that such a site has been identified and should be in operation in the near future.

- Waste Disposal

The disposal of waste from the parish of St. Thomas is handled as part of the National Solid Waste Management program under the Ministry of Local Government. All waste generated in the parish is transported to the municipal dump in Kingston. The process appears efficient and should be adequate to meet the waste disposal needs of the proposed development. The proposed

development is along a route from Seaforth already traversed by garbage disposal units.

Schools

There is one kindergarten in close proximity to the proposed development area. It caters to the age cohorts 3-5 years. Children for higher age groups will be expected to travel to neighbouring communities of Spring Garden, Seaforth, Belevedere and Morant Bay.

- The Primary Level

Consistent with the national data, the largest educational component covers the persons with primary schooling, the age group 6-11 years, in the grades 1-6. The enrolment in the primary level was 12,130, for the academic year 2000/01. Another national pattern mirrored in St. Thomas sees enrollment exceeding capacity, as children are registered at more than one school.

In Table 4, the largest educational component is at the primary level, although declining somewhat since 1970. The female populace recorded the sharpest decline. In the 15 years and over group the proportion of the St. Thomas population with primary education moved down from 91% to 59% for males. The corresponding levels for females were 90% and 54% respectively.

Table 3: Distribution of the Population of St. Thomas aged 15 years and over by Educational Attainment, By Sex: 1970, 1982 and 1991.

	,Male			Female		
School Type	1970	1982	1991	1970	1982	1991
No School	814	570	428	609	422	307522
Primary	16,359	13,377	14,925	16,955	13,804	14,069882
Secondary	651	5,328	9,638	862	6,159	11,3166,543
University	45	112	169	20	86	1581,612
Other	139	744	173	299	1,303	26424
TOTAL	18,008	20,131	25,333	18,745	21,774	26,1149,583

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

- The Secondary Level

The secondary level educational component covers the persons in the age group 12 – 18+ years. The enrolment in the primary level was 7,307 for the academic year 2000/01. Another national pattern mirrored in St. Thomas sees enrollment exceeding capacity.

Referring to Table 4. There have been impressive advances in the number of persons 15 years and over, attaining secondary level education. This is seen in both sexes, from just 1,500 persons in 1970 to about 21,000 in 1991. Expressed in percentage terms, in 1970, proportion of the population 15 years and over with secondary schooling accounts for about 4% and 5% of the male and female. In 1991, proportion of the population 15 years and over with secondary schooling accounts for about 38% and 43% of the male and female

Health Services

The delivery of health services in the parish of St. Thomas is organized through 4 Heath Districts, which are further disaggregated into 22 Health Centres. All indications point to an adequate number of facilities to meet the medical needs of person in the proposed development. The major comprehensive health provider is the Princess Margaret Hospital and notwithstanding deficiency that are typical to the health services island-wide, is adequate to serve the parish's major medical needs. (Table 6)

Post Office

There is an island-wide program to upgrade the postal service in all parishes. Any efforts that could hasten the implementation of needed upgrade for the post offices and postal agencies in Morant Bay and Seaforth would be aided the efficient delivery of mail to the residents in the proposed development.

Fire Stations

The typical response times in the event of a fire is 5 minutes. The closest fire station is located at Morant Bay, given the distance of the proposed site to Morant Bay, it is estimated that the response time would be exceeded by at best 15 minutes. This is unacceptable and should be given special attention by the appropriate authorities.

Recreational Facilities

The project is designed to provide adequate parks and open space for recreational use. There are also recreational sites in Bath, namely Bath Botanical Gardens, and bordering the former Goodyear Factory. The coastline of St. Thomas offers beaches and beach parks that can be easily accessed by road.

Existing Infrastructure

Electricity

The 1991 census reported more than 50% of the households in St. Thomas receiving electricity compared to 32% in 1982. Paralleling this growth has been the decline in the use of kerosene for lighting, from 68% to 49% in 1991.

Telephone

The dependence on Cable and Wireless Jamaica Ltd. to provide telephony services has reduced substantially. This resulted from the increase use of mobile telephony through the introduction of new mobile companies, namely Digicel and Centennial. With the increase in telephony providers, there will be adequate telephony service for all households in the new development.

Water

The sanitary conditions in a parish can be best judged by the availability of piped water. In the 1991, census 22.7% of all households in St. Thomas had water piped into their dwellings. The public Standpipe remained in 1991, as the single most important source of water for households.

The National Water Commission (NWC) which has responsibility for the provision of potable water, has completed it's water demand/supply study. It has concluded that adequate water resources exist to supply the potable water needs of the proposed development. A copy of the NWC's approval letter is available as required (see appendix 9).

Roads

Access to the proposed site occurs from a single secondary road, which serves the town of Seaforth. It is expected that the proposed development will add an additional 100 cars in the first year after completion, with a further 200 within 4 years. There will be additional traffic especially during the construction phases,

which may extend over 10 years as additions to houses proceed. The existing road surface requires urgent upgrade and at least one connecting bridge requires expansion.

HEALTH AND SAFETY

There is no municipal dump in St. Thomas and household refuse has to be transported to Portland or Kingston for disposal. This situation is not sustainable in the log-run. There is need for the parish council to identify a site in St. Thomas for Solid Waste Disposal.

Any major development project must prioritize the safety of their workers and surrounding inhabitants. It is expected that all necessary measure shall be employed by the contracted service providers to ensure such safety.

HISTORICAL MONUMENTS AND SITES OF ARCHEOLOGICAL VALUE

The proposed site has been used for agriculture over the last 100 years. In recent times large-scale banana production (predominantly for export) took place as part of the Morant Lands Estate agriculture processing activities. The demise of the estate resulted on subsistence farming, consisting of various crop types replacing banana cultivation.

On the area identified for the proposed development, the study team did not identify any historical monuments. Archeologically valuable sites were not identified.

AESTHETICS

The proposed development details the establishment of farms along the southern section of the development bordering the river. It is important that the agricultural practices are environmentally correct and not threatening to the households that would inhabit the northern sections of the property. These is

provision for parks an open spaces in the plan and these appear adequate given the scale of the development. A landscaping design that places emphasis on soil conservation is best suited for this project.

Considering illegal sand mining in the Morant River. There has been minimal illegal sand mining activity in the vicinity of the proposed site. It is however recommended that the Mines and Geological Division consider the granting of licenses to qualified operators to mine material in the river channel, as part of activities aimed at minimizing erosion of the river's banks and flooding.

ATTITUDES

Much of the population of St. Thomas is employment in Kingston, where wages are typically higher and employment opportunities greater. Increasingly, inhabitants of Kingston are seeking residential units in St. Thomas, seeking to escape the high housing cost and high crime levels that affect Kingston. These twin factors are catalytic in supporting projects that provide increased housing in the parish.

The project will provide economically priced 2-3 bedroom units. With the reduction in mortgage rates at the NHT, these should be increasingly attractive to prospective buyers. This should allow increased numbers of persons of differing income levels to benefit from the development.

CHAPTER FOUR

SEWAGE

CONCEPT

The concept of the sewage disposal has been concluded after reviewing the technical state, provided by the Water Resources Authority (WRA) (March 15,2002). The design will incorporate a septic tank with a leaching field. The treatment provided by the septic tank is the reduction and stabilization of solids. Subsurface leach fields will accomplish the safe disposal of the septic tank effluent by the treatment process of filtering, percolation, soil absorption and evapotranspiration.

The septic tank should have two components. The first component acts as the Primary clarifier where the majority of grease oils and retained and digested solids are removed. Waste water is retained in the first compartment to allow the settled solids to separate from the waste water and be deposited on the bottom of the tank and for the scum to float to the surface. The first compartment also performs the function of an anaerobic digester where bacteria in the tank break down some of the heavy solids (sludge) that have accumulated at the bottom.

An interior baffle separates the first compartment from the second compartment. The baffle permits the waste water from the clear water space between the sludge and scum layers to flow from the first compartment into the second compartment without carrying solids over from the first compartment. The second compartment acts as the secondary clarifier.

The sludge volume reduction that occurs in the first compartment is the result of a natural biological treatment process. The reduction of solids contained in the wastewater entering the second compartment is important because it greatly reduces the quantity of solids entering the leach field.

Although digestion of the settled solids is reasonably good some sludge accumulate and tank must be de-sludged at regular intervals once every 1-5 years. Upon investigation, while in use the tank should be emptied when it is approximately one-third full of sludge.
The effluent from the septic tank is, from a public health point of view, as dangerous as raw sewage and will require further treatment.

The second stage of sewage is the biological breakdown of the effluent, which takes place in a leaching field. The leaching field is generally constructed of perforated pipes in trenches that permit the wastewater from the septic tank to percolate through the soil. The proposed leaching field should be lined with poly ethyl (plastic) at its base to prevent ground water contamination. The trenches should be backfilled with pea gravel and sand below the perforated pipes (see appendix 14).
The permeability of the leaching field will eventually decrease under continuous inundation hence if possible the use of two leaching fields is recommended, to promote the maintenance of anaerobic conditions in the leach field and thus extend the useful life (see appendix 14).

DESIGN

Assuming five persons per lot, the average daily flow of sewage is 5 x 70 gallons/day resulting in an average daily flow of 350 gallons per household.

The purpose of the septic tank is to receive excreta and other wastes to provide a first stage treatment involving sedimentation and sludge digestion in the dual-chamber tank. The effluent from the tank contains 20–40% of the influent suspended solid and has relatively high Biological Oxygen Demand (B.O.D). Most of the solids must be retained in the septic tank so that the discharged effluent does not cause excessive clogging around the drainage trenches of the leaching field.

Generally the design capacity for a lot which may accommodate a dwelling for the proposed development may have an occupancy level of 1 –5 persons this will utilize a septic tank of 750 gallons. In consideration of further demand the recommended size should facilitate 1,150 gallons.

The design of leaching field is dependent on the percolation rate of the soil test being conducted.

The proposed septic tank must be at least 36 square feet, which would be ideal for a two-bedroom occupancy.

The capacity of the proposed design will facilitate 1,150 gallons of influent, which would have a retention time of 3 days, at start up.

The area, which the leach field will occupy, would be at least 117 square feet.

ANALYSIS OF FUTURE DEMAND

The septic tank has been designed to facilitate a capacity of 1, 1500 gallons with the number of persons being served being 6 –11 persons. An additional leaching field has been proposed promote to the maintenance of anaerobic condition and thus extended its useful life.

MANAGEMENT OF PROPOSED SYSTEM

The proposed septic tank and leaching field will require maintenance from the owners of each lot and should be de-sludge at least once in every 1 – 5 years. Grease traps should be provided for effluent leaving the bathroom (not from water closet), washrooms, and kitchens to minimize the volume of grease entering the septic tanks.

The features for the disposal system (manholes, grease traps, septic tanks and leaching fields) must be approved by the Parish Council before construction. A caveat must be on each title to ensure that property owners adhere to the proposed method of sewage disposal. The entire construction process must be monitored to ensure compliance.

ANALYSIS OF THE EFFECT OF THE TREATED EFFLUENT ON THE RECEDING ENVIRONMENT

The proposed sewage system will have no effect on the environment as the BODs, SS and coliform organisms will be very low after it passes through the soil about 0.09m deep.

LOCATION OF TREATMENT SOLUTION

The septic tank and leaching field should be at least 1.5 m from the nearest boundary or dwelling. No other structures should be placed above septic tanks or leaching fields. The lot size should be a minimum of 550 meter square to facilitate on lot sewage disposal (Recommended) by the National Environment and Planning Agency).

ALTERNATIVE:

The alternative method of sewage disposal to be contemplated is that of a central system. The central system however is quite expensive and the issue of

management becomes another problem. Often the management of the central systems are left to the NWC and the proposed beneficiaries. It must also be noted that sewage effluent standards must adhere to NEPA"s Sewage Effluent Standard attached in the appendix. (see appendix 10)

CHAPTER FIVE

POTENTIAL SIGNIFICANT ENVIRONMENTAL IMPACTS

Flood Hazard Potential

Potential for Flooding - Morant River

The subdivision is situated on the flood plain of the Morant River. There is the potential for flooding during high flows, particularly on the southwestern boundary of the property.

The deposition of large volumes of sediments in the river has raised the level of the channel increasing the susceptibility to flooding.

Available data from MGD suggests that the hills above Seaforth and Whitehall, drained by tributaries of Morant River are prone to landslides and contribute to deposition of large volumes of sediments in the Morant River.

During field visits to the site, the height of the river during moderate flows was less than 0.3 metre below the level of the riverbank.

The Morant River is currently going through dynamic changes where there is deposition of material in the centre of the channel and erosion along the sides of the river resulting in changes in the river's geometry. These changes are likely to accelerate flooding on the site near to the river if not remedied by corrective measures.

Potential for Flooding from Gullies

Flooding normally occurs in the shallow depression proposed for community open space and play field. Regular flooding also occurs on the main road where the drainage overflow from the meandering gully crosses the road, then runs parallel to it for approximately 150 metres. This flooding normally originates where the north meandering south and west east drainage features confuence near the northern western section of the site.

Tributaries (minor waterways) of the two gullies drain through housing lots for proposed subdivision. Under existing conditions, many of these lots will be flooded during high flows if flood control measures are ignored for this area.

Increased flooding from gullies could occur where there is evidence that landslides and erosion in the upper reaches of the drainage channels in the north results in deposition of sediments raising the level of drainage channels to cause overland flow.

Flooding from Backflows

During high flows in the Morant River, backflows in the gullies may be created when run-off from the hills in the north is backed up at the confluence of the gully and Morant River when the river is in spate. When backflows are created in the drainage system, it eventually leads to flooding. Further, if the gullies are blocked along main crossings such as culverts, etc., then potential for flooding increases. There was evidence of flooding on the main road where one of the gullies crosses the roadway because the culvert was blocked by other debris

An example of flooding from blocked culverts occurred during recent heavy rains, resulting in flooding and erosion of the main road and surrounding land within the subdivision.

Erosion Potential

The alluvial sediments that make up the riverbank are loose and highly erodable. The potential for erosion along the bank of Morant River and major bends of gullies draining the site is high due to the erodability of soil material.

During the recent May 2002 flood rains, the bank of the Morant River showed signs of excessive erosion resulting in loss of land on the southwestern margin of the subdivision. A subdivision road recently cut prior to heavy rains and aligned parallel to the river has partly broken away due to erosive action of the river.

Erosion surfaces are very evident, particularly along major bends in the drainage channels. An earth berm near the proposed community open space has been badly damaged due to excessive erosion from the gully draining the site.

The wingwalls of the bridge under the main road is being threatened because of undermining of the gully bank at that location due to erosion. Urgent erosion protection measures are necessary to maintain the integrity of the bridge structure.

Slope Stability and Landslide Hazard

Essentially, the proposed subdivision is flat to gentle sloping. The potential for slope movement or landslides on the site is very low. However, further to the north and north west from the subdivision, the land rises gradually to form limestone hills and weathered/altered volcanic rock slopes, the latter being potentially unstable to slope movement. Since the Morant River and its tributaries drain these areas, there is the likelihood that high levels of deposition could occur from rock and debris slides and debris flows originating from the steep hillsides. Channels of the river and gullies on and in the vicinity of the site will be elevated, thereby contributing significantly to flooding.

SOCIO-ECONOMIC IMPACTS

POPULATION

1. Increase in population
2. Negative impact on vegetation cover

TRAFFIC

1. Increased traffic flow
2. Increased potential of accidents due to an increase in pedestrian traffic and motor vehicle traffic

HEALTH

1. increased noise pollution during and after construction
2. Dust Pollution during construction

POTABLE WATER

1. Increased demand for water due to an influx in the population.

SOLID WASTE DISPOSAL

1. Increased solid waste
2. Additional pressure on the already overburdened disposal site both during the construction phase and during operation
3. Spillage of debris on the roadway during construction
4. Odour

DRAINAGE

The potential for flooding is quite high in this area due to the nature of the site.

BIOLOGICAL IMPACTS

TERRESTRIAL FAUNA

The single most important threat to avifuana and other terrestrial fauna in Jamaica is habitat loss. As such, the complete removal of vegetation for the establishment of the proposed development will greatly impact on the future existence of resident on-site species as well as endemic species for which the tree canopies function as concealment and nestling purposes.

Further disturbance resulting from pollution)due to noise and dust) as well as human trafficking could serve as a deterrent to the species which are dependent on the resources of these habitats for the purposes of feeding, nesting and raising their young.

FLORA

1. Owing to the erosion of the banks of the Morant River presently, soil erosion and land slippage becomes a major issue if vegetation cover is removed from these areas. This would be intensified by periods of heavy rainfall during the construction stage of the development. The removal of the vegetation from these points along the Morant River at any stage of the development would threaten the stability of the river bank.
2. Excavation and grading exacerbate the situation.
3. From the species collected and observed, there would be loss of one endemic species (*Bumelia nigra*) during the development.

4. Heavy machinery as well as storage of construction materials compacts soils making them even less permeable and thus destroying soil structure. This reduces the regenerative potential of vegetation.
5. The possibilities of flooding and severe soil erosion during periods of heavy rainfall are intensified if the vegetation along the banks of the river and the natural ravines are removed.

POST-DEVELOPMENT IMPACTS

The development plan for the site is shown in Appendix X. Housing lots will be located on the slopes at the northern section of the property and on the southern section of the property paralleling the main road. The remainder of the property is reserved for agricultural use, opens pace/playing field and sewage ponds.

It is proposed to construct a cut-off drain on the northern slopes. Major drains are also proposed to carry run-off from the northern section of the site into the Morant River. Minor drains (curb and channel and road side ditches) are proposed for the roads in the sub-division. River Training works along the southern boundary of the property and a berm is also proposed for the north-western section of the development to protect the housing lots in this area from flooding from Gully B.

The proposed drainage plan for the site will significantly reduce the risk of flooding from the gullies in the area planned for housing development north of the main road and also flooding along the roadway. The proposed river training works will however not significantly reduce the risk of flooding to the section of the property south of the main. Preliminary estimate indicates that this area could be inundated by the 10 Year Return Period peak flow in the Morant River.

Flooding from the Morant River could adversely impact the housing and agricultural lots south of the main road and the sewage ponds.

As with any development the change in land-use will also cause a change in runoff volume and pattern from the site. The construction of buildings, roads and other paved surfaces will result in increase runoff from the site.

The housing lots north of the main road will occupy approximately 14.3 hectares. This represents less than 3 percent of the total drainage area of the gullies impacting the site. Post Development runoff from the housing area north of the main road is expected to increase by approximately 50 percent. This increase however represents only approximately 6 percent of the runoff from the gullies. Increased runoff from the northern section of the site is not expected to significantly increase the risk of flooding in this area, given the proposed improvement to the drainage.

CHAPTER SIX

DIASTER VULNERABILITY

RAINFALL

The nearest rainfall stations to the site with long-term data are located at Seaforth, Middleton, Belvedere and Morant Bay. The 30-Year mean annual rainfall for the Seafort, Middleton, Belvedere and Morant Bay Stations are 2200 mm, 2522mm, 1915 mm and 1992 mm respectively (Table 1). There is a decrease in average rainfall depth from north to south.

Rainfall for Middleton is probably most representative of the site. The mean monthly rainfall for this station varies from a low of 58 mm in March to a high of 409 mm in October.

TABLE 1: 30-YEAR RAINFALL (1951-1980)

STATION	J	F	M	A	M	J	J	A	S	O	N	D	Total
Belvedere	74	46	33	71	221	221	155	133	297	330	180	104	1915
Middleton	97	102	58	102	267	254	229	257	335	409	229	183	2522
Morant Bay	72	52	46	92	222	201	137	152	282	466	167	103	1992
Seaforth	86	69	48	81	246	241	193	208	302	371	213	142	2200

Source: National Meteorological Service

The estimated maximum 24-hour rainfall for the Seafort, Middleton and Morant Bay Stations are presented in Table 2. The estimated 24 -hour rainfall for the Middleton Station ranges from 274 mm (5-Year Return Period) to 556 mm (100 Year Return Period). It is significant to note however that rainfall intensity of 1109 mm in 24 hours was recorded at Bowden Pen on January 23, 1960.

TABLE 2: ESTIMATED MAXIMUM 24-HOUR RAINFALL

STATION	5 Year	10 Year	25 Year	50 Year	100 Year
Seaforth	238	294	366	419	471
Middleton	274	342	429	493	556
Morant Bay	225	270	326	368	409

The section of the site reserved for open space was inundated by floodwater subsequent to the heavy rains over the period May 22-31, 2002. For the Morant Bay Station, 357.6 mm of rain fell over the period May 23 to 26, 2002. The Sunning Hill Station, located northeast of the site had 314.4 mm of rainfall in 24 hours on May 25, 2002. The rainfall at Sunning Hill on May 25, 2002 corresponds to a Return Period of 10 years. Similar data was not available for the Seaforth and Middleton Stations.

RUN-OFF

As discussed, majority of the site is located on the flood plain of the Morant River. The Morant River forms the south-western boundary of the site and is the dominant drainage system in the area. The Morant River is one of the major rivers draining the southern slopes of the Blue Mountains.

High siltation rate in the Morant River Watershed have resulted in significant deposition in the river channel in the vicinity of the site. The deposited material

has elevated the riverbed. The riverbed is estimated at 0.5m below the river bank in some areas. The difference in height between the riverbed and the section of the site south of the Morant Bay - York Main Road is approximately 2.0 m.

Drainage at the site is also influenced by a number of seasonal gullies originating on the slopes north of the site forming a dendritic drainage pattern. The most significant of these seasonal gullies is gully B located in Sub-Area B, with a drainage area of 302 hectares. Sub-Area B drainage area extends to Middleton in the north and Spring Garden in the east.

Gully A and B merges in the vicinity of Agricultural Lot #13, then flow in a south-east direction through Agricultural Lot #14 where it is also joined by Gully C. The gully then separates into two channels, one crossing the main road west of Lot 1 and the other between Lot 20 and 21. Both gully merges in the vicinity of Agricultural Lot 2 and 3 before joining the Morant River.

The site is also impacted by the gully in Sub-drainage Area D. The gully for this drainage Sub-Area crosses the road in the vicinity of Residential Lots 32 and 33 on the southern side of the main road. This gully also joins the gully drainage Sub-Areas A, B and C in the vicinity of Agricultural Lot #2.

The section of the site south of the Morant Bay - York Main Road is well drainage due to:

1) Existing drainage network
2) Proximity to the Morant River
3) High permeability of the underlying alluvium (sand, gravel and boulder).

The section of the site north of the main road is also fairly well drained. The area reserved for community open space/play field and Agricultural Lot 14 are

however flood prone and therefore poses drainage problem under existing condition.

The section of the main road adjacent to Agricultural Lot 14 is prone to flooding. Outflow from the gully flowing east through lot 14 is channeled along a minor road, and onto the main road in the vicinity of Lot 14 before crossing the main road via culverts.

The section of the main road where major gullies cross are also prone to flooding. This is due to constriction to flow caused by blockage of the culverts, and poor alignment of the culvert with drainage channel. Runoff from these gullies is fairly rapid and therefore flooding of the roadway is only temporary.

FLOODING HISTORY

Based on informal interviews with resident at York, there is no recollection of flooding of the section of the property south of the main road. Flooding of Agricultural Lot 14 and the area reserved for open space/play field is however a regular occurrence. Flooding in this area occurred as a result of the heavy rains over the period May 20-30, 2002. The rainfall over this period for the site had a return period of 10 years. It is obvious that even at low to moderate rainfall intensity this section of the site is flooded. During the site visiting on July 4, 2002, evidence of the flooding of the site was very obvious. Debris brought down by the floodwater was scattered all over the site.

The island experienced major floods 1986, 1993, 2001 and 2002. The author saw no documented evidence of these flood events significantly impacting site. However, based on interviews with personnel from the Water Resources Authority the section of the site south of the main road was inundated following the flood rains of January 26, 1993.

The lack of information on flooding of the site is most likely due to the fact that the site is presently not occupied by housing. Flooding in none residential areas tend to be under-reported/documented.

FLOODING FLOWS

The Water Resources Authority (WRA) does not monitor streams flow in the Morant River in the vicinity of the site and therefore there is no measured flow at this location. Flood flow estimated by the WRA for the Morant River in the vicinity of the site is presented in Table 3.

TABLE 3: ESTIMATED PEAK-FLOW - MORANT RIVER @ MORANT FARM

RETURN PERIOD (YRS)	ESTIMATED FLOW	
	(cfs)	m^3/sec
2	9,794	277
5	22,671	642
10	32,332	916
25	45,508	1289
50	55,338	1567
100	65,441	1853

Source: Water Resources Authority.

The hydrologic analysis carried out by the WRA indicates that a substantial portion of the site, south of the main road would be inundated by a 10-Year Return Period flood.

Flood flows from the major gullies impacting the site were, estimated by the Rational Method (Table 5). The parameters used in the estimation are presented in Table 4 and the methodology as shown in the Appendix. (see appendix 11)

TABLE 4: PARAMETERS FOR ESTIMATING PEAK FLOW

T_c minute	GULLY	AREA (hectares)	Runoff Coefficient					Rainfall Intensity (mm/hr)				
42	A	55	0.42	0.44	0.48	0.51	0.54	58	68	80	80	100
60	B	302	0.42	0.44	0.48	0.51	0.54	33	40	48	53	59
16	C	51	0.42	0.44	0.48	0.51	0.54	98	114	140	154	172
16	D	36	0.42	0.44	0.48	0.51	0.58	98	114	140	154	172

T_c - Time of concentration

TABLE 5: PRE-DEVELOPMENT PEAK FLOW IN GULLIES

GULLY	PEAK FLOW - m^3/sec				
	5 Years	10 Years	25 Years	50 Years	100 Years
A	3.75	4.61	5.91	7.07	8.32
B	11.72	14.88	19.48	22.86	26.94
C	5.88	7.16	9.60	11.22	13.26
D	4.15	5.06	6.77	7.92	9.36

The estimated peak flow in Gully B above the confluence with Gully A ranges from 12 m^3/sec for the 5 year Return Period to 27 m^3/sec for the 100 year Return Period.

The flow in Gully A combines with the flow from Gully B in the vicinity of Agricultural Lot 14. Flow in Gully C also combines with the flow from Gully A and B on the eastern side of the Agricultural Lot 14. The Flow from both gully crosses the main road via two box culverts, flowing through the housing lots south of the main road and eventually discharging to the Morant River.

CHAPTER SEVEN

MITIGATION

FLOOD MITIGATION

Mining of Morant River

River mining is to be encouraged in the Morant River in order to remove excess sand and gravel from the riverbed and lower the channel of the river, hence minimize flooding. The proposed River Training Cost is $ 43,000,000. The Mines and Geology Division should consider the granting of license to qualified quarry operators to mine material in the river channel.

Landuse Zoning

Revised development proposal for Morant Farms shows a mixture of residential and agricultural land use. The high risk flood prone areas are proposed for agricultural purposes, while residential lots are on land of higher elevation north of the main road and on a narrow strip south of, and parallel to the main road. The proposal to have agricultural lots on flat areas near the Morant River is recommended since it removes residential lots away from high flood hazard

zone. This is recommended since it removes residential lots away from high flood hazard zone. Other flood prone areas caused by gully overflows are proposed to be used as open spaces in the revised subdivision plan, and this is also recommended.

Re-alignment of Gully

The north – south meandering gully which drains on the north western border and then easterly to Morant River needs to be realigned to minimize the impact of flooding and erosion on site where residential development is proposed.

In order to protect the residential lots from flooding, an alternative is to construct rock berms between the meandering gully and residential lots on the northwestern boundary.

The re-alignment of the drainage channel should in most instances follow the natural drainage pattern/direction on the site.

Given that the gully is aligned to drain in a southerly direction along its drainage path, at the location, then flooding of the main road and agricultural areas in vicinity of proposed lot 14 will be minimized.

Control of Minor Gullies

Small gullies, or tributaries of major gullies which originate on the northern section of the site is proposed to drain through residential lots before ending into major gullies on site. Given that the site at that location could have drainage problems if developed under existing conditions, redirecting flows into kerbs and channel structures on to proposed subdivision roads must control the minor

drainage features. In addition, there should be allowance for drainage easement between lots where necessary to direct flows into main gullies.

Since the source of tributaries originate at the foot of the limestone hills on the northern boundary, it may be necessary to reduce or eliminate flows emanating from this area. Cut-off drains could be used on the foot of the hill aligned parallel to the ridge so that runoff can be collected and directed into existing major gullies.

Maintenance of Drains

Tree trunk, trash and other debris normally block hydraulic structures. When this occurs, drainage channels must be regularly cleaned to prevent blockage during rainy periods and minimize flooding. Where necessary a drainage maintenance programme should be designed to ensure that drainage maintenance schedules are adhered to and should involve the participation of the residential community.

Construction of Temporary Berm on Morant River/River Training

As part of the mining operations recommended in the river channel of the Morant River, sand and gravel material should also be placed on the bank of the Morant River in the vicinity of the site. A minimum height of 1.5 metres is recommended for the berm and this would assist in flood protection of lands proposed for agricultural purposes. Run-off calculations from flood analysis could also be used to assist in the design of the temporary embankment structure. For long term mitigation and protection, the project proponent is proposing to invest in detailed river training (Gabion Basket being contemplated).

Erosion Protection Measures

Meandering gully on the north- western boundary is to be straightened, thereby minimizing erosion along bends.

Major bends along gully courses should be protected by gabion structures; for example, drainage channels that run through proposed lot 14 for agricultural use, should be protected at the location where the direction of flow changes.

The wingwall of the bridge on the main road needs to be stabilized using gabion structures.

Landslide Mitigation Measures

Flood analysis and modeling must include parameters that contribute to elevating river/gully channels during major rainfall events.
Continuous mining of the bed of the Morant River to be encouraged in the vicinity of the site.

Site Grading

Site grading will be required in preparation for construction of residential lots. As part of the grading exercise, minor drainage ways will be filled to facilitate development on the northern section of the subdivision.

Provided that flows from the foothills are eliminated using cut-off drains, it is recommended that suitable back-fill such as river aggregate be placed in gully areas and be properly compacted to improve ground conditions at those locations for building foundation purposes.

SOCIO-ECONOMIC MITIGATION

1. A re-vegetation exercise would be put in place to address the removal of vegetation

2. To address the impact of increased traffic the project proponent through the appropriate agency, will ensure that road signs are erected guiding vehicular movement. Speed limit signs should be established to regulate and reduce the possibility for accidents.
3. To reduce the possibilities of increased noise during the construction phase the project proponent will ensure that construction activities are limited to regular working hours. Dust abatement may be achieved through the use of sprinklers on a regular basis.

BIOLOGICAL MITIGATION

TERRESTRAIL FAUNA

In order to negate these effects, areas which consist of woody phanerophytic (over 3m tall) vegetation could be preserved as possible green areas in the development. In addition, the preservation of large trees during site preparation and development activities should be encountered to reduce furter habitat loss to the resident and visiting species to the site. This would consequently establish certain conservation measures where these species are concerned.
Additionally, equipment fitted with noise reduction devices such as mufflers could be used.

FLORA

1) Use soft engineering techniques for the stabilization of soil, such as vegetative stabilization in preference to built structures.
2) Have temporary control plans to reduce soil erosion during construction (e.g. silt fencing, trash barriers and short term seeding or mulching of exposed soil).
3) To avoid soil compaction, limit access to heavy machinery and to the storage of materials.

4) The possibilities of flooding and severe soil erosion during periods of heavy rainfall could be lessened if further measures are taken to stabilize the banks of the river and the natural water channels (ravines).
5) The development should be designed giving just consideration to areas of unstable soil or subsurface conditions.

MITIGATION COSTS

Development costs for this proposed development is expected to be quite high. This is as a result of the proposed site location which requires serious investment in the protection of the natural environment, property, and life. The major mitigative measure which is expected to control effect of flooding from the river is that of river training. Preliminary estimated costs is coming out at 43 million Jamaican dollars. Other mitigative measures suggested above (berm construction, drain maintenance, re-alignment of gullies) are coming out at a modest 20 million Jamaican dollars. One of the measures proposed, mining of the Morant River is expected to generate income for the local inhabitants.

Other measures will be incorporated as a matter of policy and will be budgeted for within the respective agencies (Ministry of Local Government and Ministry of Land & Environment). These measures speaks to issues such as public education, disaster response and management.

CHAPTER EIGHT

DISASTER MITIGATION AND MANAGEMENT

Emergency preparedness is aimed at minimizing the loss of life and the loss of life and property during a natural event. Preparedness includes actions taken in anticipation of the event and special activities both during and immediately after the event.

Two levels of preparedness can be identified: public safety information and hazard awareness planning. The first includes a number of efforts aimed at increasing the amount of information disseminated to the public and promoting co-operation between the public and the authorities in case of an emergency. In the course of an event, or in its aftermath, social and public behaviour undergoes important changes.

Flood awareness planning is concerned about improving the ability of a particular area or region to respond to a flood. Disaster preparedness promotes the development of a system for monitoring known hazards, a warning system, emergency and evacuation plans, emergency routes, and the formulation of educational programs for public officials and professionals.

FLOOD RESCUE AND RELIEF

After a flood calamity local residents usually undertake the first relief activities. However, their efforts must usually be complemented with those of national or regional authorities. The Office of Disaster Preparedness and Emergency Management (ODPEM) will advise you that the keystones of post- flood disaster relief are the preparation of lifelines or critical facilities for emergency response, training, disaster rehearsals, and the identification and allocation of local and external resources. For Morant Farms, the nearest shelter, in the case of flooding or other disasters, is the Paul Bogle Junior High and the Seaforth Primary schools. The local churches are also used.

POST-FLOOD REHABILITATION AND RECONSTRUCTION

Concurrent with or immediately after relief activities, post-disaster rehabilitation is carried out to restore the normal functions of public services, business and commerce, to repair housing and other structures and to return production facilities to operation. However, mitigation is often ignored in this phase: rehabilitation proceeds without any measures to reduce the chances of the same impact if the event happens again. In a developing country such as ours, road systems that are flooded or blocked by landslides year after year are commonly rebuilt at the same site and with similar design specifications.

In considering reconstruction costs however, existing development policies and sectoral projects need to be reevaluated. In many cases, they are no longer appropriate or do not coincide with the best use of natural resources.

EDUCATION AND TRAINING

Education and training, both formal and informal prepare people at all levels to participate in hazard management. Informal learning can be delivered through brochures, booklets, and audio and video tapes prepared by the Office of

Disaster Preparedness and Emergency Management and other relief groups such as Red Cross and OAS and through the national media. Additionally, courses, workshops, conferences, and seminars organized by nationally and by community organizations disseminate great amounts of information relief management and strategies.

Finally, direct observation after a disaster has proved to be one of the most effective means of learning. Post-disaster investigations describe the qualitative and quantitative aspects of natural hazards such as flooding often improving on information produced by modeling and conjecture by indicating areas where development should be extremely limited or should not take place. A direct outcome of the learning process is:

1. the improvement of policies and program actions, building codes, standards, construction and design skills.
2. the improvement of the key logistical aspects of disaster prevention, such as communication and warning systems.
3. the establishment of community and resource organizations to confront similar future disasters.

FORWARD PLANNING

In reality, the planning process in development areas does not usually include measures to reduce hazards, and as a consequence, natural disasters cause needless human suffering and economic losses. Therefore from the early stages of the process critical assessments have to be done, hence the need for this study (EIA). Adequate planning can minimize damage from flood events.

People being attracted to flood prone areas or otherwise marginal lands is not unique to St. Thomas or even Jamaica. This issue is quite ancient and is due highly to the relegated locus for urbanization, particularly for low-income families. How the land is used and developed can change the risks resulting

from floods. While some activities can be designed to mitigate the effects of flooding, many current practices and structures have unwittingly increased the flood risk.

Clearing the floodplain for agriculture permits a progressively higher percentage of a large flood discharge to be carried by the floodplain. Some parts of the flood are eroded, as is the case in Morant Farms, and other parts are built up by deposition of coarse sediment, while the channel capacity of the river channel is gradually reduced.

Drainage and irrigation ditches, as well as water diversions, can alter the discharge into floodplains and the channel's capacity to carry the discharge.

Deforestation will reduce the vegetation and forests absorption capacity, thus increasing run-off. Urbanization of a floodplain or adjacent areas and its attendant construction increases runoff and the rate of runoff because it reduces the amount of surface land area available to absorb rainfall and channels its flow into sewers and drainage ways much more quickly.

In short, floodplain dynamics are basic considerations to be incorporated in an integrated development and planning project. It is essential that recognizes that that the changes brought on by development can and will affect the floodplain in many ways.

CHAPTER NINE

ENVIRONMENTAL MONITORING PLAN

Flooding

As discussed earlier, the area is undoubtedly proned to flooding. There are several monitoring mechanisms that can be established.

- Implementation of effective engineering measures to protect roads from inundation.
- Simply ensure that proper solid waste control measures are adhered to in order to avoid poor quality of run-off and the transport of debris in the water bodies during heavy rainfall events

This will be montored by the project engineer, the project contractor and the project proponent.

Development Control

At this point the Local Parish Council would have received application plans for the proposed residential units. The Parish Council should ensure that buildings are erected according to what have been proposed and nothing less or more. In the case of the contractor, that minimum standards are adhered to.

Sewage

In this instance, the method of sewage disposal being prepared is Septic Tanks/Tile fields. The engineer and project proponent should ensure that the septic tanks and the tile fields are built to required specifications.

Public Amenities/Open Space

There will be increased need for public amenities and Open Space. It is quite crucial therefore that the community groups collaborate with non-government agencies and their elected representative to ensure the establishment and maintenance of these facilities..

Disaster response and management

The community members will need training to be able to respond effectively to the prospect of heavy rains and flooding. There needs to be an effective public education programme which should be undertaken by the Office of Disaster Preparedness and Emergency Management.

Community Based Organizations

There exist the need for a community based organizations within the Morant Farms Area, to ensure the follow – up of development proposals. Community Based Organizations are not new. They are set up as a means of social organization at the local level and was first promoted in Jamaica in 1938 which helps to foster social and political change. They aim to rationalize and guide development activities and seek to ensure that proposed developments do not impact negatively on the environment. St. Thomas has STEPA (the St. Thomas Environmental Protection Agency) which acts as a watchdog for St. Thomas. Any CBO which evolves out of this area, can work closely with STEPA.

CONCLUSION

Development speaks not to what you have, but rather to what it is you do with what you have. The Morant Farms area, like other areas, is not without serious concerns and issues, but as outlined in the body of this document, once the issues are identified and addressed, the project proponent can produce a development which is not just acceptable, but safe for the present generation and the generation to come.

The location has been studied in detail. The physical, biological and environmental issues has been analysed and mitigative measures proposed to deal with potential impacts. It is identified that development costs will not be low due to required mitigative and protective measures, but this phenomena is not new to any well planned development. it must also be noted that as a matter of policy, that Operation PRIDE speaks to incremental development, and incremental development as we know it take place in phases. The critical issues of sewage and flood mitigation have been addressed in detail and the resources to address them identified.

APPENDICES

LIST OF REFERENCES

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Parish Development Committee – Parish Council

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