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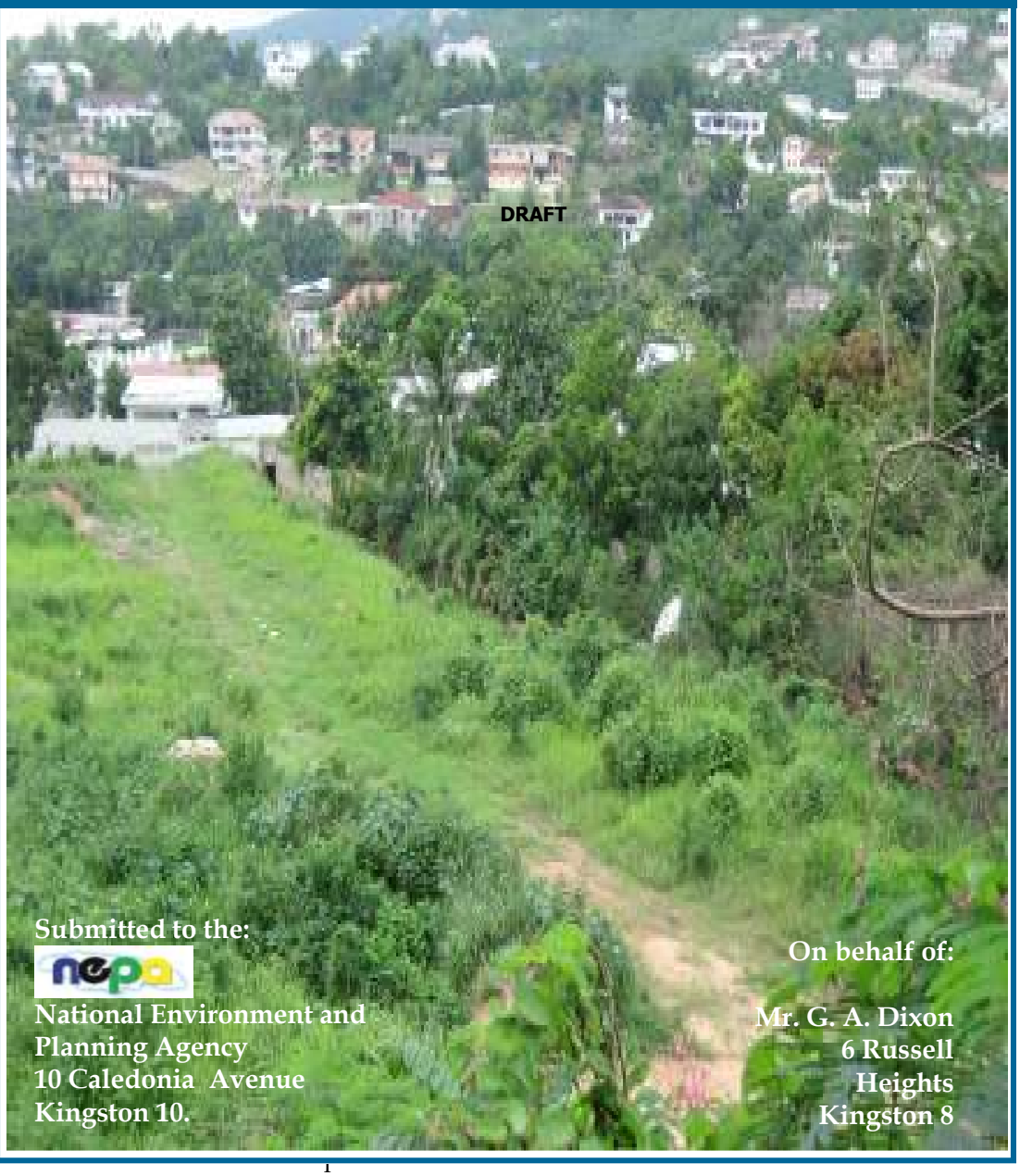
ENVIRONMENTAL IMPACT ASSESSMENT

FOR A PROPOSED RESIDENTIAL DEVELOPMENT –

PART OF AMBASSADOR HEIGHTS, ST. ANDREW



Submitted to the:

National Environment and Planning Agency
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On behalf of:

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2008 October 24

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EXECUTIVE SUMMARY

This Environmental Impact Assessment (EIA) is a prerequisite of the National Environment and Planning Agency (NEPA) under the Natural Resources Conservation (Permits and Licenses) Regulations, 1996. The mitigation measures together with the proposed Monitoring and Management Plan when implemented will serve to limit the extent of negative impacts on the existing environment.

E1. PROPOSED ACTION AND ALTERNATIVE

The proposed project will encompass a total of approximately 123 primarily residential lots on 93,176.77 square metres (23.02 acres) of land which has been earmarked for the development. The developer will provide both housing units and residential lots for sale to the middle to upper income level market.

E1.1 Infrastructure

Roads, Transportation and Traffic

The area can be accessed from both the Old Stony Hill Road and the Mannings Hill Road. The Ambassador Heights property is located along a Class C road which meanders and narrows in some sections.

The proposed development will consist of three (3) internal roads.

It is expected that route taxis and contract carriage buses will provide local transportation services in the development area.

Roads, Transportation and Traffic

The transportation of construction materials, solid waste and the labour force would temporarily increase traffic flow along the roadway.

This is not a high traffic volume corridor, therefore, the impact of traffic on air quality (PM2.5 and PM10 particulates, CO, and SOx) air would not be considered significant.

Potable Water

The National Water Commission (NWC) would ultimately be responsible for the water supply to the community through the Constant Spring Filter Plant.

Electricity/Telephone

The Jamaica Public Service Company Limited (JPSCo.) would provide electricity to development from its station in Constant Spring, Kingston 8.

Cable and Wireless (Jamaica) Limited (C&WJ) supplies land line and cellular services to residents in the area. Mobile service is also available through Digicel and Claro. The extension of landline service to the proposed development is within the capability of C&WJ.

Drainage

The property is bounded by the Shingle Hut Gully (northern boundary) and Mother Hector Gully (eastern boundary) which intersect and channel storm water flows southwards.

Solid Waste Disposal

The development will demand arrangements for solid waste disposal. Solid waste from the development will be disposed of at the Riverton City Landfill in St. Andrew. The Metropolitan Parks and Markets Waste Management Limited (MPM) through the National Solid Waste Management Authority (NSWMA) is responsible for solid waste disposal in Kingston and St. Andrew. The necessary mechanisms will be installed for accessing the services of the NSWMA.

Sewage

The development proposes the use of septic tanks discharging into a reed bed.

Landscaping

Currently the site is predominantly covered with vegetation, landscaping provides the means for making the site attractive, while improving its visual aesthetic character and highlighting the natural elements of the site.

E1.2 Alternatives to the proposed development

"No Action"

In the event that the development does not proceed, the proposed site is expected to maintain its natural characteristics.

E2. ENVIRONMENTAL RESOURCES

E2.1 Climate

Precipitation

The mean annual total of 1,639 mm of rainfall at Armour Heights (closest to Ambassador Heights) exceeded that of the adjacent monitoring station at Constant Spring (1,589 mm) and was more than twice that of Kingston and St. Andrew (KSA) (745 mm).

Temperature & Humidity

Temperature data for the Ambassador Heights area is not available; however, data from the monitoring station at the Norman Manley International Airport (NMIA) indicated a 30 year maximum temperature within the KSA of 31.9°C and a minimum of 22.3°C.

Relative humidity varies with elevation and as such, humidity within KSA varies with location. Humidity in St. Andrew ranges from 80 – 88 per cent in the morning to 64 - 90 per cent in the afternoon.

E.2.2 Geomorphologic Landscape

Limestone Karst Features

The Project Area is predominantly composed of white limestone hills (Mid Eocene to Lower Miocene in age). The Project Area is bounded on the east and north by gullies, which carry storm water from the surrounding areas, towards the south.

Slopes on the eastern side of the limestone hill are relatively steep varying from 15 degrees to 30 degrees, and on the south and west, the slopes are moderate ranging from 12 degrees to 18 degrees.

Structure

The 1: 50,000 Geological Sheet of Kingston reveals that the project area is hinged between two (north-west – south-east and north-south trending) geological faults. The northwest-south east fault is located immediately to the west of the site while the north-south fault forms the limestone gorge (a very deep gully) on the eastern boundary of the property.

E2.3 Soils

The Ministry of Agriculture soil maps (scale of 1: 50,000) broadly classify the soil on site as the Bonnygate Stony Loam (no. 77) type (Price 1960, Stark 1964). In this classification unit, about 75 per cent is Bonnygate soil type and 25 per cent is small areas of other minor types of soils.

E2.4 Hydrogeology

The Project Site falls within the Wagwater River Watershed Management Unit and is underlain by the Troy/Claremont Formation, which is characterized by a high degree of secondary permeability, associated with karstification and/or faulting. Due to the high permeability of this unit and its associated high infiltration capacity, perennial drainage within the Project Area is predominantly underground.

The gorge (Shingle Hut Gully) formed by the geological fault on the eastern boundary of the property acts as a main drainage area for storm water from the site and surrounding areas, while the Mother Hector Gully, which is partly fault controlled, forms the northern boundary and joins the main gully (gorge) on the north-eastern boundary of the site.

E2.5 Risk Assessment of Natural Hazard

The site's risk from natural hazards including hurricanes, earthquakes, and landslides varies. Runoff from the area impacts the potential for flooding downstream.

E3. BIOLOGICAL RESOURCES

E3.1 Fauna

Birds

Overall, the avian diversity of the study area is low. One hundred and eight (108) birds were counted within the study area belonging to twenty-six (26) species. Of these, seven (7) were Jamaican endemic species.

Butterfly Species

Eight species of butterflies were identified from the study area including one Jamaican endemic (*Mestra dorcas*) and one endemic subspecies (*Battus polydomas jamaicensis)*.

Other species

No wild mammal species were observed within the study area. Three species of lizards were observed, namely; *Anolis opalinus*, *Anolis grahami, and Anolis valencieni.* One nocturnal frog species (*Eleutherodactylus* sp.) was identified.

E3.2 Flora

The vegetation of the proposed development area is severely degraded with the entire site covered by secondary growth.

Species diversity was relatively high, however, both the tree diameter and canopy height were very low.

The other most abundant species were mainly introduced species characteristic of the vegetation of rural residential habitats.

E4. SOCIO-ECONOMIC IMPACT ASSESSMENT

The socio-economic, physical planning and spatial implications are extensive given the scale of the proposed development within the context of the KSA. It is with this in mind that physical planning measures that integrate economic, social and environmental aspects of development

within an interdisciplinary framework are to be implemented. This would ensure that sustainable comprehensive social and economic community development is achieved.

E4.1 Demographics

Population

The preliminary census data for 2001 revealed that the KSA population was 651,900 of which St. Andrew accounted for 555,828. The population of the Ambassador Heights area stood at 231.

Population Density

Kingston and St. Andrew have population densities of 4,760 persons per square mile and 1,254 persons per square mile respectively. The population density of Jamaica is 216 persons per square kilometre.

Population Projection

If it is assumed that an annual growth rate of about 0.29 per cent for the period 1991 – 2001 in St. Andrew remains constant; it is projected that the population will reach 567,210 and 581,620 in the years 2010 and 2020 respectively.

4.2 Existing Land use

The land use of the area is predominantly residential in nature with the exception of a quarry that is located about 500 metres south of the proposed development.

Housing

In 2001 a total of 192,713 households and 183,340 dwelling units were in KSA. Of these figures St. Andrew accounted for a total of 164,513 and 156,137 respectively or 21.9 and 21.6 per cent of Jamaica's total number of households and dwelling units. During this period there were a total of 110 households within the West Rural Enumeration District (# 64), which includes the Ambassador Heights area.

E4.3 Social Services and Amenities Infrastructure

Post Office

The Constant Spring and Stony Hill Post Offices would serve the proposed development.

Schools

The development lies on the outskirts of a school community. There is one (1) Primary and Junior High and one (1) High School within the vicinity of the proposed development. Two (2) Preparatory Schools are within close proximity.

Health Services

Hospitals and Health Centres within the KMA would serve the proposed development. The closest hospitals are the Andrews Memorial Hospital, the University Hospital of the West Indies (UHWI), Medical Associates Hospital and the National Chest Hospital (NCH). The closest health centre is at Stony Hill. There are also several private doctors in close proximity.

Fire Service

The Stony Hill Fire Brigade would serve the proposed development.

E4.4 Physical Infrastructure

E5. HEALTH AND SAFETY

Essentially, Health and Safety considerations in a proposed development activity speaks to minimizing and eliminating the effects of hazards on the safety and health of proposed residents and employees.

E6. PUBLIC CONSULTATION

The public consultation included telephone conversations with stakeholders and a survey conducted in communities within a 1 kilometre radius of the proposed site location. From the community survey, 30 persons (67 per cent) indicated that the proposal will be a positive venture, as it will lead to further development of the area.

E7. SIGNIFICANT IMPACTS AND MITIGATION MEASURES

Table E7.1: Geology and Soils: Significant Impacts and Mitigation Measures

INDICATOR	IMPACT & MITIGATION
Construction/Implementation	
Soils *Erosion Impacts*	**Impact** The area around the Shingle Hut Gully is generally unstable, thereby increasing the potential for erosion with incremental increase in development near to the gully. In the event of intense rainfall, high flows will have the potential to carry large rocks and debris from landslides and erosion on the steep gully slopes during development and post-development stages. This will eventually lead to blocked storm water drains onsite and offsite, particularly at the culverts down gradient of the site that is likely to contribute to overflows on the Mannings Hill Road. **Mitigation / Erosion Protection Measures** **A. Removal of Vegetation** The project area must not be stripped entirely of vegetation for construction purposes. It is important that vegetation be removed only in areas that are in the path of proposed infrastructure works and footprints of buildings. The preservation of vegetation cover will offer good protection to the ground surface during development and post-development stages. **B. Handling of Earth Moving Operations** Material excavated from earth moving operations during construction of roads etc. must be handled efficiently and removed quickly and economically to its final destination. Stockpiling of waste from construction must be carried out in areas that will not be affected by rapid runoff from the site. **C. Drainage and Erosion Control Measures** In the design of onsite drainage, it will become necessary to use sediment traps/grating to minimize blockage as a result of eroded material entering the drainage system. In such instances, buried drains are not recommended as this will be difficult to maintain if the drainage system is blocked on a regular basis.
Geology *Landslides* *Earthquake/Seismic Impacts*	**Impact** Information from the Landslide Susceptibility Map of Kingston (CDMP, KMA Project 1998) for shallow and deep-seated landslides indicates that the project site and its environs exhibit low landslide susceptibility. In a few areas however, moderate landslide susceptibility is shown in the vicinity of the site. The geological faults on the east and west of the project site have resulted in rocks that exhibit extensive fracturing and deep weathering on the slopes of the limestone hill. The large, loose boulders, cobble-size limestone and semi-intact rock are evident on the slopes. **Mitigation** Rock fall will be the main mode of slope movement on the project site. Large, loose or loosely attached boulders must be removed from the slope in a safe and economic manner. In cases where boulders are too large to be removed by mechanical means, the rock should be broken up by controlled blasting or by using pneumatic drilling method. **Impact** As indicated earlier, the project area is hinged between two geological faults and is, therefore, influenced by these geological structures. These faults are not known to be seismically active and therefore slip motion/movement on the fault planes is not anticipated. Loose and semi-intact rocks in the project area can be easily mobilized or detached from the slope by ground shaking during a moderate to large earthquake. **Mitigation** The type of housing structures that will best withstand moderate to large earthquakes are short, stiff structures such as single-2 storey structures. The height of these buildings responds best to long period waves which are frequently generated during large earthquakes. Reinforced concrete structures tend to withstand earthquake loads better than most other types of building structures. Un-reinforced masonry structures suffer badly during ground shaking and should not be encouraged.

Table E7.2: Hydrology and Water Quality: Significant Impacts and Mitigation

INDICATOR	IMPACT & MITIGATION
	Construction/Implementation
Hydrology *Flooding*	**Impact** No documentary evidence of flooding in the project area and its immediate surroundings was found for this study. Storm water from the site and adjoining areas drain directly into the Shingle Hut Gully and also to the subsurface. Downstream of the site, the Shingle Hut Gully crosses the Mannings Hill Road via a culvert. During heavy rainfall, the culvert is often blocked leading to flooding of the roadway and causing landslide damage on the road. Field observations indicate that there are new developments adjoining the project area and other sections of the sub-catchments. There is also available information that a number of medium to high-density development projects located in this watershed is at varying stages in the Development Approval Process for residential purposes. Groundwater flow is likely to be unconfined in this area and some level of subsurface drainage will enter the surface drainage system and contribute to surface flows where fault controlled gullies intercept elevated groundwater drainage. Development of the site for residential purposes normally leads to a 1.5 to 2-fold increase in storm water runoff caused by increase in pavement structures such as paved roads, driveways and sidewalks as well as runoff from roofs of houses. If the drainage system for the site is undersized and there will be frequent blockage due to rock/soil debris entering the system. **Mitigation/ Flood Protection Measures** **A. On-Site Flooding** Flooding is not expected to directly impact the project area because the land slopes in all directions. Flooding on site could occur if the system is blocked and could impact negatively on nearby communities; therefore, the preferred option is the design of u-drains for the development. **B Reduce Scouring at Drain Outfalls and in the Shingle Hut Gully** The construction of drop inlets will facilitate the reduction of run-off velocities, therefore , minimizing scouring. Gabion mattresses and rip rap works at all storm outfalls will provide adequate scour protection. Stepping of open paved drains running through the proposed recreational areas will also reduce critical velocities, therefore, reducing scouring. In order to protect communities downstream of the proposed development the required densities will be adhered to and low impact development (LID) principles will be practised as far as possible. **C. Upgrading of the Drainage System** In the medium to long term, upgrading of the off-site drainage will be necessary to facilitate developments of higher densities in the project area and its environs. This should include, but not limited to, sizing of the culverts across the Mannings Hill Road down gradient of the site and upgrading the drainage system in Havendale. **D. Control of Construction Waste and Removal of Vegetation** Waste material from earth works and vegetation from site clearance would not be disposed of in the Single Hut Gully. **Potential Risk** According to hydro-stratigraphic information the project site is located atop the Limestone Aquifer. The regional groundwater table largely exists under unconfined conditions in the Limestone Aquifer. Yates and Yates [1988] report on the migration of bacteria within the subsurface and the risk of contamination to groundwater by human waste/sewage. Contamination of groundwater is dependent on the depth to water within the aquifer, the hydraulic conductivity of water within the aquifer, and the subsequent attenuation time in the soil. Hydrologic analyses of the nearest wells (Lakehurst Corehole and Havendale Exploratory) indicate that the piezometric surface is 78 metres below ground level. The soil formation on site is Bonnygate Stony Loam. These soils are very rapidly drained above the bedrock and are predominantly shallow (1 to 35
Risk to Groundwater	

INDICATOR	IMPACT & MITIGATION
	Construction/Implementation
	cm). This means infiltration rates are high, and the capacity for organisms to be filtered or adsorbed is low. Such conditions favour the extended survival and subsurface transport of enteric bacteria and viruses. Although the Bonnygate Stony Loam soil unit is characterized by rapid internal drainage there is yet a considerable depth below ground surface to the water table. This may be of significance in attenuating contaminants and protecting groundwater quality. **Risk Management** Having identified potential risks to the groundwater quality, risk management has to focus on an appropriate level of sewage treatment/disposal to tertiary level treatment. Tertiary level treatment includes any mechanical or non-mechanical treatment process which includes removal of nutrients by natural (e.g. Evapo-transpiration bed/reed bed, biological denitrification) or chemical means (e.g. phosphorus precipitation). The development proposes to use septic tank and reed bed system which are sufficient based on assessment of the aforementioned risks.

Table E7.3: Biology: Significant Impacts and Mitigation

INDICATOR	IMPACT & MITIGATION
	Construction/Implementation
Biology *Flora*	**Impact** I. Direct Impacts The direct impact of the proposed development will produce extensive and irreversible change in the vegetation composition and structure of the area in the short and medium term with a near complete removal of the remaining natural vegetation of the area. This change in land use will in turn dramatically alter the fauna of the site by way of a sharp decrease in both numbers of individuals, species diversity, and a compete loss of endemic fauna with the exception of a few such as the Red-billed Streamertail hummingbird, and the lizard *Anolis grahami,* that are both highly tolerant of development and human presence. In general therefore, the development will only further enhance the area's already poor suitability for many of Jamaica's native, in particular endemic species. II. Indirect Impacts Both the direct and indirect ecological impacts of the proposed development appear to be of greater importance to neighbouring offsite locations because of the development area's close proximity to a naturally occurring seasonal water course that occurs as a step-sided ravine predominantly to the northern and eastern edges of the site. This area, while outside the proposed site, contains a greater number of both endemic and economically important trees such as Maccafat (*Acrocomia spinosa*). This area is also more heavily forested and in turn supports a greater diversity of endemic fauna. While not studied in great detail, the observations made during this assessment suggest that development should minimize disturbance on this ravine ecosystem for three reasons: (1) The area provides a natural drainage of surface water in this section of the greater Hope River watershed. Any removal of the vegetation within the ravine or extensive blockage due to dumping may result in an increased risk of water retention with the associated risks to human health and property. (2) The ravine provides a naturally vegetated corridor through which flora and fauna may move or be dispersed to other suitable habitats, and through which seasonal migration may occur. (3) The vegetation of the ravine is part of the green belt of the site which significantly enhances the aesthetics of the area as a whole. III. Aesthetic Enhancement Beyond the maintenance of the ravine there are also opportunities for aesthetic improvements by: (1) Maintaining as many of the larger trees of the site, in particular those that contain collections of orchids among other attractive epiphytes. (2) Incorporating limestone outcrops within the site where possible into the landscaping design. (3) Relocating native plants with landscaping value where possible, in particular the endemic palms (*Thrinax spp* and *Acrocomia spinosa*). **Mitigation and Monitoring** As previously stated, the Ambassador Heights development site is of no significant ecological importance. Mitigation and monitoring should, therefore, focus primarily on the off-site impacts of

INDICATOR	IMPACT & MITIGATION
	Construction/Implementation
Fauna	construction/development. **Impact** Removal of the current forest will completely modify the fauna of the area. The dominant faunal group, the birds, will be among those species most significantly affected. Approximately 50% of the property's birds are forest dependent. As such, the development will produce a change in the avian community from one dominated by forest dependent species, composed of many endemic species and subspecies, to a community comprised of a few species almost totally of non-endemic birds. **Mitigation** Where possible faunal groups, especially endemic species, would be relocated to a similar habit where feasible.

Table E7.4: Utilities and Services: Significant Impacts and Mitigation

INDICATOR	IMPACT & MITIGATION
	Construction/Implementation
Physical Infrastructure *Solid Waste*	**Impact** The proposed development areas will produce an unknown quantity of solid waste. This is considered a moderate environmental impact, as the exact quantity is unknown. The effects of this waste production can include: ▪ Increased demand for and consumption of limited landfill space. ▪ Increased demand for municipal collection services. ▪ Increased use of roads by collection trucks which could affect the surface of the road, congestion, and fugitive dust along roads. ▪ Breeding of pests and disease vectors such as flies, vermin and roaches if storage areas are not hygienically maintained. ▪ Visual dis-amenity and odours. **Mitigation** ▪ Domestic waste reduction, re-use and re-cycling. Examples of this is separation of organic waste for composting, recycling of glass bottles, and reuse of cooking oils for diesel production. ▪ Adequate solid waste storage bins and other facilities within the development. Residents should be encouraged to ensure that storage containers are tightly covered to prevent the breeding of mosquitoes and other vermin.
Potable Water	**Impact** The development will demand for potable water for residents. The NWC have indicated their willingness to supply the proposed development. The increased demand will place a burden on a municipal resource that has to be reliably met. **Mitigation** Protection of recharge areas in the source catchments is the most effective means of mitigating against the increased demand, as it will safe guard water production. However, there are other measures that could be implemented by the developer, including: ▪ Re-use of treated wastewater and storm water for irrigation. ▪ Water conservation (e.g. low flow toilets, controlled shower and faucet heads, maintenance and monitoring of water mains). ▪ There should be on site reserves or individual household reserves of water in the event of disruption of public supplies (due to drought or heavy turbidity). ▪ Indigenous ornamental species that do not require large amounts of water should be used for landscaping as far as possible. This includes hardy species like bougainvillea, palms and lantana.
Energy Consumption	**Impact** Although the power demand of the development can probably be met by JPSCo. the issue pertains to the use of non-renewable resources, and the national fuel bill, as well as, contributions to green house gases, which are ultimately detrimental to the environment. **Mitigation** ▪ The use of renewable resources will be encouraged - including the possibility of solar power. ▪ There should be energy saving lighting installed for all buildings using lights and other energy star rated equipment.

STUDY RATIONALE

This Draft Environmental Impact Assessment (DEIA) is a requirement of the National Environment and Planning Agency (NEPA) under the Natural Resources Conservation (Permits and Licenses) Regulations, 1996. As shown in the steps in Figure 1 the information provided in the Project Information and the Permit Application Forms, NEPA was able to decide on the need for an Environmental Impact Assessment (EIA) of the proposed project (see Appendix I). This decision was communicated to the project proponent. The EIA adequately provides information required to analyze the significant socio-economic and environmental effects of the Proposed Action and determines whether a permit would be granted for the proposed residential subdivision.

Essentially the purpose of this EIA is to inform the decision makers in all agencies required to approve authorizing actions and the public in general regarding the anticipated significant environmental effects of the Proposed Subdivision and possible ways to mitigate them. However, the information in this study does not control an agency's discretion on a project. Nevertheless, the local agency must adopt feasible mitigation measures or alternatives within its jurisdiction if they are to avoid significant environmental effects identified for the Proposed Action.

This EIA contains the Table of Contents, Executive Summary, and Chapters 1 through 6 which include photographs of the site and Appendices which include the Subdivision Plan, and an approval letter from the National Works Agency (NWA), one of the relevant government agencies directly related to the EIA process. This EIA is available for public review at the office of NEPA, 10 Caledonia Avenue, Kingston 5.

The primary team members for the EIA were:

- Beverline Brown Smith, MURP, B.A (Hons), Dip – Mgmt. of the Environment
- Leo Douglas, PhD (Candidate), M.Phil (Distinction)
- Norman Harris MSc. Engineering Geology, BSc

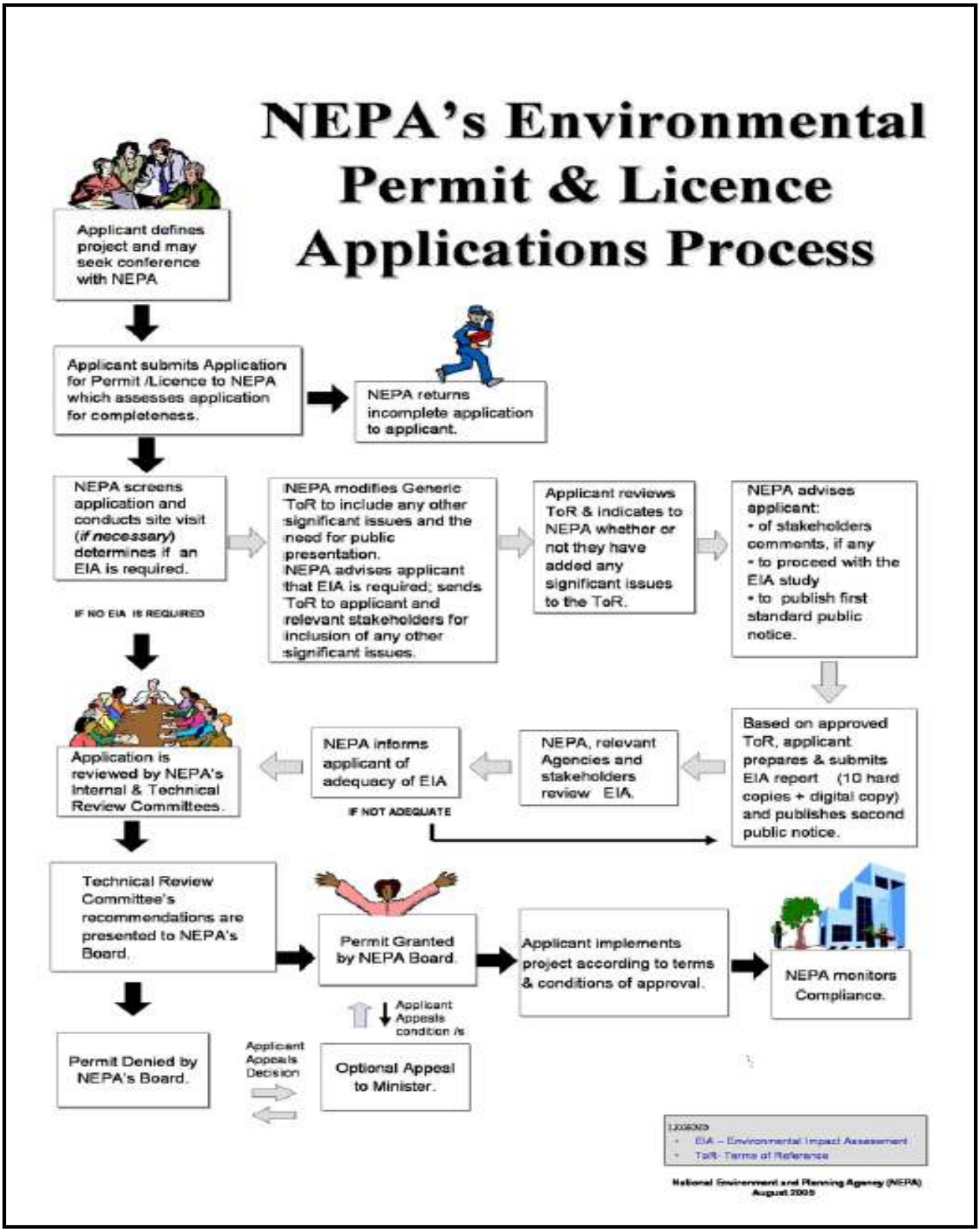


Figure 1: Steps in the Review of EIAs and Post Permit Granting Activities at NEPA

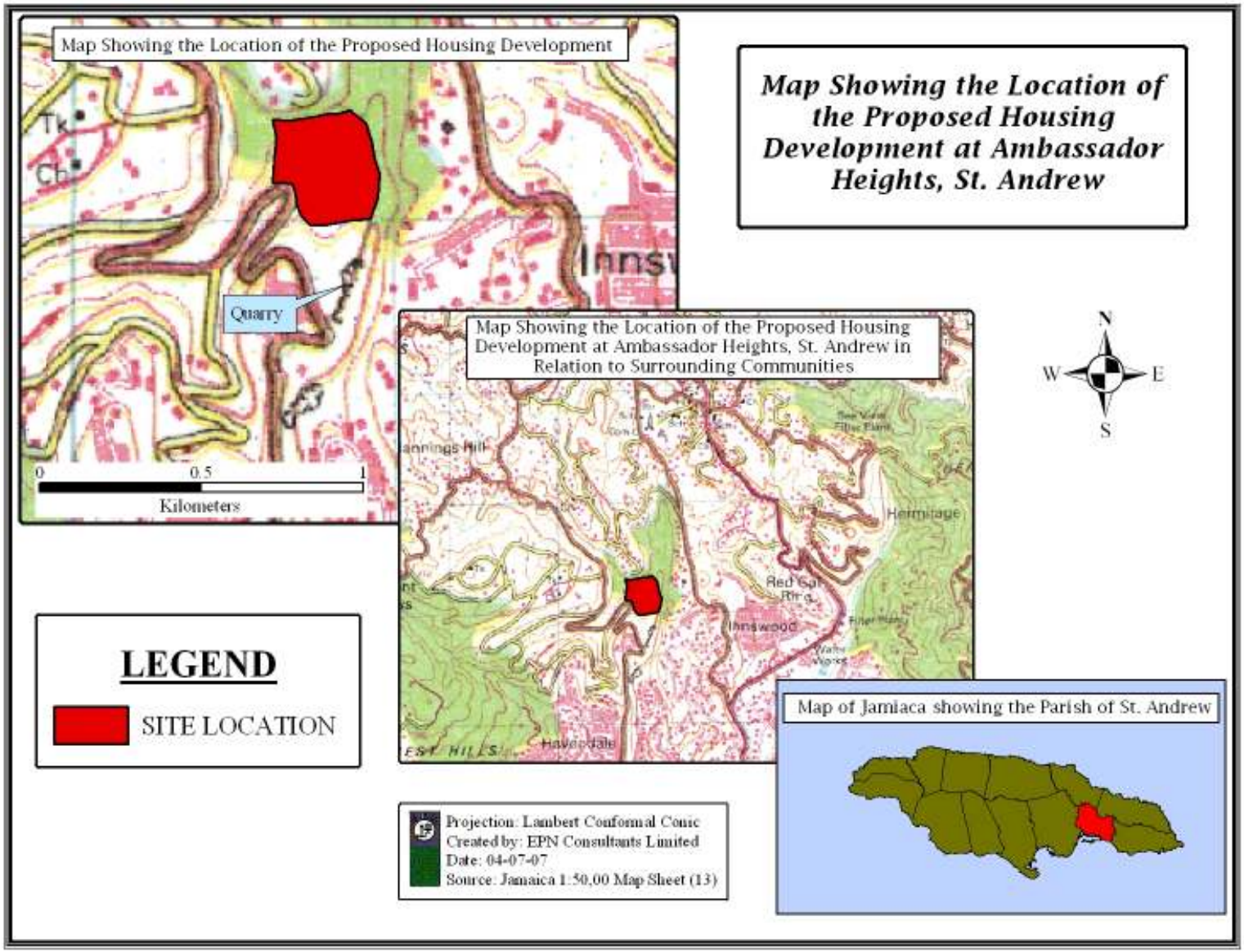
1 INTRODUCTION

1.1 BACKGROUND

The Ambassador Heights development area is located in northern St. Andrew in south-eastern Jamaica. Specifically, the development area is part of suburban St. Andrew and falls within the Wagwater River Watershed Management Unit.

The site is located on the Mannings Hill Road, approximately 7.25 km (4.5 miles) north of Half-way-tree and 3.6 km (2.2 miles) south east of the community of Mannings Hill (see Map 1). The Mannings Hill main road to Half-way-tree main road forms the western boundary of the site.

In the currently proposed development plan, an area of 23.02 acres will be developed into 100 residential lots with an additional three (3) lots zoned for wastewater treatment and recreational use.



Map 1: Showing location of proposed development at Ambassador Heights, St. Andrew

2.0 PROPOSED ACTION AND ALTERNATIVE

2.1 THE PROPOSED AMBASSADOR HEIGHTS DEVELOPMENT

The proposed project will encompass a total of approximately 123 primarily residential lots (120) on 93,176.77 square metres (23.02 acres) of land which has been earmarked for the development. The development proposes:

1. Fifty-eight (58) detached, two storey houses, each having an area of approximately 380 square metres;
2. Thirty-eight (38) semi-detached, two-storey townhouse units with basement, each having an area of approximately 400 square metres; and
3. Twenty-four (24) two-storey townhouses, each having an area of approximately 340 square metres.

Development would proceed in three (3) phases. It is intended that works will be phased as follows:

(i) Phase one- Lots 1-42
(ii) Phase two-Lots 43-81
(iii) Phase three-Lots 82-122

The development will provide housing solutions for sale to the middle to upper income level markets. The larger lots sizes are zoned for the plateau, while the smaller lots (to a minimum size of 340 square metres) are mostly planned for the lower slopes**.**

Wastewater will be treated to the tertiary level through a system of septic tanks which will be discharged into a reed bed. Lot 123 which is reserved for the waste water treatment plant will be included in phase 1.

2.2 PHYSICAL INFRASTRUCTURE

2.2.1 Roads, Transportation and Traffic

The area can be accessed from both the Old Stony Hill Road and the Mannings Hill Road and features a simple Class C road network, which meanders and narrows in some sections.The transportation of construction materials, solid waste and the labour force would temporarily increase traffic flow along the roadway. The additional traffic movement could have a moderate effect on traffic flow especially during peak hours.

2.2.2 Potable Water

The NWC would ultimately be responsible for the water supply to the community. Currently water is supplied to the area from the Hermitage Dam through the Constant Spring Filter Plant. The Hermitage Dam's design capacity is 1.789 MM^3 or 394 MIG (1,491.4 MLD), while the Constant Spring Filter Plant's design capacity is 82 MLD. The water demand will be calculated based on the per capita demand for the proposed development. Arrangements will be made between the developer and the NWC to address the water supply for the new development.

2.2.3 Electricity/ Telephone

The Jamaica Public Service Company Limited (JPSCo.) would provide electricity to development from its station in Constant Spring, Kingston 8.

Land line and cellular services is provided to residents in the area by Cable and Wireless (Jamaica) (C&WJ). Additionally, mobile service is also available through the primary providers, such as, Mossel (Jamaica) Limited (Digicel) and MiPhone (Claro). The impending extension of land line service to the proposed development is within the capability of C&WJ; however, ample notice should be given to companies offering telephone service during the planning stages of the development. This is to ensure that the additional demand is effectively met in a timely manner.

2.2.4 Drainage

The property is bounded by the Shingle Hut Gully (northern boundary) and Mother Hector Gully (eastern boundary) which intersect and channel storm water flows southwards. In

addition to accessing these established drainage channels, new engineered drains will be implemented where necessary. Details of these will be shown in the Storm Water Drainage Plan for the development.

2.2.5 Waste Water Disposal

i. Solid Waste Disposal

The development will demand arrangements for solid waste disposal. Solid waste from the development will be disposed of at the Riverton City landfill in St. Andrew. The necessary mechanisms will be installed for accessing the services of the NSWMA.

During the construction phase of the development it is expected that private trucks will be hired to remove construction and other debris from the site.

ii. Sewage

The area does not feature a central sewage system; as such, the developer proposes a Wastewater Treatment System that features septic tanks discharging into a reed bed.

2.2.6 Landscaping

Currently the site is predominantly covered with vegetation, landscaping provides the means for making the site attractive, while improving its visual aesthetic character and highlighting the natural elements of the site. Landscaping activities would have a beneficial impact and would entail the landscaping of common areas/open spaces and along verges and roadways.

2.3 ALTERNATIVE TO THE PROPOSED DEVELOPMENT

Alternative 1: "No Action"

In the event that the development does not proceed, the proposed site is expected to maintain its natural characteristics maintaining baseline conditions described in details in Chapters 3 and 4 and summarized below.

2.3.1 Physical

The most outstanding physical characteristic of the Ambassador Heights site is its location between two fault lines, one of which forms the eastern boundary of the site. However, these faults are considered inactive.

2.3.2 Terrestrial

The vegetation of the proposed development area is severely degraded, and, as such the entire site is covered by secondary growth. The property is home to one (1) endemic plant, while several endemic birds were observed.

2.3.3 Socio-economic

The site is strategically located within the outskirts/suburban area of the Kingston Metropolitan Area (KMA), and on the residential periphery of communities, such as, Havendale and Stony Hill. These areas currently, and are expected to continue to provide all the basic social services, such as, health and education without the need for major improvement in physical infrastructure such as roads, and potable water supply.

2.3.4 Impacts

There would be no significant impacts if the development is forfeited and, as such, the proposed site is expected to maintain its natural characteristics. However, the potential development of the area would be stifled.

3.0 ENVIRONMENTAL RESOURCES

3.1 THE PHYSICAL ENVIRONMENT

3.1.1 Climate

Jamaica experiences what is described as a bimodal rainfall pattern, which consists of two peak periods, with higher values of rainfall (May to June & September to November) and corresponding periods of lower rainfall amounts. The island's primary peak is in October, while the secondary peak in is May. Jamaica experiences the lowest rainfall levels during the period February to March and the month of July.

Parish Rainfall Summary for May 2007
(Rainfall in mm)

		MAY	MAY	MAY	JUN	% OF 30 YR NORMAL		
		2007	2006	30 YR NORMAL (1951-80)		2007	2007	2007
Parishes	KEY					MAR	APR	MAY
Hanover	HAN	199	153	294	309	100	26	68
Westmoreland	WES	213	137	302	262	88	62	70
Manchester	MAN	157	201	237	102	143	52	66
St. Elizabeth	STE	107	182	243	163	235	45	44
Clarendon	CLA	228	115	191	149	327	7	120
St. Catherine	STC	310	198	171	139	259	28	181
Trelawny	TRE	263	107	181	130	353	73	145
St. James	STJ	296	84	223	203	231	66	133
St. Ann	STA	206	182	164	115	366	46	126
St. Mary	STM	199	129	175	122	212	83	114
Portland	POR	276	96	321	278	320	85	86
St. Thomas	STT	125	53	251	219	183	18	50
Kgn & St. And.	KSA	131	142	180	123	224	33	73
Jamaica	JAM	209	137	226	184	236	53	92

Figure 2: Showing rainfall data by parish for May, 2007
Source: http://www.metservice.gov.jm/documents/documents/RainfallSummaryJune2007.pdf

Historically, KSA receives the third least amount of rainfall throughout Jamaica. In May, 2007, (the secondary peak of the bimodal rainfall pattern for the island), the Island received an

average 209 mm of rainfall, while Kingston and St. Andrew received 131 mm of rain as shown in Figure 2 above .

A. Precipitation

Based on information from the Meteorological Service of Jamaica (Metservice), there is no climate and wind frequency data for the Ambassador Heights area. However, the office has two (2) monitoring stations in close proximity to the proposed site; these are located at the Constant Spring Filter Plant and within the Armour Heights area. Although these monitoring stations are at relatively lower elevations than the Ambassador Heights area, it is expected that some similarities exist.

Table 1: 30 Year (1951- 1980) Mean Monthly Rainfall (mm) – Constant Spring& Armour Heights, St. Andrew

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	TOTAL
KSA (NMIA)	18	16	14	27	100	83	40	81	107	167	61	31	745
CONSTANT SPRING F.P.	40	40	49	96	179	119	108	182	242	295	162	77	1,589
ARMOUR HEIGHTS	51	41	30	91	206	130	97	216	234	299	165	79	1,639

Source: Meteorological Service of Jamaica

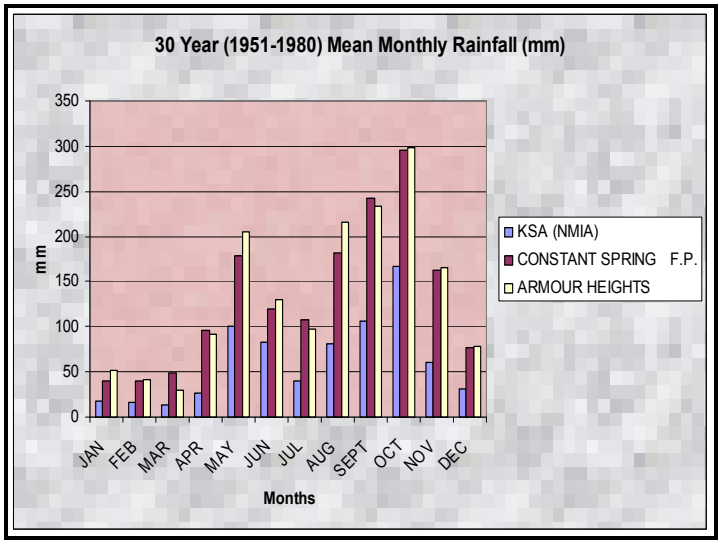


Figure 3: 30 year (1951-1980) mean monthly rainfall (mm) – Constant Spring and Armour Heights, St. Andrew.
Source: Metrological Service of Jamaica.

Based on data from the Metservice, the months of August, May, September and October are the wettest, while the driest days are experienced between January and March. As shown in Table 1 and Figure 3 above, both locations received maximum precipitation during the month of

October, just prior to the end of the Atlantic hurricane season. However, it should be noted that the Armour Heights area experiences slightly higher rainfall levels than Constant Spring as highlighted in Table 1 above.

The mean annual total of 1,639 mm of rainfall at Armour Heights (closest to Ambassador Heights) exceeded that of the adjacent monitoring station at Constant Spring (1,589 mm) and was more than twice that of KSA (745 mm). In general, the wettest month is October, which has the greatest number of rain days, a total of ten (10) (Metservice).

B. Temperature & Humidity

Temperature data for the Ambassador Heights area or for both rainfall monitoring stations is not available; however, data from the monitoring station at the Norman Manley International Airport (NMIA) indicated a 30 year maximum temperature within the KSA of 31.9°C with a minimum is 22.3°C.

Based on Jamaica's location, the island can receive a maximum of 13.2 hours of sunshine (in June) with a minimum of 11.0 hours (December). Mean sunshine in mountainous areas and hilly interior, such as, the Ambassador Heights area can amount to less than 6 hours per day, caused mainly by the persistence of clouds. Data from the Metservice indicates that KSA receives a maximum of 8.6 hours and a minimum of 3.1 hours of sunshine.

Relative humidity varies with elevation and, as such, humidity within Kingston & St. Andrew varies with location. Based on data obtained at the NMIA, humidity for Kingston ranges from 73 – 80 % in the mornings (7:00am) and 60 - 68% in afternoons (1:00pm), humidity in St. Andrew, on the other hand, ranges from 80 - 88% in the morning to 64 - 90% in the afternoon.

C. Winds

Jamaica's wind pattern is dominated by the northeast trade winds by day combining with the sea breeze on the North Coast to give an east-north-easterly wind at an average speed of 15 knots (17 miles per hour). Along the South Coast, the east-south-easterly winds are at an average speed of 18 knots (21 miles per hour). However, during the period December to March,

the Trades are less dominant and the local wind regime is a combination of Trades, sea breeze, and a northerly or north-westerly component associated with cold fronts and high-pressure areas from the north (United States of America).

3.1.2 Geomorphologic Landscape

A. Limestone Karst Features

The Project Area is predominantly composed of white limestone hills (Mid Eocene to Lower Miocene in age). The structure is karst landscape type, i.e. a rugged topography, formed by numerous collapse structures, sinkholes and solution cavities of various kinds, between which conical (kegel-karst) or tower (turm-karst) shaped hills rise to several metres.

There is hardly any surface drainage in such areas, as precipitation quickly passes underground into an extensive sub-terrain drainage system. The direction of flow of underground water is controlled first, by the direction of the dip, joints and faults within the limestone; secondly, by the changes in the lithology of the limestone (solution); and thirdly, by the height and relief of the karst basis (Sweeting 1958).

In the immediate environs, the area depicts a moderately developed limestone karst consisting of semi-conical hills and moderate to deeply dissected limestone valleys (see Plates 1 & 2). The valley walls extend to great depths forming a gorge-like feature on the east boundary of the site.

Plate 1: Limestone hill shown in background on which residential Development is to be located. Looking towards the east.

Plate 2 : Moderate to subdued limestone karst topography Surrounding the project site showing semi rounded hills and valleys.

B. Topography

The project site is bounded on the east and north by gullies, which carry storm water from the surrounding areas. The land slopes steeply towards the east, down a very deep gully known as the Shingle Hut Gully (see Plate 3). Towards the south, the land slopes moderately and eventually joins an existing development, known as, Ambassador Heights Phase 1.

Plate 3: The eastern side of the limestone hill to the left of photograph. The land slopes steeply towards the gully.

Slopes on the eastern side of the limestone hill are relatively steep varying from 15 degrees to 30 degrees, and on the south and west, the slopes are moderate ranging from 12 degrees to 18 degrees**.** Near the top of the hill, the topography is more subdued ranging in gradient from 5 degrees to 8 degrees.

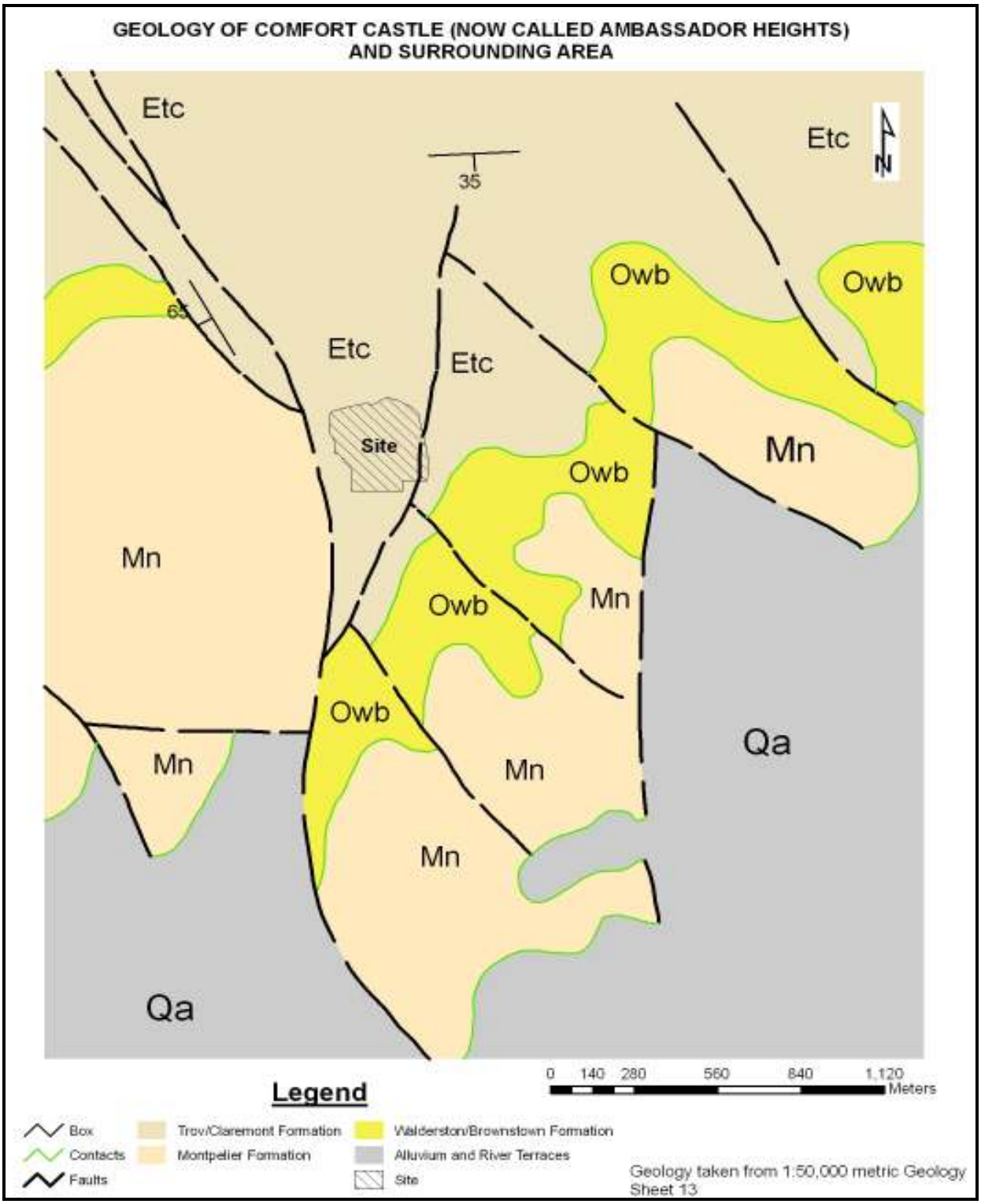
The geomorphic features are partly shaped by limestone karst development, as well as by geological processes, which occurred in the past. These features are generally aligned in a north-south direction.

3.1.3 Geology

A. Lithology

Information obtained from the 1: 50,000 Geological Sheet of Kingston (Sheet 25) indicates that the geology of the project area is comprised of hard recrystallized limestone of the Troy-Claremont Formation of the White Limestone Group (see Map 2). This limestone is often well bedded and exhibits high secondary permeability. The Newport Formation (Mn) and the Walderston-Brownstown Formation (Owb) of the White Limestone Group, outcrops on the west and east of the project area respectively. The limestone formations have slight variations in karst characteristics and contribute to the development of groundwater systems.

The physical characteristics of the Troy-Claremont Limestone observed on the site differ somewhat from the typical hard, recrystallized limestone that makes up this rock. The limestone is highly fractured, fragmented and extensively weathered; giving some sections of the land surface a stony appearance. Further examination reveals large, loose boulders and semi-intact limestone rocks (rocks loosely or partly attached to the bedrock) jutting out on the hillsides as well as cobble-size limestone material strewn across the slopes of the limestone hill (Plates 4 & 5). In many instances, the limestone boulders and cobble-size fragments are embedded in reddish brown terra-rossa/latertic soils derived from the weathering and leaching of the limestone.



Map 2: Showing the geology of Ambassador Heights

Plate 4: Semi-intact limestone rock (foreground) and cobble size material (background) embedded in reddish brown soil

Plate 5: Stony ground on southern section of site

Detailed examination of the site was hindered by thick vegetation cover and poor access; however, a deep cut on a property adjoining the western boundary of the project area confirms the existence of highly fractured, fragmented and weathered limestone at significant depths below ground level (see Plate 6).

Plate 6: Highly weathered and fragmented limestone (cobble size Limestone) exposed on an excavated cut adjacent to the project site

B. Structure

The 1: 50,000 Geological Sheet of Kingston reveals that the project area is hinged between two northwest-south east and north-south trending geological faults. The northwest-south east fault is located immediately to the west of the site while the north-south fault forms the limestone gorge (very deep gully) on the eastern boundary of the property. The geological structures are largely responsible for fractured appearance of the limestone, which underlies the property and the major gullies and valleys on the west and east of the project area.

3.1.4 Soils

The Ministry of Agriculture soil maps (scale of 1: 50,000) broadly classify the soil on site as the Bonnygate Stony Loam (no. 77) type (Price 1960, Stark 1964). In this classification unit, about 75% is Bonnygate soil type and 25 per cent is comprised of small areas of other minor soil types.

A. Physical Characteristics of Soils

In tropical karst areas, the topography influences the soil. The steep slopes are marked by the absence of soil. Field observation indicates that hilltops are covered by a leaf litter over the limestone forming a layer of acid peat/humus that isolates the plants growing on it from the

surrounding alkaline limestone. Relatively thicker soil deposits occur on horizontal limestone rock surfaces; deep soil accumulation is typically restricted to closed large depressions/sinks.

The Bonnygate Stony Loam soil unit is mainly characterized by physical soil limitations, such as, shallow soils, stony surface, steep slopes, high erosion hazard and low moisture supplying capacity (Hewitt, 1964). The soils are very rapidly drained above the bedrock, which are predominantly shallow (1 cm to 35 cm), strong brown to reddish brown loamy and clayey soils, stony and in places with many limestone rock outcrops (50% or more). The soil texture is always very fine and the texture class is mostly silty loam, in the presence of sand, silt and clay (see Plate 7).

Plate 7: Thick, deep reddish brown soil seen on the foot of the southern section of the limestone hill on a road cut adjoining the project site

B. Chemical Characteristics of Soils

The Bonnygate Stony Loam soil type has a mildly alkaline pH and a low natural fertility in nitrogen, phosphate and potassium.

3.1.5 Hydrogeology

A. Hydrogeological Setting

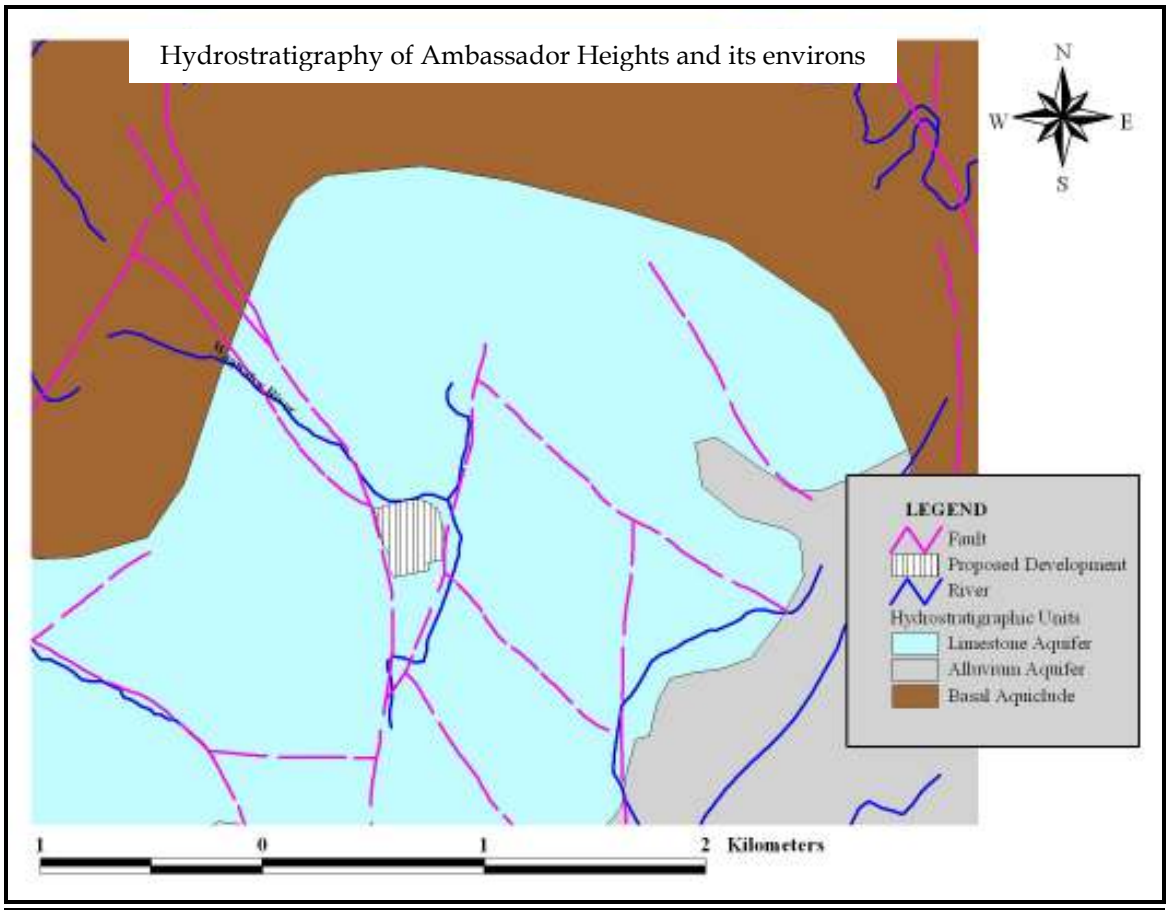
The Project Site falls within the Wagwater River Watershed Management Unit of the Blue Mountains North Hydrologic Basin. The project area is underlain by the Troy/Claremont Formation, which characterizes the Limestone Aquifer in the island's hydrostratigraphic complex. An aquifer is any subsurface unit that is competent in storing and transmitting significant quantities of water under normal pressure gradients. The Troy/Claremont Formation is the oldest of the White Limestone Group. It consists of a sequence of recrystallized and dolomotized limestones (in the lower portions of the formation) and well bedded micrites (non-recrystallized limestone) in the upper sections and rests conformably on the lowest hydrostratigraphic sequence (Basal Aquiclude).

The presence of extensive, even pervasive minor fracturing of the limestones, with a strongly preferred NNW-SSE orientation has the potential for providing directional flow paths for drainage within the project area. Regional groundwater flow is toward the south in this section of the basin, essentially following along gradients of hydraulic head. Conduit-type flows may occur along prominent subsurface channels and a more diffuse type, but still directionally controlled flow occurs via minor fractures. Prominent surface drainage features are located within the project environs and appear to be aligned with the orientation of geological faults.

B. Surface Hydrology

The gorge (Shingle Hut Gully) formed by the geological fault on the eastern boundary of the property acts as a main drainage area for storm water from the site and surrounding areas (see Map 3). Another gully known as the Mother Hector Gully, which is partly fault controlled, forms the northern boundary and joins the main gully (gorge) on the north-eastern boundary of the site (see Maps 4 and 5).

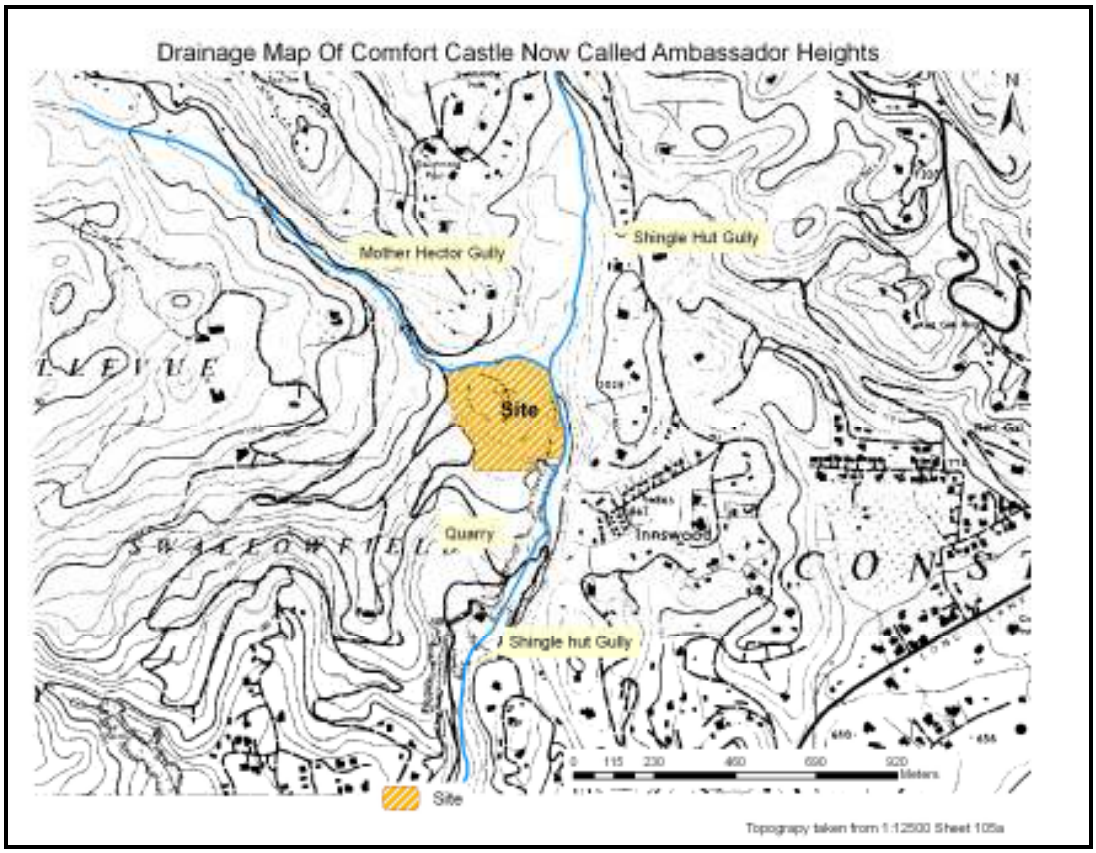
The Shingle Hut Gully drains southerly along the fault zone, flows through the residential community of Havendale and into the Turnbridge Gully further south.



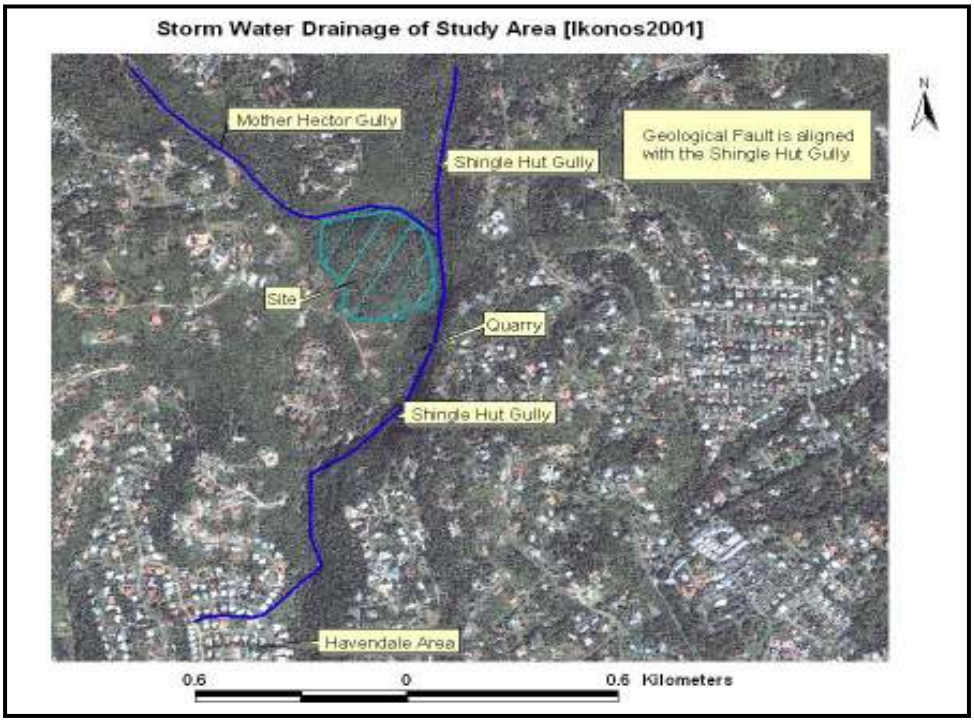
Map 3: Hydrostratigraphic units within the project environs
Source: Water Resources Authority

The site and adjoining areas, therefore, form part of the upper catchments for the Turnbridge Gully (Kingston 1:10,000 Sheet 1). The Shingle Hut Gully extends to great depth (exceeding 50 metres in some areas in its upper reaches), drains through a geologically unstable environment, and passes close to an active limestone quarry.

This gully has the potential to carry large volumes of rocks and debris down steam during high rainfall events.



Map 4: Showing main drainage channel in the Ambassador Heights/Comfort Castle area



Map 5: Ikonos image showing storm water drains in the area

C. Groundwater Hydrology

The Troy/Claremont Formation (Limestone Aquifer) is characterized by a high degree of secondary permeability, associated with karstification and/or faulting. Due to the high permeability of this unit and its associated high infiltration capacity, perennial drainage within the Project Area is predominantly underground. Transmissivity (yield per unit volume of aquifer) of the Troy/Claremont Formation is variable, as the size and number of conduits that develop within the unit will determine its local productivity. Transmissivity will be very high within the conduits. Conversely, lower values exist in sections of the aquifer that do not have well developed channels.

D. Regional Water Table

Hydrologic analyses of the nearest wells (Lakehurst, Corehole and Havendale Exploratory) indicate that the piezometric surface is 78 metres below ground level. The regional groundwater table largely exists under unconfined conditions in the Limestone Aquifer. These wells are located further south within the Wagwater River watershed of the basin, and have been drilled through a different part of the limestone succession than occurs at the site. It is anticipated that the response of the piezometric surface to rainfall events will vary based on lithologic differences among the formations of the White Limestone Group.

Recharge to the Limestone Aquifer, primarily occurs through discrete areas such as outcrops, fissures or dolines/sinkholes, and much of the aquifer does not receive diffuse, regionally infiltrated rainwater. Accordingly, groundwater flow is largely compartmentalized. The Bonnygate Stony Loam soil unit, which overlies the limestone in the area, is mainly characterized by physical soil limitations, such as, shallow soils, stony surface, steep slopes, high erosion and rapid internal drainage. This further suggests that the Limestone Aquifer is unconfined, thus increasing the quantities of water infiltrated to the subsurface. The high permeability of the regional limestone and the physical characteristics of the overlying soil unit make the proposed area for development highly susceptible to point source pollution.

E. Water Demand

The following calculates the peak residential water demand for the Ambassador Heights Housing Development:

Number of units = 120

Assuming 5 persons per unit, then

Number persons to be served = 120 x 5 = 600 persons

Using a consumption rate of 0.182 m^3/day (40 imperial gallons per day) per person, then

Daily consumption = 600 x 0.182 = 109.2m^3/day

Assuming 20% loss: 1.20 x 109.2 = 131.04m^3/day

Then consumption = 131.04 m^3/day

The maximum daily consumption is estimated at an additional 30%:

1.30 x 131.04m^3/day = 170.35 m^3/day

**Please note that the use of 5 persons per household instead of 4 persons was deliberate.*

3.1.6 Storm Water Runoff

Storm water runoff for the sub-catchments area was estimated using the Rational Method. This is expressed using the formulae Q=CIA, where

Q = Peak Run off Discharge in cu ft/sec (m^3 /sec)

C = Runoff coefficient

I = Rainfall Intensity, inches/hr (mm/hr)

A = Area of catchments in Acres (hectares)

The runoff coefficient C, which is a function of porosity, vegetation, slope, soil moisture conditions and other factors, was taken from established tables developed for the rational method. The rainfall intensity was determined for return periods of 5, 10, 25, 50 and 100 years and was obtained from Rainfall-Intensity-Duration-Frequency curves developed for the NMIA. This is the nearest rain-gauge station with measured rainfall intensity data. The sub-catchments area was obtained from the topographic map of the area using planimetric method. The peak discharge for the respective return periods is provided in Table 2.

Table 2: Estimated Runoff for Project Site for Return Periods of 5, 10, 25, 50 and 100 Yrs

	RETURN PERIOD				
Return Period (yrs)	5	10	25	50	100
Run off coefficient	0.40	0.42	0.46	0.49	0.53
Rainfall Intensity (inches/hr)	1.92	2.29	2.76	3.1	3.4
Sub Catchments Area (acres)	476	476	476	476	471
Surface Runoff ft/sec	365.6	457.8	604	723	857.8
Surface Runoff m/sec	10.3	12.95	17.1	20.4	24.2

3.1.7 50 Year Return Period

Based on the methodology used the 50-year run-off coefficient is expected to be 0.49 while the rain intensity is expected to be 3.1 inches per hour, an increase from the 25-year return period at 0.46 and 2.7 respectively. The drainage layout of the proposed development will be able to withstand this. The proposed primary culvert drain was designed for storm events exceeding 25-yr return periods while the secondary drainage features (local systems will provide sufficient drainage for the more frequent storm events). The final disposal of storm water run-off from the site will be in the Shingle Hut Gully which is able to facilitate the volume of water expected from major storm events exceeding the 50-year return period.

3.2 RISK ASSESSMENT

3.2.1 Flood Hazard

The soil type found at the Ambassador Heights development site is characterised by its shallowness, stony surface, steep slopes, high erosion potential and rapid internal drainage, thus making the possibility of flooding minimal. However, with the Mother Hector Gully (northern boundary) merging with the Shingle Hut Gully on the eastern boundary, the probability of flooding at the site increases in severe rainfall events (50-100-year). This is due to the fact that the Shingle Hut Gully has the potential to transport large volumes of rocks and debris during heavy events which might pose a threat to the eastern boundary of the property.

3.2.2 Hurricane Hazard

The Atlantic hurricane season occurs between June and November, during which tropical cyclones originating in the south-eastern Atlantic may bring increased rainfall to Jamaica. As shown in Table 3, since 1988 several major systems have affected Jamaica.

In most cases hurricanes affect the southern parishes of Jamaica (including St. Andrew) more than the northern parish. Statistically, hurricanes are most likely to hit later in the season, (between September and November). Hurricanes may result in mudslides and landslides on the steeper slopes of the development site.

Table 3: Major weather systems (named) affecting Jamaica (1988-2008)

Name	Date
Tropical Storm Gustav	August 28, 2008
Hurricane Dean	August 20, 2007
Hurricane Dennis	July 5, 2005
Hurricane Emily	July 16, 2005
Hurricane Ivan	September 10, 2004
Tropical Storm Charley	August 11, 2004.
Hurricane Claudette	July, 2003
Hurricane Lily	September 30, 2002
Hurricane Isidore	September 18, 2002
Hurricane Michelle	October 29, 2001
Hurricane Iris	October 7, 2001
Tropical Storm Helene	September 19, 2000
Hurricane Gordon	November 8, 1994
Hurricane Gilbert	September 12, 1988

3.2.3 Earthquake Hazard

Based on Jamaica's proximity to a major plate boundary, the island is prone to earthquakes, with a few extremely devastating earthquakes including Port Royal 1692 and Kingston 1907 on record. The Ambassador Heights property is situated between two faults lines which would make the site prone to seismic activity however, the faults are not known to be seismically active.

3.2.4 Soil Erosion of Land Slippage Hazard

The geology and geomorphology of the site makes it susceptible to soil erosion and landslides. Erosion as a result of heavy rainfall is expected on steep slopes especially if vegetation is stripped for construction purposes. Some of this eroded material will end up in the Shingle Hut Gully on the eastern boundary of the property. This Gully is generally unstable and this increases the potential for erosion with incremental increase in development near to the gully.

In general, the site and its environs exhibit low landslide susceptibility, however, moderate landslide susceptibility is shown in the vicinity of the site. Approximately 500 metres south of the project area a rockslide/fall on the side of the steep Shingle Hut Gully was observed, this was probably as a result of past quarry activities.

3.3 TERRESTRIAL ECOLOGY

3.3.1 Faunal Survey Methods

The fauna (with the exception of birds) was assessed along seven transects placed randomly across the study area as access would permit. Transect data was collected for all non-aquatic higher vertebrates, that is mammals, reptiles, and amphibians, and also for one insect species group, the Lepidoptera (moths/butterflies). Individuals of each species were tallied as they were encountered for all groups. At the end of each census period, the abundances of these animal groups were ranked using the DAFOR (Dominant, Abundant, Frequent, Occasional, and Rare) scale of relative abundance. Each transect was counted once. Transects were not less than 50 metres in length.

A. Mammal and Herpetology (Reptile and Amphibian) Survey Method

Transects were assessed by investigating the observable areas associated with soil, vegetation, and sheltered sites under both organic and inorganic matter. All vertebrate species observed, or evidence of their recent presence, such as, droppings, pellets, skin, burrows, nests, tracks, etc. were recorded and an estimate of species abundances made using the DAFOR scale of relative abundance.

B. Lepidoptera Survey

All Lepidoptera species encountered along the transect surveys either stationary or flying were recorded.

C. Bird Survey Methods

Bird species and abundance were surveyed by way of point counts. Ten point counts were surveyed. Point counts are generally preferred in bird habitat-use studies because habitat data

can be easily associated with the occurrence of individual species (Bibby et al.1992). Point count method of sampling bird populations is ideal for shrubby habitats where species are often hidden by foliage, and where the overall habitat is a dense mosaic of habitat patches as was observed to be the case in Ambassador Heights. Each point count lasted for 10 minutes, during which time all species and numbers of individuals of each species both seen and heard were recorded. All points were surveyed once. The point count results are presented in Appendix VI.

3.3.2 Faunal Survey Results

A. Birds

One hundred and eight (108) birds were counted within the study area belonging to twenty-six (26) species (see Appendix VI). Of these, seven (7) were Jamaican endemic species as listed in Table 4 below:

Table 4: Jamaican endemic species recorded from Ambassador Heights the development area.

	COMMON NAME	SCEINTIFIC NAME
JAMAICAN EUPHONIA	Blue Quit, Short Mouth Blue Quit	*Euphonia Jamaica*
Sad Flycatcher	Little Tom Fool	*Myiarchus barbirostris*
Jamaican Woodpecker	Woodpecker	*Melanerpes radiolatus*
Red-billed Streamer tail		
White-chinned Thrush	Chap-Man-Chick, Hopping Dick	*Turdus aurantius*
Jamaican Tody	Robin Redbreast	*Todus todus*
Yellow-shouldered Grassquit	Yellow Back, Yellow Backed Finch	*Loxipasser anoxanthus*

Source: Field visit

Additionally, there were four Jamaican endemic sub-species present as listed in Table 5 below:

Table 5: Jamaican endemic sub-species recorded from Ambassador Heights the development area.

	COMMON NAME	SCEINTIFIC NAME
Bananaquit	Beeny Bird, Sugar Bird	*Coereba flaveola*
Jamaican Parakeet	Parakeet	*Aratinga nana*
Jamaican Oriole	Banana Katie, Aunt Katie	*Icterus leucopteryx*
Greater Antillean Grackle	Cling-Cling	*Quiscalus niger*

Source: Field visit

Overall the avian diversity of the study area was low. There were few endemic species and sub-species and many endemics known from more mature forest habitats within the general

area were absent. Jamaican endemic species and subspecies are inherently of greatest conservation importance in that their entire ranges are restricted to this island and many are limited in their national distributions due to their specific habitat requirements. This overall low diversity is directly related to the degraded state of the vegetation within the proposed development. The lack of both structure and species diversity of the vegetation able to provide suitable habitat for a diverse avian community is therefore expected.

Among the resident Jamaican bird species identified, a gradient in species distribution was observed across the study site. The southern half of the development area, dominated by grasses and low shrubs with fewer large trees, was predominantly occupied by common non-endemic Jamaican bird species.

Within the more heavily vegetated interior and northern sections of the property, however, Jamaican endemic species such as the Yellow-shouldered Grassquit and Jamaican Woodpecker were more common. These island endemic species have habitat requirements more closely associated with mature forest of tall trees, high species richness and dense forest cover. The presence of these species was also facilitated by the close proximity of the development area to more forested areas and a heavily forested seasonal water course that bordered the northern and eastern sections of the development area.

Neotropical Migratory Bird Species

Five Neotropical migrants were recorded during the survey as shown in Table 6 below:

Table 6: Neotropical migratory birds recorded from the Ambassador Heights development area.

	COMMON NAME	SCEINTIFIC NAME
Common Yellowthroat	-	*Geothlypis trichas*
American Redstart	Butterfly Bird	*Setophaga ruticilla*
Ovenbird	Betsy Kick-up	*Seiurus aurocapillus*
Black-throated Warbler	-	*Dendroica caerulescens*
Prairie Warbler	-	*Dendroic discolor*

Source: Field visit

All of these migrant bird species are known from similar habitats across Jamaica. Of these migrants only one was particularly abundant, the Common Yellowthroat. This species is a

specialist of dense/shrubby habitat. Because much of the Ambassador Heights property was in early succession, the preferred habitat requirements of this species abounded, their high abundance was not surprising.

Rare or Uncommon Species

Only one species that is considered nationally uncommon was identified during the census period, namely the Yellow-shouldered Grassquit. However, this species is locally common in suitable habitat in many sections of Jamaica.

None of the species observed are currently considered to be globally threatened with endangerment (Stattersfield A. J et al. 1998).

B. Butterfly Species

Eight species of butterflies were identified from the study area including one Jamaican endemic (*Mestra dorcas*) and one endemic subspecies (*Battus polydomas jamaicensis)*. See Table 7 below for a complete list. None of these species are listed as threatened (Brown 1972).

Table 7: Relative abundance of butterfly species observed within the study area:

COMMON NAME	SCIENTIFIC NAME	DAFOR SCALE OF RELATIVE ABUNDANCE
Long-tailed Skipper	*Choides sp.*	A
Sulphur Butterfly	*Eurema sp.*	A
The Zebra Butterfly	*Heleconius sp.*	F
	Dryas iulia delita	O
Little Blue	*Brephidium sp.*	O
	Mestra dorcas (endemic)	O
Buckeye	*Junonia coenia*	O
Black Swallowtail	*Battus polydomas jamaicensis (endemic ssp).*	R
	Hemiargus hanno ceraunus	R

Source: (Field visit)

C. Mammals and Herpetofauna

No wild mammal species were observed within the study area. There was, however, evidence of the use of the property by dogs based on their droppings. Three (3) species of lizards were observed, namely; *Anolis opalinus*, *Anolis grahami, and Anolis valencieni.* All three (3) species

were relatively common within the more heavily vegetated sections of the development area. One individual of a species frog of genus *Eleutherodactylus* was also identified.

D. Nocturnal Species

As indicated above, one nocturnal frog species (*Eleutherodactylus* sp.) was identified. *Eleutherodactylus* species are only active at night and/or during periods of significantly increased moisture levels such as during the rainy seasons. While not identified during the study period, both the Common Barn Owl (*Tyto alba*) and the Jamaican Owl (*Pseudoscops grammicus*) are known from the area (BirdLife Jamaica Broadsheets). These two nocturnal birds are common in both forested and human dominated landscapes. There was no evidence of the roosting sites (either natural or man-made) for bats[1] within development area.

3.3.3 Vegetation (Flora) Survey Methods

Vegetation assessment was conducted by identifying plants along a 10 metre transects placed across the 10 (bird) point count locations. Along each transect, the vegetation within a 1.5 metre band was sampled by recording:

1. Tree species (for the purpose of this study, a tree was defined as any plant (succulent or woody) that had a diameter greater than 4.5 cm measured at a height of 1.4 metres above ground level (that is at an approximate breast above ground).
2. Canopy height - where there was relatively continuous canopy cover in the transect 0area.

Tree species were identified according to Adams (1972) and according to Parker (2003). The relative abundances of the species observed were ranked using the DAFOR scale of relative abundance.

The results of this assessment are presented in Appendix VII.

[1] It is now believed that 21 species of bats are found on Jamaica. These bats are found in either caves or man-made structures providing suitable environmental conditions (see Genoways et al. 2005)

3.3.4 Flora Results and Discussion

The vegetation of Ambassador Heights has been affected by a degradation history common to similar areas on the boundaries of the KMA. Based on the results of this survey, the vegetation of the proposed development area is severely degraded (see Plate 8). The entire site is covered by secondary growth and the vegetation is best described as secondary scrub containing a patchwork of highly localized cultivation, abandoned residential areas, grasslands and ruinate[2] successional forest re-growth. See Appendix VII for a complete list of the plants identified from the site.

Plate 8: Ruinate vegetation of proposed development area

While species diversity was relatively high, both the tree diameter and canopy height were very low. In general canopy height, was continuous, was less than 4 metres, and tree density of a diameter (at breast height) greater than 5 inches was also low. The species composition was also indicative of degraded human dominated lands. The dominant tree species along the edges was *Cassia emarginata*, a species common to grazed savannah, marginal agricultural lands and forest in early succession on poor soils. The same is also true of both *Cecropia peltata* and *Albizia lebbeck,* also common through the area. The other most abundant species were almost all introduced species characteristic of the vegetation of rural residential habitats. These species include Mango trees (*Magnifera indica*) and Ackee (*Blighia sapida*). It is not surprising that these

[2] Ruinate is a descriptive term for lands undergoing secondary succession from agriculture or similarly clear-cut land uses to natural regeneration. The type of ruinate vegetation that develops largely depends on the local climate, type of previous human land use, and the dominant vegetation life zone of the area.

trees were among the largest within the development areas; because of their value as food sources, they are often permitted to grow while surrounding trees are harvested for domestic and commercial uses.

There was evidence that many sections of the development area were previously used for both small scale agriculture and for residential housing. The area contained scattered concrete foundations of what appear to be long abandoned residences (see Plate 9). Additionally, many common Jamaican ornamentals were present throughout the property including species of *Croton, Helconia,* and *Hibiscus* to name a few that occurred along the transect area.

Plate 9: Abandoned residential area.

There was also evidence of ongoing and abandoned cassava (*Manihot esculenta*) and banana *(Musa sp*) cultivation within the study area.

Completely dominating the southern sections of the proposed development area was one introduced species, Molasses or Wynne Grass (*Melinis minutiflora*) as shown in Plate 10. Molasses grass is a perennial grass species that may grow up to 1 meter or more. The grass, which is native to tropical Africa was introduced into Jamaica in the 1800s and now thrives on steep hills and stony banks primarily between 1,500 and 4,000 feet above sea level. When dry, the grass burns easily.

Plate 10: Molasses Grass covering sections of the steep southerly slopes of development site.

This species is usually associated with the "bush fires" in the St. Andrew Hills in the dry months between January and April of each year. Due to its annual pattern of rapid growth, drying, and burning, molasses grass often prevents the regeneration of natural vegetation, and may, therefore, be at least partially responsible for the general lack of more diverse, mature natural vegetation in the development area.

4.0 SOCIO-ECONOMIC IMPACT ASSESSMENT

4.1 SOCIAL IMPACT ASSESSMENT METHODS

This SIA model is an effective means of identifying or predicting the probable impacts of a development and recognises levels of impacts at all stages of the project life-cycle - Planning/Policy Development (Phase I), Construction/Implementation (Phase II), Operation/Maintenance (Phase III) and Abandonment/Decommissioning (Phase IV). In this context, impacts are discussed based on their desirability, scale, duration in time and space, intensity or severity, cumulative or counter balancing.

The SIA for the proposed Ambassador Heights Housing Development will seek to understand the behaviour (past, present & future) of the individuals, communities and agencies affected by development. The social variables assessed are captured within the model (*The Interorganizational Committee, 1994*) described below:

- Population Characteristics
- Community and Institutional Structures
- Political and Social Resources
- Individual and Family Changes
- Community Resources

Population Characteristics – this covers the receptor community's demography, that is, the present population, its structure and composition, population projection and migration pattern in the context of the larger geographical unit – the parishes of St. Andrew & Kingston.

Community and Institutional Structures – this outlines the size, structure, and level of organization of local government including linkages to the larger political systems. The historical and present patterns of employment and the level of diversification of economic activities are described.

Political and Social Resources – seek to identify the "power base" or the distribution of power authority, interest groups and the affected public, and the levels of leadership , their capabilities and capacities within the community and region (Kingston 8).

Individual and Family Changes – the SIA seeks to structure the present concerns that could influence the daily life of individuals and families within the receptor communities. These changes range from attitudes toward the project to an alteration in family and friendship networks to perceptions of risk, health, and safety.

Community Resources -resources include existing land use patterns; the availability of housing and community infrastructure, such as, health, police, fire protection and sanitation facilities.

Data to support the SIA were collected through three principal means; analysis of existing document, interviews and a community survey (Appendix IV) conducted, within the defined Social Impact Assessment (SIA) area - Ambassador Heights (see Map 6) as described below:

1. Obtaining primary data through:
   - reconnaissance of the site and adjacent areas;
   - interviews with and a socio-economic survey among local stakeholders
   - telephone interviews with personnel of relevant government agencies and service providers, such as, JPSCo, Jamaica Constabulary Force (JCF), NWC etc.
   - traffic counts along the Mannings Hill (at the main entrance to Havendale) main road.

2. Obtaining Secondary data through:
   - Analysis of National Population 1991 and 2001 Census Data Sets.
   - Documentary research of information from government institutions, such as, NEPA, Ministry of Education (MOE) and the Social Development Commission (SDC)

3. The use of Geographic Information System (GIS)

- Review and presentation of land use (with respect to social amenities) and the 2001 Population Census Enumeration District and Traffic Count data sets.

The survey was conducted over a two day period on 2007 July 18 & 19. The survey instrument comprises fourteen (14) questions and data analysis was done using the Microsoft Excel programme.

The survey was conducted within a one kilometre (1 km) radius of the proposed site (the SIA area), focusing on households within closest proximity to the proposed development. A total of forty five (45) interviews were conducted, which represents approximately 6 per cent (5.8%) of the number of households within the SIA area. The number of households in the Enumeration District (ED) within which the proposed development falls along with neighbouring EDs were ascertained from the 2001 Population Census (Statistical Institute of Jamaica (STATIN). A total of four (4) EDs were chosen and these are shown in (Map 6):

- WR 64
- WR 65
- NC 1
- NC 2

The households for each ED were calculated and a grand total of 764 arrived at.

4.2 POPULATION CHARACTERISTICS

4.2.1 Demography

The enumerated population of KSA in 2001 was 651,900 of which St. Andrew accounted for 555,828 while the population of Ambassador Heights stood at 231 (STATIN, 2001). At the end of 2005, STATIN estimated a population of 658,800 for Kingston and St. Andrew; this was 24.8% of the island's population of 2,660,700 (see Table 8).

Although one of Jamaica's smallest parishes, St. Andrew, hosts the largest share of the Island's population, accounting for approximately 21.20% or 555,827 persons in 2002. This is attributed to the fact that much of St. Andrew constitutes the KMA, both in land mass and population,

with 89.9 per cent of the parish being urban. In 2001, the population of St. Andrew stood at 555,828, an increase of 15,945 over the 1991 population figure of 539,883.

The parish's population in 2001 represented 21.32 per cent of Jamaica's total population, while its urban population stood at 483,083 or 86.91% of the parish's population. The administrative and commercial capital within the parish is Half-way-tree; however, other urban nodes include New Kingston, Cross Roads and Liguanea. The KMA's population stood at 579,137 at the end of 2001.

Table 8: Population change in Jamaica and Kingston & St. Andrew, 2001-2005

	2001	**2002**	**2003**	**2004**	**2005**
Jamaica	2,607,600	2,621,500	2,635,700	2,648,200	2,660,700
Kingston & St. Andrew	651,900	652,900	653,400	656,100	658,800
% of Total Population	25.0	24.9	24.8	24.8	24.8

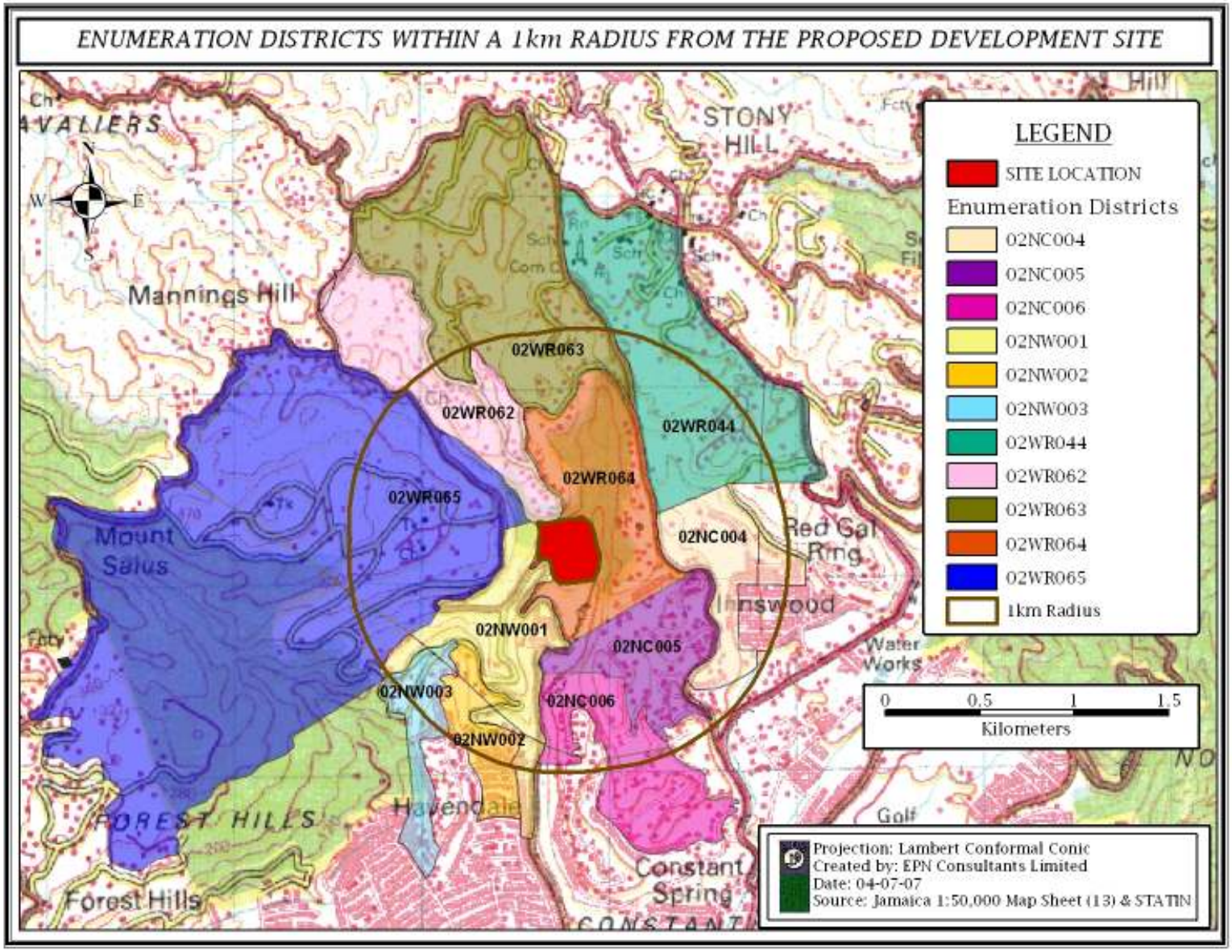
Source: STATIN & PIOJ

Relevant population change summaries for 1991 to 2001 are shown below:

- the annual rate of Jamaica was 0.91 per cent
- the annual rate of growth for Kingston was -0.38
- the annual rate of growth for St. Andrew was 0.29

The population structure of the parish based on the 2001 Population Census indicates that 29.78 per cent (165,499) of the population were under the age of 15 years; while 63.19 per cent (351,164) were in the 15-64 age cohort and 17.09 per cent (39,063) were 65 years & over. From the socio- economic survey conducted within the SIA, the 15-24 and 35-44 age groups accounted for 22% or ten (10) each of those surveyed.

Based on the Jamaica Survey of Living Conditions (JSLC) Parish Report 2002, sixty two per cent (62%) of St. Andrew's population belong to 15-64 age group (working age), while nine per cent (9%) was over 65. This varied slightly from the 2001 figures which stood at 63.19% and 7.03% respectively. The age dependency ratio in 2002 stood at 60 per cent i.e. 60 working age individuals to every 100 persons, this was the lowest recorded for that period, this figure however, supersedes that of the 2001 census which stood at 58.25% which was also the lowest during that period.



Map 6: Enumeration District Map for Ambassador Heights, St. Andrew

Hierarchy of Urban Centres

STATIN defines three classes of special areas: Classes A, B & C; Class A special area includes all parish capitals and the KMA which covers Kingston and urban St. Andrew. Class B special areas include all other urban areas with a population in excess of 2000. Class C special areas are rural communities of special interest.

The Parish of Kingston is classified as 100 per cent urban while its counterpart St. Andrew is was 87 per cent urban and 13 per cent rural in 2001. The KMA, which encompasses areas, such as, Cross Roads, New Kingston, Half Way Tree and Manor Park, is Jamaica's Central Business District (CBD) and the administrative capital, however, when coupled with Portmore the area becomes one of the largest urban areas within the Caribbean. In 2001, the KMA population stood at 579,137, with Constant Spring (12,072), Liguanea (10,410), Half-Way Tree (4,936) and New Kingston (1,754) being some of the major population centres.

4.2.2 Migration

The main economic sectors of commerce and manufacturing (which provides numerous employment opportunities), and tertiary educational opportunities are the main pull factors affecting migration, as it relates to St. Andrew. Between 1991 & 2001, 24,363 persons migrated to St. Andrew from other parishes, while the parish of Kingston lost a total of 66,276 migrants, most of who are assumed to have migrated to St. Andrew or St. Catherine.

4.2.3 Population Density

The significant inequality in rural and urban populations in the parish of St. Andrew is influenced primarily by economic opportunities and also by topography. As such, the population density within the parish is higher in areas closer to the main business districts, such as, Cross Roads, Downtown, New Kingston and Liguanea. The parishes of Kingston and St. Andrew have population densities of 4,760 persons per square mile and 1,254 persons per square mile respectively. The population density of Jamaica is 216 persons per square kilometre. Population density within the SIA is equally influenced by topography and economic activity.

4.2.4 Population Projection

If it is assumed that an annual growth rate of about 0.38 per cent for the period 1991 – 2001 in Kingston remains constant, it is projected that the population will reach approximately 92, 360 and 88,528 in the years 2010 and 2020 respectively. On the other hand, if an annual growth rate of 0.29 per cent is assumed for St. Andrew for the same period then it is projected that the parish's population will stand at 567,210 and 581,620 in the years 2010 and 2020 respectively based on the following formula:

Population P $= [\log P_0 + N * \log (1 + r)]^{10}$

P= P of a Certain Year
P_0= Population of a Region at Year 0
N = Number of years from year 0
r = Annual growth rate

Thus, the population of Kingston and St. Andrew could stand at 659,570 in the year 2010 and at 670,148 in 2020, as shown in Table 9 below.

Table 9: Population Projection for KSA 2001-2020

Parish	census 2001	2005	2010	2015	2020
Kingston	95,810	94,287	92,360	90,444	88,528
St. Andrew	554,241	560,005	567,210	574,415	581,620
Total	650,051	654,282	659,570	664,859	670,148

Source: STATIN

4.3 COMMUNITY AND INSTITUTIONAL STRUCTURE

4.3.1 Political Organization

Politically, the parish of St. Andrew is divided into twelve (12) Constituencies while there are three (3) in Kingston. There are a total of forty (40) Parish Council Divisions (Electoral Districts). The project area falls within the St. Andrew West Rural Constituency and within the Stony Hill Division. At the local level, the Citizens Association deals with the day-to-day concerns of the community.

4.3.2 Employment and Income

In 2001, the average unemployment rate for Kingston and St. Andrew were 6.37 and 12.22 per cent respectively. With individual parish data no longer available, information obtained from

STATIN and PIOJ placed the national unemployment rate at the end of October stood at 9.6 per cent, while the average for 2006 stood at 10.3 per cent (see Table 10).

Table 10: Total labour force employed and unemployed

LOCATION	TOTAL	EMPLOYED	UNEMPLOYED	PERCENTAGE UNEMPLOYED
Kingston (October 2001)	45,500	42,600	2,900	6.37
St. Andrew (October 2001)	261,800	229,800	32,000	12.22
Jamaica (October 2006)	1,249,100	1,129,500	119,600	9.6
Average for 2006(Jamaica)	1,253,100	1,123,700	129,400	10.3
Jamaica (October 2007)	1,268,800	1,149,000	119,800	9.44
Average for 2007 (Jamaica)	1,261,275	1,419,250	124,450	9.85
Jamaica (April 2008)	1,287,300	1,134,600	152,700	11.9

Source: STATIN & PIOJ

The Socio-economic Survey conducted within the SIA revealed that unemployment rate within the area stood at 36 per cent which is more than three times the national figure of 10.3 per cent for 2006. Majority of the unemployed individuals (7) were from ED West Rural 65, while the number of unemployed persons within the immediate vicinity of the proposed development stood at only one (1) person. Majority of those who were employed were skilled workers and professionals such as teachers, masons, nurses and business persons.

4.3.3 Economic Activity

The SIA area for the most part is composed of persons who work within the KMA and retirees, as such; economic activity within the area is limited to small scale farming and businesses like corner shops.

4.4 COMMUNITY RESOURCES

4.4.1 Existing Land use

The land use of the area is predominantly residential in nature with the exception of a quarry that is located about 500 metres below the proposed development site. Residential development is generally of low density, as residential lots tend to be large. The main area of natural vegetation is the proposed development site and the steep slopes to the east of the property.

4.4.2 Housing

The parishes of Kingston and St. Andrew accounted for a total of 192,713 households and 183,340 dwelling units, based on the 2001 Population Census. Of these figures, St. Andrew accounted for a total of 164,513 & 156,137 respectively or 21.9 & 21.6% of Jamaica's total number of households and dwelling units. During this period, there were a total of 110 households within the West Rural-64, ED which includes the Ambassador Heights area. However, these figures have since increased due to new residential developments in the area (see Plate 11). The average number of persons per household in 2002 for St. Andrew stood at 3.2, which was less than the national figures of 3.7. The survey conducted in the SIA area indicated that the average household size is four (4) persons. The existing South Ambassador Heights development has an estimated 2.1 persons per household.

Plate 11: Residences in the Ambassador Heights Area.

Home ownership within the parish in 2002 stood at 48.2 per cent, whilst 19.2 per cent occupied rent free and nearly 1/3 rented their dwelling. The main outer wall materials for St. Andrew based on 2001 national survey were: (i) concrete and block (77 per cent), (ii) wood (12 per cent) and (iii) wood and concrete (7 per cent), while the main roofing material was also metal sheeting (73 per cent). However, the JSLC parish report 2002 indicated that 75.5 per cent of dwellings within the parish had outer wall material of block and steel, while 12.1 per cent were concrete nog. Based on the nature of surrounding existing community(s) the main outer wall material was found to be concrete and block.

From the Socio- economic Survey conducted in the area, 96 per cent of housing units within the area are detached units while 4 per cent are attached as shown in Figure 4 below. The survey also confirmed observations that were made as it relates to main outer wall material in the area, with 78 per cent of the houses of the householders interviewed having concrete and blocks for outer wall material (see Figure 5).

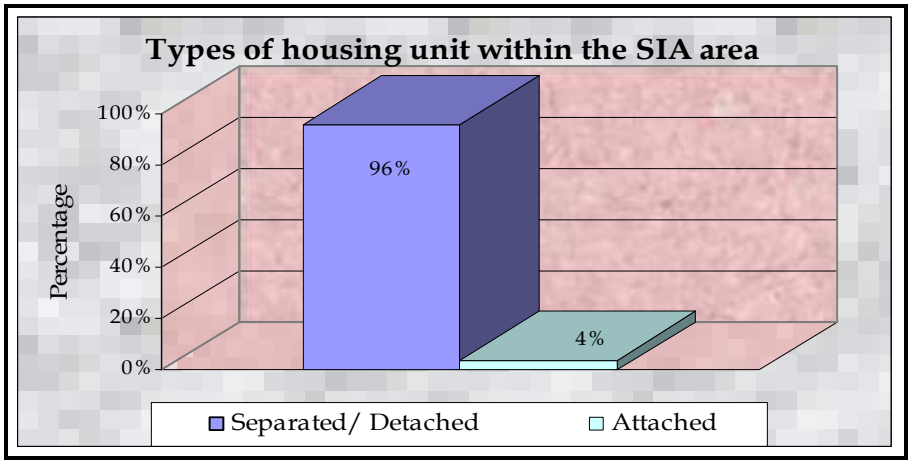


Figure 4: Showing type of housing units in Ambassador Heights SIA area.
Source: Community Survey

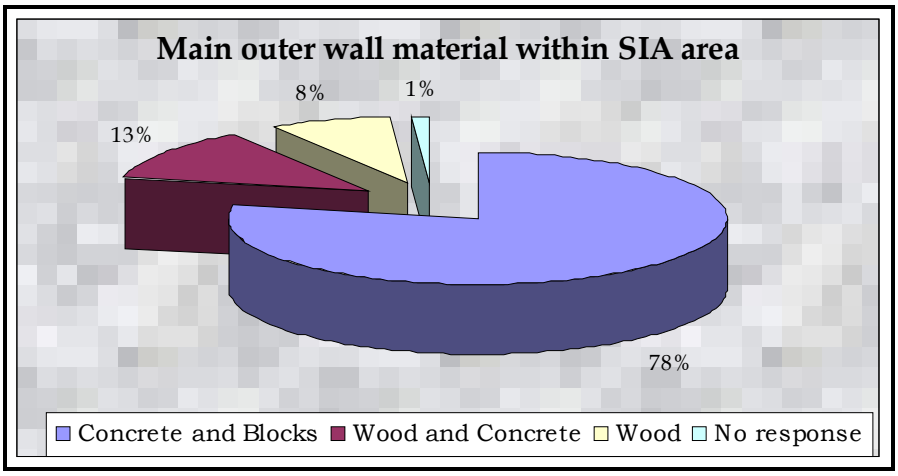


Figure 5: Showing main outer wall material in SIA area
Source: Community Survey

4.4.3 Social Services and Amenities Infrastructure

Within the framework for a totally integrated development, the promotion of a harmonious integration of all sectors, such as, the physical, social, cultural, economical, environmental and governance systems is integral to the objective of achieving sustainable development. Ultimately this collaboration between sectors should ensure that social carrying capacity needs are met within stated objectives.

Given the urban setting within which this development would occur, the average Vehicle Kilometre Travelled (VKT) to social infrastructure facilities would be reduced when compared to rural areas. Essentially, the primary consideration in reducing VKT would be completing multiple tasks in one trip.

A. Police

The Stony Hill Police Station's division stretches from Red Gal Ring to Toms River (border of St. Mary and St. Andrew) in the north, along an imaginary line westward to include areas such Parks Road (border of St. Andrew and St. Catherine) and sections of Smokey Vale and eastward to the border of St. Mary. The station's division encompasses a total of fifty eight (58) districts, which according to the officer, should ideally be served by two (2) police stations. The officer also noted that the station is currently short-staffed; however, he failed to give details as it relates to number of persons on staff or on each shift, from observation however, at least three officers - including the inspector were on active duty at the time of our visit. Nationally, police

stations operate 24 hours on four shifts, which would indicate that the Stony Hill Police Station has at least 15 members on staff. The station has two cells.

In addition to being short staffed, the station lacks the adequate resources for its day to day operations as currently the station operates with only one vehicle. It was noted that originally there were two units; however, the other was put out of service due to an accident. With such a large area to cover, coupled with its location close to four schools (Stony Hill Primary & Junior High, Homestead, the SOS Children's Home and the St. Andrew Juvenile Home) and the Stony Hill Health Centre, and given the fact that the unit doubles as an emergency service vehicle, the station's ability to adequately serve is restricted.

With regards to hot spots within the station's division it was noted that areas, such as, Red Gal Ring, Temple Hall, Toms River and Old Stony Hill Road report high incidents of traffic accidents including fatalities . Nevertheless, no fatal accidents have occurred along the Old Stony Hill Road. Generally, most accidents occur when it rains. As it relates to robberies, the occurrences of these are prevalent in areas, such as, the urbanized area of Stony Hill, Golden Spring, Wireless Station Road, Cavaliers, Boon Hall, Old Stony Hill Road and Clarks Hill. The Officer was keen to note that the developer should carefully select the persons he employs during the construction/implementation phase and provide adequate security, as the incidents of robbery and to some extent murders increase with the construction of new developments.

In addition to the security concern expressed above, concern was also expressed that being already short-staffed and lacking in resources, the division could be further stretched with the addition of a new housing scheme (Johnson, 2007).

B. Post Office

Based on the location of the development (off Old Stony Hill Road), the new residents would have a choice of the Constant Spring (see Plate 12) or the Stony Hill Post Offices (see Map 7). The Constant Spring Post Office has a staff complement of forty three (43) inclusive of eighteen (18) postmen and the Postmaster/mistress. As one of the larger post offices in St. Andrew, Constant Spring serves a total of eighteen (18) districts within which there are over forty (40) communities, and also distributes mail to the more recently built Grants Pen Post Office.

Communities served by the post office at Constant Spring include Cherry Gardens, Norbrook, sections of Shortwood, Constant Spring Road, Old Stony Hill Road and communities leading off.

Plate 12: The Constant Spring Post Office

In addition to offering the regular services, such as, mail collection and delivery, issuing of pension cheques and the selling of stamps, the post office offers other services which include photocopying and Bank and Money Orders while being an agent for Paymaster and FedEx.

A Postmistress at the post office noted that the area of the proposed development is not served by postmen; however, the developer should notify the post office in writing, in order that the necessary adjustments can be made to have the new development listed. Newcomers can exercise their option to purchase a mailbox.

In the case of the Stony Hill Post Office which appears to be in closer proximity to the proposed development, there are just fewer than ten (10) full-time staff members. At present, the Post Office serves communities such as Golden Spring, Boon Hall, Old Stony Hill Road, Stock Farm, Sea view and Faith Town. The Post Office offers basic services which entail mail collection and

delivery and selling of stamps. The Post Office does not offer delivery of mail by a postman and, as such, persons would have to collect their mail at the facility.

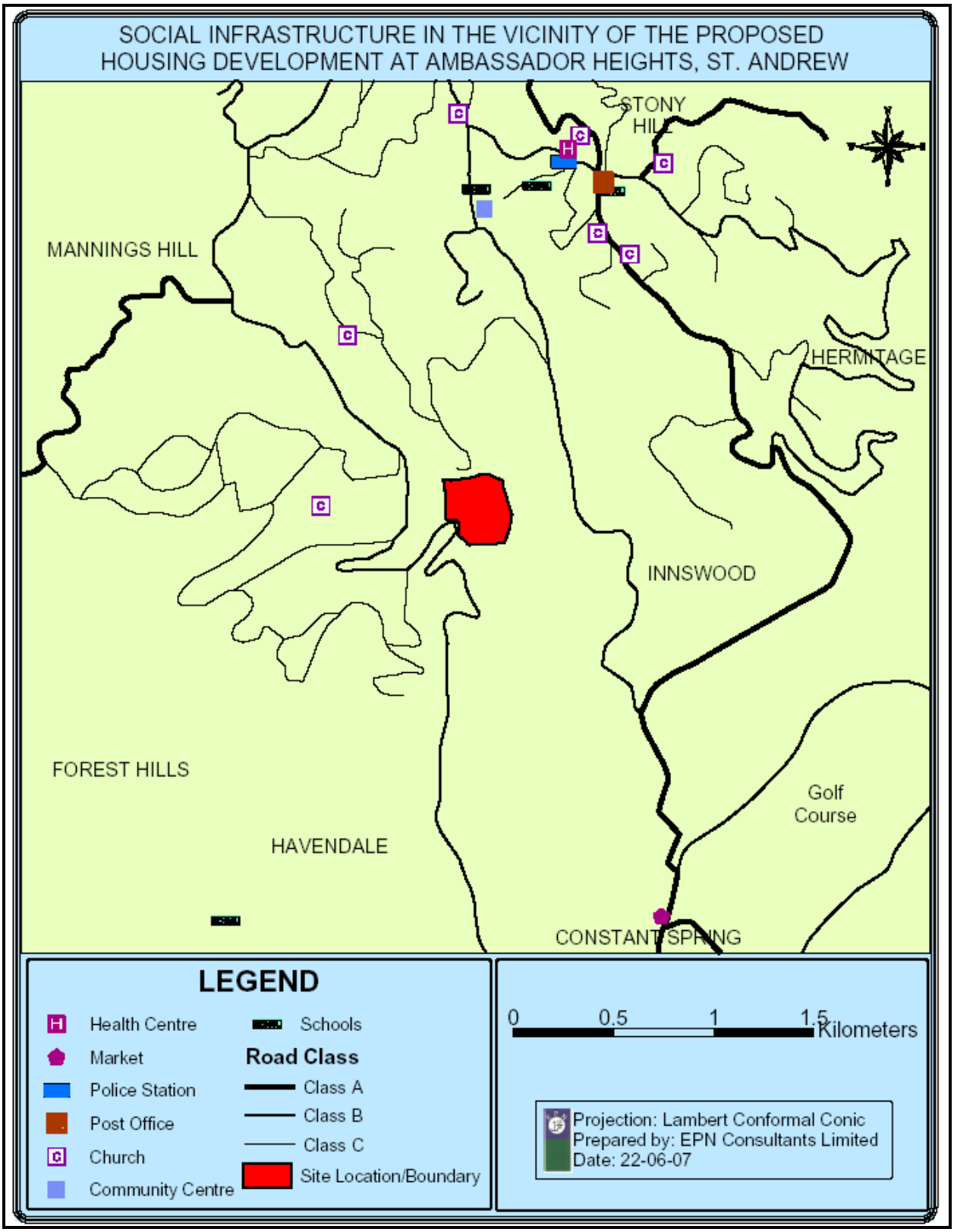
C. Schools

Based on the location it can be said that the proposed development lies on the outskirts of a school community with at least thirty (30) schools (public and private) located within a sixteen (16) kilometre radius of the site (see Plate 13).

There are three (3) Primary Schools (ages 6-12), four (4) Primary and Junior High Schools (ages 6-15) and eight (8) High Schools (ages 12-19). The Stony Hill Primary and Junior High and Meadowbrook High are within the closest proximity to the proposed development. Enrolment in the schools within the 16 kilometres radius of site exceeds their capacity except Swallowfield Primary and Junior High, while enrolment at the Mannings Hill Primary School and Holy Childhood High School was almost twice their capacities. During the 2006-2007 period, the pupil: teacher ratio within the schools was below the standards of 42:1, 30:1 and 20:1 set by the Ministry of Education for primary, primary and junior high and high schools respectively (see Table 11).

Through conversations with residents within adjoining communities it was revealed that a large number of high school students in the area travel to attend Oberlin High School in Lawrence Tavern.

Plate 13: The Immaculate Conception High School and the Constant Spring Primary and Junior High School



Map 7: Showing social infrastructure within the vicinity of Ambassador Heights

I. Public Schools

The public schools are listed in Table 11 below:

Table 11: Total Enrolment and Capacity by School (2006/2007)

LEVEL	CAPACITY	ENROLMENT	NO. OF TEACHERS	PUPIL/TEACHER RATIO
Primary				
Half Way Tree Primary	960	1,147	41	31:1
Dunrobin Primary	955	1,413	45	37:1
Mannings Hill Primary	410	524	18	33:1
Primary & Junior High				
Constant Spring Primary & Junior	1,040	1,309	65	24:1
High	975	1,107	49	26:1
Stony Hill Primary & Junior High	1,015	1,063	43	27:1
Shortwood Practising Primary & Junior High	1,430	1,257	52	28:1
Swallowfield Primary & Junior High				
High/Secondary				
Immaculate Conception High	1,200	1,579	92	19:1
Merl Grove High School	1,200	1,429	89	18:1
Holy Childhood High School	800	1,769	112	18:1
The Queens School	1,000	1,762	97	18:1
Calabar	1,600	1,863	94	23:1
St. Andrew High	1,400	1,459	84	20:1
Meadowbrook High	1,200	1,396	77	19:1

Source: Ministry of Education & Youth
* Pupil Teacher ratio excludes teachers on leave and administrators

In 2001: The age cohort 5-19 in Kingston & St. Andrew totalled 194,714 or 29.8 per cent of the population

2. Private Schools

In addition to the public schools listed, several private schools are with 16 kilometres radius site, and encompass preparatory schools, high schools and tertiary institutions. These schools include:

Preparatory school

- Charlton Preparatory
- Dunrobin Preparatory
- Quest Preparatory

- Immaculate Preparatory
- Stella Morris Preparatory
- Stony Hill Preparatory
- The Queens Preparatory

Academy & Preparatory /High

- Hillel Academy & Preparatory
- Emmanuel Christian Academy & Preparatory
- Covenant Christian Academy & Preparatory
- American International School of Kingston
- Charlton Secondary

Teachers College

- Shortwood Teachers College

Special School

- Salvation Army School for the Blind

The closest private school the development is Quest Preparatory School, while several pre-schools or kindergartens are also located with 16 kilometres of the site.

D. Health Services

The South East Regional Health Authority (SERHA) provides public health surveillance and enforcement and delivery within KSA, St. Thomas and St. Catherine. This SERHA region has a combined population of approximately 1,244, 500.

I. Hospitals

Hospital services (general and specialist) are administered, through the boards of four (4) Regional Health Authorities; South East, Southern, North East and Western, with hospitals classified as Type A, B or C, according to the level of service offered and the size of the population served.

Fifteen (15) hospitals (public & private) are within SERHA with the Andrews Memorial Hospital, the University Hospital of the West Indies (UHWI), Medical Associates Hospital and the National Chest Hospital (NCH) being closest to the proposed development (see Table 12).

The Andrews Memorial Hospital is a private hospital that offers services such as radiology (including x-ray, ultrasound & CT scan), physiotherapy, dental, outpatient and kidney stone removal along with 24 hour accident and emergency. Facilities at the hospital includes a lab, accident and emergency unit, maternity ward, medical ward, surgical ward, outpatient department and a pharmacy.

The hospital has a total of seven (7) out patient doctors and over one hundred (100+) consultants. With regards to emergency response it was noted that the hospital has no ambulance service of its own. However, there is a close relationship between the hospital and Deluxe and Ambucare, who are ambulance service providers (Smith, 2007).

The National Chest Hospital, in addition to dealing "with anything to do with the chest ", provides dental, dermatology, plastics surgery, dietary, ambulatory, casualty, and physiotherapy services in addition to in and out patient services. Personnel at the hospital noted that all patients with chest related ailments, for plastic surgery and for dermatology services have to be referred to the hospital.

As it relates to facilities at the hospital, there is an x-ray department, surgical department, a pharmacy, an out patient area and a lab. It was indicated that currently lab services are suspended but are "to come back on stream shortly", while the hospital has received new x-ray equipment and "can now x-ray more than the chest".

Staffing at the hospital includes a senior medical officer, a cardio somatic consultant, six (6) resident doctors, three (3) senior house officers and forty eight (48) nurses (Gayle, 2007).

Table 12: Hospitals in the South East Regional Health Authority by type and bed complement

PARISH	NAME	ADDRESS	TYPE	NO. OF BEDS
St. Catherine	Spanish Town Hospital	Burke Road	B	320
	Linstead Hospital	Rodney Hall Road	C	51
	Kingston Public Hospital (KPH)	North Street	A	422
	Victoria Jubilee Hospital (VJH)	2 North Street	Specialist	192
	Bustamante Hospital for Children (BHC)	Arthur Wint Drive	Specialist	244
	University Hospital of the West Indies	(UHWI) Mona	A Quasi Public	444
	National Chest Hospital (NCH)	36½ Barbican Road	Specialist	100
	Sir John Golding Rehabilitation Centre	7 Golding Avenue	Specialist	67

PARISH	NAME	ADDRESS	TYPE	NO. OF BEDS
Kingston & St. Andrew	Hope Institute	Elletson Flats	Specialist	40
	Bellevue Hospital (BVH)	16 ½ Windward Road	Specialist (psychiatry)	1,200
	Andrews Memorial Hospital	27 Hope Road	Private	47
	Maxfield Medical	69 Maxfield Avenue	Private	9
	Nuttal Memorial Hospital	6 Caledonia Avenue	Private	62
	St. Joseph's Hospital	22 Deanery Road	Private	42
	Medical Associates	9 Tangerine Place	Private	
St. Thomas	Princess Margaret Hospital	54 Lyssons Road	Public C	98

Source: SERHA

II. Health Centres

A total of forty-eight (48) Health Centres ranging from Type I to Type V are located within KSA, this figure also includes six (6) satellite locations. Based on its location the closest public health centre to site is Stony Hill Health Centre, however, several private doctors are located within the Manor Park area. The Stony Hill Health Centre is a Type III facility whose services include:

- Child health (Pediatric services)
- Pre-natal health
- Child guidance counseling
- Sexually Transmitted Infection Service
- Public Health (food handling etc.)
- Curative
- Mental Health
- Dental
- Family planning
- Dressing
- Social Services

The health centre has a staff complement of seventeen (17) persons, inclusive of a doctor, a public health nurse, a registered midwife, a family nurse , two (2) orderlies (a male and a female), a part-time registered nurse, enrolled assistant nurse, a dental nurse, a visiting dentist, a pharmacist, a pharmacy technician, a visiting dermatologist and a visiting medical health officer. This is in addition to a cashier and two (2) clerks in the records department.

E. Fire Services

The Stony Hill Fire Brigade serves in a zone which runs from Constant Spring to the border of St. Andrew and St. Mary and also to the border of St. Andrew and St. Catherine. The station is an "out" station and thus it operates on four (4) shifts with nine (9) persons on each shift. The station is manned by a district officer, a sergeant, a corporal and firemen/fire-fighters. The

station has one (1) unit that is fully equipped; however, this is from the controversial batch acquired by the government in 2006/2007. An officer at the station indicated that both manpower and equipment are sufficient for the day-to-day operation of the station. However, in case back up is needed the head office (York Park) is called and they will dispatch a unit from their station or a neighbouring station.

With regards to incidents of fires (fire calls), the officer noted that most calls within the Stony Hill area are in response to bush fire specifically during the dry season (K. Morrison, 2007).

F. Recreation and Entertainment

There are very few recreational areas within, and on the outskirts of the city limit, as such the closest "recreational" facility to the proposed development site is the Constant Spring Golf Club and the Constant Spring Football Club. In relation to entertainment, there are a wide range of entertainment spots in the City, including the hotels in the New Kingston area.

G. Financial Services

The development is located within relatively close proximity to the Stony Hill, Manor Park (Constant Spring), and Mannings Hill area, which would lend to accessibility to major financial services, such as the National Commercial Bank

H. Emergency Services

The Jamaica Fire Brigade (JFB), the Jamaica Defence Force (JDF) and the JCF have a national responsibility to respond to emergency calls. However, more "personalised" provision is made through private ambulance providers within Kingston and St. Andrew. These include Ambucare, Deluxe and St. John's Ambulance. Unlike Ambucare and Deluxe, the St. John's Ambulance which is an arm of the Salvation Army, offers its services voluntarily.

With over twelve (12) ambulances within these entities, in addition to the services of the JDF, JFB and JCF, sufficient capacity is provided within the KMA.

Plate 14: Commercial activities on Mannings Hill Road: a plaza, Pizza Hut, a gas station and a supermarket

4.4.4 Physical Infrastructure

A. Electricity

The Mannings Hill area obtains electricity service from feeder stations within Constant Spring. Based on the *JSLC Parish Report, 2002*, electricity was the chief source of lighting for 93.4 per cent of households in St. Andrew. This is compared to 89.7 per cent in 1998 which is slightly lower than the 2001 Population Census figure which was just over 95 per cent (95.47).

B. Telephone

In 2001, 75 per cent (123,736) of households in the parish of St. Andrew reported having access to a telephone, of which 85.4 per cent (105,783) had access to a land line and 14.5 (17,953) had access to a Cellular phone. The percentage of persons with access to telephone represents the highest figures throughout the island.

Currently land line and Internet service is supplied to the area by Cable and Wireless, while Flow has plans to commence operations within the area in the near future. Cellular services are available from C&WJ, Claro and Digicel.

C. Potable Water

Majority (109,254/66.4%) of households in St. Andrew in 2001, obtain potable water from water piped into their dwelling, with water piped into yard accounting for 18.2% (30,035) of households. Of the 110 households identified within the West Rural-64 ED within which the proposed development is located, 105 (95%) had water piped into their dwellings.

Potable water is supplied to the area by NWC, from the Hermitage Dam, which is said to have a capacity of 1.789 MM^3 or 394 MIG; however, through conversations with residents in the area, it was learnt that frequent water lock-offs seems to be a major problem.

D. Roads & Transportation

The area features a simple but for the most part winding road structure. The Mannings Hill main road (Class C) is for the most part narrow while sections are in disrepair. The road network within the existing Ambassador Heights development is in fair condition; however,

there is a need for improvement in the existing drainage system. On the other hand, the Class B Old Stony Hill Road, which connects the area to Stony Hill, features similar characteristics to that of the Mannings Hill Road.

The area does not feature a formal taxi/bus (including JUTC) route, as such, person who wish to travel to and from areas such as Stony Hill either travel in their private vehicles or taxis. In light of this, it is likely that these taxis will extend their services to Ambassador Heights once the demand exists.

Table 13: Traffic Count Survey, Manning Hill Main Road, St. Andrew, 2007 August 16

TIME	VEHICLE	7:00AM - 8:00 AM		8:00 AM – 9:00 AM		9:00AM – 10:00 AM		
DIRECTION		NORTH	SOUTH	NORTH	SOUTH	NORTH	SOUTH	TOTAL
	CARS	17	60	11	56	20	40	204
	SUV's	4	28	3	17	4	9	65
	PICKUPS	5	13	9	3	4	8	51
	TRUCKS	2	3	2	3	-	-	10
	MINI BUS	2	4	1	4	3	4	18
	MOTOR BIKES	3	3	4	11	2	7	30
	BICYCLES	1	1	-	2	-	3	7
	VANS	1	5	2	5	5	6	24
	TOTAL	35	117	32	110	38	77	
TOTAL		**152**		**142**		**115**		**409**

Source: Field visit

As a means of establishing the potential impact of the proposed development on weekday traffic pattern in the area, a limited traffic survey was conducted during morning peak hours (7:00 am - 9:00 am) on 2007 August 16 (see Table 13). The survey revealed that just under 75% (74.3%) of vehicles travelled southbound (towards Havendale/Mannings Hill), while the remaining (25.7%) travelled northbound (towards Stony Hill). Class 1 vehicles (Cars & SUV's) accounted for over 65 per cent (65.8 %), most of which travelled during the period 7:00 am to 8:00 am.

In the SIA area, 76% (34 persons) of the residents interviewed were dissatisfied with the present road conditions within the area as road maintenance was identified as area in which most improvement was needed. On the contrary there was a high level of satisfaction with transportation services in the area (see Figure 6 below).

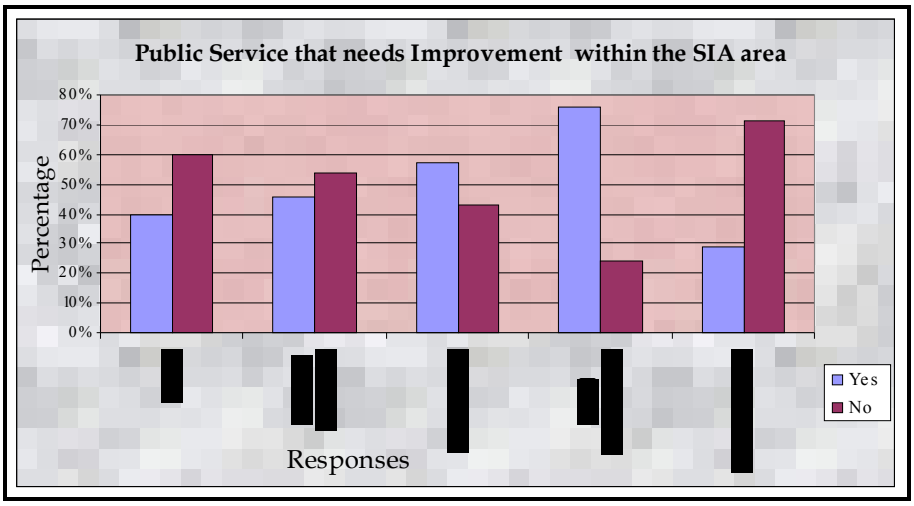


Figure 6: Showing attitude of the residents towards public services in the SIA area
Source: Community Survey

E. Waste Disposal

i. Solid Waste Disposal

The NSWMA, through its MPM, has the responsibility for solid waste collection and disposal within St. Andrew. The solid waste is disposed of at the Riverton City Landfill in St. Andrew. An estimated 4,085.76 kilograms of solid waste would be generated weekly at the fully populated development site. This figure was derived using the formula:

*1.52kg * 3.2 (persons per household based on 2001 Population Census) * 120 (number of residential lots) * 7 (amount of days in the week).*

The collection schedule for garbage within the area is twice weekly - on Mondays and Thursdays. During the construction and implementation stages solid waste will be stored without endangering life or property as if left unattended it will increase the potential for flooding if washed into the nearby Shingle Hut Gully and serve as an attraction for pests/vermin.

The scale of the development demands formal arrangement for solid waste disposal either through the NSWMA or through private collection. In the case of the NSWMA the relevant approval for accessing the service has to be obtained from the Agency.

b. Sewage Disposal

Private (not shared) water closets are the dominant (95% or 105 households) means of sewage disposal within the project area in 2001. These figures are similar to the JSLC Parish Report 2002 figures which indicate that the main type of sanitary facilities for 94 per cent of households within St. Andrew is water closets. This represented the highest prevalence, as pit latrine use decreases.

However, the Population Census figures for the parish in 2001 indicated 82.8 per cent of households had water closets, of which 75% (102,301 households) had water closets that were not shared.

4.5 POLITICAL AND SOCIAL RESOURCES

The SIA area is both rural and suburban in nature, with the rural area located to the north of the proposed development in a community known as Mannings Hill District, while the suburban area is located within the proposed development area. Features normally present in suburban areas identified south of the development site include the existence of planned housing developments.

4.5.1 Governance

The SIA area falls within two (2) constituencies (St. Andrew North Central and St. Andrew West Rural) thus, however, the Member of Parliament for the constituency in which the development falls (West Rural) is Mr. Andrew Gallimore for the Jamaica Labour Party (JLP), while Mr. Carl Samuda – also of the JLP, is the Member of Parliament for the adjacent North Central constituency.

Politically the SIA's constituency "swung" during the October 2002 General Elections, as during the previous elections (1993 and 1997) the ruling Peoples National Party (PNP) was victorious over the JLP, however JLP won in 2002 and again in 2007.

4.5.2 Community Leadership

The forming of Citizens' Associations is the established way of promoting community leadership for fostering and maintaining the wellbeing of community members and such Associations are normal in the urban landscape including the receptor community.

4.6 HEALTH AND SAFETY CONSIDERATIONS

The concept of Health and Safety in the context of this report is rooted in the discipline of risk analysis which treats with the detection of potential causes for accidents and the evaluation of their probability and the extent to which they could cause damage, requiring that global risks be brought to an acceptable level. Bearing this in mind, it is any attendant risks associated with the project that are of relevance and these are referred to specifically as social risks. These social risks include the social consequences of accidents and unsatisfactory working and living conditions. Also included are the perceived or potential risks of exposure to conditions (hazards) that may produce acute and chronic effects on the safety and health of existing and proposed residents, visitors and employees.

4.6.1 Main Impact Groups

- Employees – during all phases and stages of development.
- Population – potential risks to potable water supply

4.6.2 Management of Potential Risks

- Pollution - soil, safe disposal of solid waste etc.
- Emergency Response – Development of an Emergency Response Plan (ERP)
- Disaster Management Plan - Awareness of the Parish Disaster Management Plan
- Development of an Occupational Health and Safety Management Plan which includes job safety analysis for each type of job during the construction phase.

4.6.3 Air Quality

A. Ambient Noise Level

Ambient noise level is a measure of the sound pressure levels in an area. Noise levels were measured using the Amprobe noise meter which was set on slow response for comparatively stable noise. These A-weighted noise levels were taken during the day on 2008 August 27 . The

noise levels recorded at three (3) separate points were within the guidelines set by NEPA (see Table 14 below). GPS readings were taken using the Neon-Line GPS instrument.

Table 14: Ambient noise levels, Ambassador Heights, St. Andrew, 2008 August 27

TIME	GPS LOCATION	NOISE LEVEL DB(A)	AVERAGE NOISE LEVEL DB(A)	NEPA AMBIENT NOISE LEVEL STANDARD DB(A)
	N18°O4'02.0" W 076°48' 13.5"	33.7 31.6 34.1 31.2	32.65	70
1:08pm	N18°O3'55.3" W 076°48' 07.0"	40.1 37.7 36.8 37.1	37.93	
1:11pm	N18°O3'57.3" W 076°48' 11.8"	32.8 27.3 26.6 28.9	28.9	

B. Ambient Air Quality – Particulate Matter

The particulate concentration in the atmosphere was measured on 2008 September 11 using a SKC DSP Sampler (Lelan Legacy). Particulates were collected over a period of 24 hours in a PM_{10} sized filter. The reading obtained was 11.0 $\mu g/m^3$ which is within the limit of 150$\mu g/m^3$ set by NEPA for ambient air quality.

4.7 PUBLIC CONSULTATION

An integral part of the EIA process that ensures that the views (on the proposed development) of the local community members and stakeholders are heard and taken into consideration, is public consultation. This includes telephone conversations with selected public and private sector stakeholders within Kingston and St. Andrew, a survey conducted in communities within a 1 kilometre radius of the proposed site as described above and a community meeting as described below.

4.7.1 Community Meeting

In his effort to apprise the community of his Development Plan for the Ambassador Heights property, the Developer called a meeting at the community's recreational area on 2008 February

15. The meeting was held between 6.00 pm and 7.00 pm and there were approximately twelve (12) persons in attendance. The format of the meeting was to introduce the project to the local stakeholders. The main findings of the baseline environmental assessment of the property were described by the Environmental Consultant. This was followed by a description of the proposed development by the Developer including the proposed engineering works that would be employed in order to mitigate potential impacts, such as, runoff from the property.

Community members were engaged in that they were allowed to ask questions related to the proposal. Responses to these questions were made by the Developer and the Consultant. In general, the attendees had a favourable opinion of the proposal and there was no dissent among those who attended.

4.7.2 Community Concerns

During consultation with residents within the SIA area several issues and concerns were raised including the needs of the current communities and concern about the proposed development. The most urgent community need identified by residents within the SIA area is that of repair to road network that links the area to Havendale to the south and Stony Hill to the north.

In addition to road repair residents complained about the irregularity of their water supply and would like to see improvement (see Figure 7). Residents were also vocal about their views on the potential impacts (both positive and negative) of the proposed development on their community and adjoining communities both in the short- term and in the long term.

The responses as visualized in Figures 7 and 8 included:

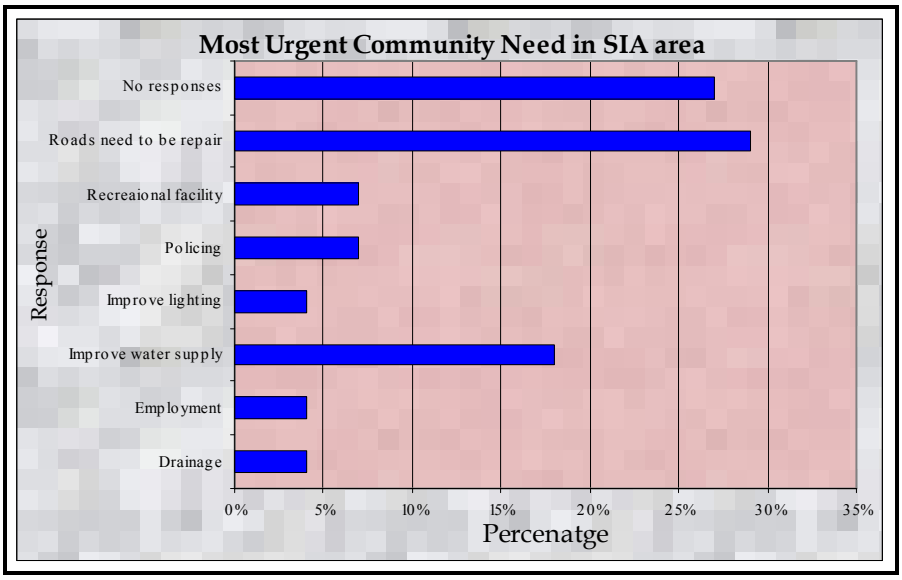


Figure 7: Most urgent need in the SIA area.
Source: Community Survey

The positive aspects of increased housing solutions are (see Figure 8):

- development of the area (in the long term)
- job creation in the short-term

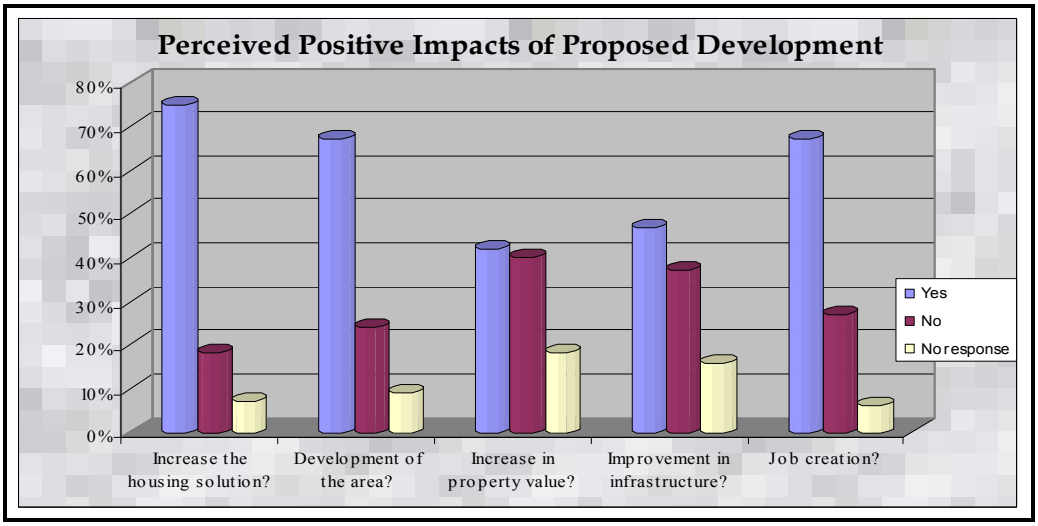


Figure 8: Showing the views of residents on the positive impact of the Development
Source: Community Survey

The most significant negative impacts are (see Figure 9):

- increase in traffic could result in traffic congestion
- loss of biodiversity
- increase in incidents of flooding

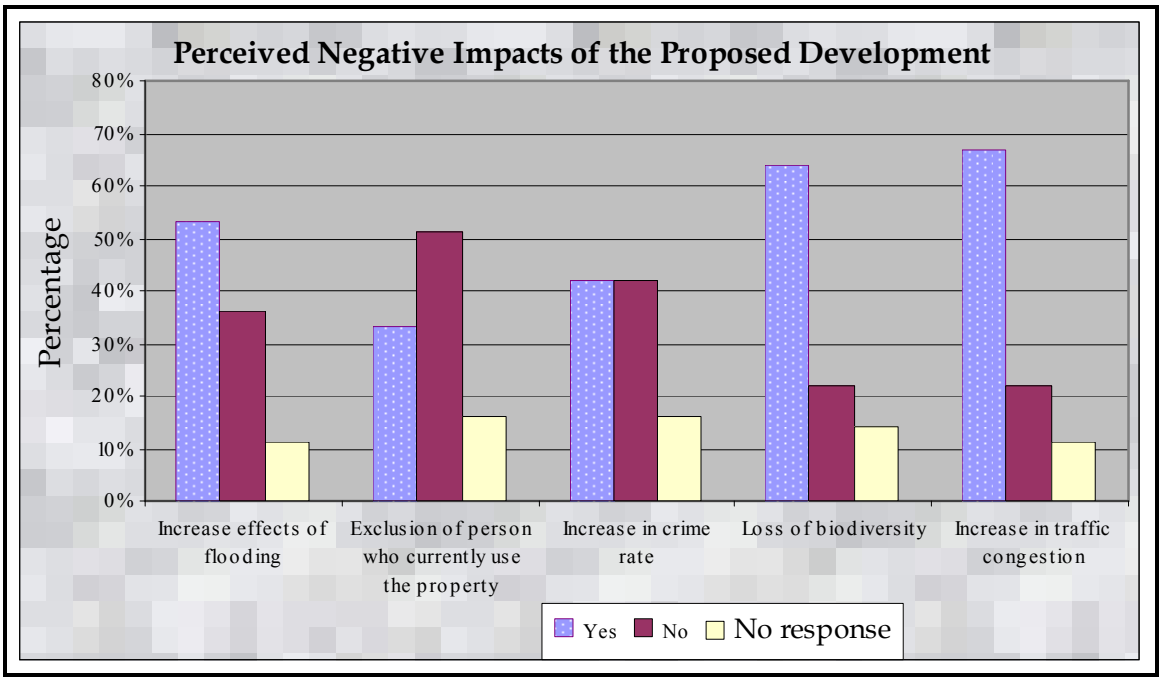


Figure 9: Showing the views of residents on the negative impacts of the Development
Source: Community Survey

5.0 IMPACTS AND MITIGATION

5.1 ASSUMPTIONS AND ASSESSMENT GUIDELINES

1. Physical Resources

a. Geology

The Proposed Action would normally have a significant effect on the environment if it would:

- Expose people or structures to major geologic hazards

b. Soils Resources

The Proposed Action would normally have a significant effect on the environment if it would:

- Cause substantial erosion
- Cause the substantial reduction in the production of agricultural crops

c. Surface waters

The Proposed Action would normally have a significant effect on the environment if it would:

- Substantially degrade water quality
- Contaminate a public water supply
- Cause substantial flooding or salutation
- Substantially alter surface flow conditions, patterns, or rates.

d. Ground Waters

The Proposed Action would normally have a significant effect on the environment if it would:

- Substantially degrade water quality
- Contaminate a public water supply
- Substantially degrade or deplete ground water resource

2. Air Resources

The Proposed Action would normally have a significant effect on the environment if it would:

- Violate any regulatory requirement of NEPA
- Violate any ambient air quality standard

- Expose sensitive receptors to substantial pollutant concentrations

3. Biological Resources

The Proposed Action would normally have a significant effect on the environment if it would:

- Substantially affect a rare or endangered species of animal or plant or the habitat of the species
- Interfere substantially with the movement of any resident or migratory wildlife species
- Substantially diminish habitat for wildlife, or plants

4. Social Impact Assessment

The Proposed Action would normally have a significant effect on the environment if it would:

- Substantially exceed carrying capacities of community resources
- Present risk to human health and safety
- Does not conform to the participatory development process

The checklists below rate the level of impact, their duration, and significance and whether they are direct or indirect based on the following legend (Table 15):

Table 15: Legend for potential development impacts

IMPACT	RATING
I	No Impact
II	Low
III	Moderate
IV	High
SIGNIFICANCE	**RATING**
I	Not significant
II	Less Than Significant Impact
III	Potentially Significant Impact
DURATION OF IMPACT	**RATING**
I	None
II	Short Term
III	Medium Term
IV	Long Term
DIRECT/INDIRECT IMPACT	**RATING**
I	No Impact
II	Direct
III	Indirect
* - Identifies positive Impacts	

5.2 POTENTIAL IMPACTS ON PHYSICAL RESOURCES AND MITIGATION

Table 1A: Geology and Soils: Impacts on Public Safety and Structures

ENVIRONMENTAL ISSUES	IMPACT	SIGNIFICANCE	DURATION OF IMPACT	DIRECT/INDIRECT IMPACT
Geology and Soils Would the project:				
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:				
i) rapture of a known earthquake fault, as delineated on the most recent earthquake fault zoning map for the area?	II	II	II	II
ii) strong seismic ground shaking?	II	II	II	III
iii) seismic related ground failure, including liquefaction?	II	II	II	III
iv) landslides?	III	III	III	III
b) Result in substantial soil erosion or the loss of top soil?	III	III	III	II
c) Be located in a geological unit or soil that is unstable, or that would become unstable, as a result of the project, and potentially result in on or off-site landslide lateral spreading, subsidence, liquefaction or collapse?	IV	III	III	II
d) Be located on expansive soil, creating substantial risk to life or property?	I	I	I	I
e) Have soil incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of waste water?	II	II	II	II

Table 1B: Geology and Soils: Significant Impacts and Mitigation Measures

INDICATOR	IMPACT & MITIGATION
	Construction/Implementation
Soils *Erosion Impacts*	**Impact** As a result of prevailing ground conditions from geological faulting, abundant rock material of varying sizes are loosely embedded in weathered rock/soil matrix on the moderate to steep slopes. This provides ideal conditions for excessive erosion during high rainfall, especially if vegetation is stripped from the slopes for construction purposes. Some of this eroded material will end up in the deep gully on the eastern boundary of the property. The area around the Shingle Hut Gully is generally unstable, thereby increasing the potential for erosion with incremental increase in development near to the gully. In the event of intense rainfall, high flows will have the potential to carry large rocks and debris from landslides and erosion on the steep gully slopes during development and post-development stages. This will eventually lead to blocked storm water drains onsite and offsite, particularly at the culverts down gradient of the site that is likely to contribute to overflows on the Mannings Hill Road. The potential impacts for erosion can, therefore, be significant if appropriate erosion protection measures are not included in the design of the development. **Mitigation / Erosion Protection Measures** **A. Removal of Vegetation** The project area must not be stripped entirely of vegetation for construction purposes. It is important that vegetation be removed only in areas that are in the path of proposed infrastructure works and footprints of buildings. The preservation of vegetation cover will offer good protection to the ground surface during development and post-development stages. **B. Handling of Earth Moving Operations** Material excavated from earth moving operations during construction of roads etc. must be handled efficiently and removed quickly and economically to its final destination. Stockpiling of waste from construction must be carried out in areas that will not be affected by rapid runoff from the site.

INDICATOR	IMPACT & MITIGATION
	Construction/Implementation
	Since the earth material is highly erodible, it is best to protect excavated cuts for roadways on site as soon as possible after they are exposed. This could take the form of a surface dressing with a sealer such as bitumen or by using sub-base material. **C. Drainage and Erosion Control Measures** In the design of onsite drainage, it will become necessary to use sediment traps/grating to minimize blockage as a result of eroded material entering the drainage system. In such instances, buried drains are not recommended as this will be difficult to maintain if the drainage system is blocked on a regular basis. **D. Density** The project area is prone to erosion based on geological and topographic factors. Therefore, there will be strict adherence to density conditions of NEPA and the Kingston and St. Andrew Corporation (KSAC).
Geology *Landslides* *Earthquake/Seismic Impacts*	**Impact** Information from the Landslide Susceptibility Map of Kingston (CDMP, KMA Project 1998) for shallow and deep-seated landslides indicates that the project site and its environs exhibit low landslide susceptibility. In a few areas however, moderate landslide susceptibility is shown in the vicinity of the site. General observations reveal that slopes are generally stable in areas that are undisturbed by construction or other types of earthwork activity. Approximately 500 metres south of the project area is a rock slide/fall on the side of the steep Shingle Hut Gully which was probably disturbed by past quarry activities (Plate 15). This gully is controlled by a fault resulting in this area being potentially unstable. The geological faults on the east and west of the project site have resulted in rocks that exhibit extensive fracturing and deep weathering on the slopes of the limestone hill. The large, loose boulders, cobble-size limestone and semi-intact rock are evident on the slopes (Plate 16). **Mitigation** Rock fall will be the main mode of slope movement on the project site. Large, loose or loosely attached boulders must be removed from the slope in a safe and economic manner. In cases where boulders are too large to be removed by mechanical means, the rock should be broken up by controlled blasting or by using pneumatic drilling method. Steep slopes near to fault scarps, such as, the areas close to the Single Hut Gully should be avoided. Rockslides can occur on or near the steep gully bank slopes if the area is disturbed for development purposes. An example of rockslide that has occurred along the Single Hut Gully is seen near the quarry down gradient of the site. **Impact** As indicated earlier, the project area is hinged between two geological faults and is therefore influenced by these geological structures. These faults are not known to be seismically active and, therefore, slip motion/movement on the fault planes is not anticipated. However, there are known faults in the Blue Mountain area in close proximity to the project site that are capable of generating moderate earthquakes that can cause significant damage. Loose and semi-intact rocks in the project area can be easily mobilized or detached from the slope by ground shaking during a moderate to large earthquake. Shepherd et al (1999) and the Kingston Seismic Hazard Assessment Project (1999) under the Caribbean Disaster Mitigation Programme (CDMP) have produced seismic maps for Jamaica and KMA respectively. These are the most current seismic hazard studies done for Jamaica and have given estimated horizontal ground accelerations of 0.27 g and 0.3 g respectively for the project area with a 10 percent probability of exceedence in 50 years. This corresponds to a return period of 475 years. **Mitigation** The type of housing structures that will best withstand moderate to large earthquakes are short, stiff structures, such as, single-2 storey structures. The height of these buildings responds best to long period waves which are frequently generated during large earthquakes. Reinforced concrete structures tend to withstand earthquake loads better than most other types of building structures. Un-reinforced masonry structures suffer badly during ground shaking and should not be encouraged. Removal of boulders and loosely attached rock in the project area is important in mitigating against rock/boulders which could be mobilized down the slopes from earthquake ground shaking, creating major rock fall hazards for the development.

Plate 15: Rock slide seen on the scarp slope of the Shingle Hut Gully near the Limestone quarry. Note boulder (circles yellow) sliding down slope.
Photo by S. Bhalai

Plate 16: Large limestone boulder seen on the southern slope of the limestone hill.

Table 2A: Hydrology and Water Quality: Impacts on Eco-systems and Public Health

ENVIRONMENTAL ISSUES	IMPACT	SIGNIFICANCE	DURATION OF IMPACT	DIRECT/INDIRECT IMPACT
III. Hydrology and Water Quality Would the project:				
a) Violate any water quality standards or waste discharge requirements?	II	II	II	II
b) Substantially deplete ground water supplies or interfere substantially with ground water recharge, such that there would be a net deficit in aquifer volume or a lowering of the local ground water table level (e.g., the production rate of pre-existing nearby wells would drop to a level that would not support existing land uses or planned uses for which permits have been granted)?	I	I	I	I
c) Substantially alter the existing drainage pattern of the site or the area, including thorough alteration of the course of a stream or river, in a manner which will result in on or off site erosion or siltation?	III	II	IV	III
e) Create or contribute runoff water which would exceed the capacity of existing or planned storm water drainage systems or provide substantially additional sources of polluted runoff?	III	III	III	III
f) Substantially degrade water quality?	I	I	I	I
g) Place housing within a 100-year flood hazard area, as mapped on a federal flood hazard boundary or flood insurance rate map, or other flood hazard delineation map?	I	I	I	I
h) Place structures that would impede or redirect flood flows within a 100-year flood hazard area?	I	I	I	I
j) Result in inundation by hurricane or tsunami?	II	II	II	III

Table 2B: Hydrology and Water Quality: Significant Impacts and Mitigation

INDICATOR	IMPACT & MITIGATION
	Construction/Implementation
Hydrology *Flooding*	**Impact** No documentary evidence of flooding in the project area and its immediate surroundings was found for this study. Storm water from the site and adjoining areas drains directly into the Shingle Hut Gully and also to the subsurface. Downstream of the site, the Shingle Hut Gully crosses the Mannings Hill Road via a culvert**.** During heavy rainfall, the culvert is often blocked leading to flooding of the roadway and causing landslide damage on the road and the potential for flooding down gradient of the site (Plates 17, 18 and 19). Groundwater flow is likely to be unconfined in this area and some level of subsurface drainage will enter the surface drainage system and contribute to surface flows where fault controlled gullies intercept elevated groundwater drainage. Development of the site for residential purposes normally leads to a 1.5 to 2-fold increase in storm water runoff caused by increase in pavement structures such as paved roads, driveways and sidewalks, as well as, runoff from roofs of houses. Permeability is, therefore, significantly reduced leading to increased runoff into gullies and drains nearby. If the drainage system for the site is undersized and there is frequent blockage due to rock/soil debris entering the system, flooding could occur on the site, which may also impact negatively on developments adjoining the property. **Mitigation/ Flood Protection Measures** **A. On-Site Flooding** Flooding is not expected to directly impact the project area because the land slopes in all directions. Construction of pavement structures and buildings will result in a decrease in permeability and increase runoff during and after development. Flooding on site could occur if the system is blocked and could impact negatively on nearby communities; therefore, the preferred option is the design of u-drains for the development. **B. Control of Construction Waste and Removal of Vegetation** Waste material from earth works and vegetation from site clearance should not be disposed of in the Single Hut Gully. These should be recycled where possible and the rest taken off site and disposed of at a legitimate disposal site If this measure is followed, an increase in flooding downstream is not anticipated. **C. Reduce Scouring at Drain Outfalls and in the Shingle Hut Gully** The construction of drop inlets will facilitate the reduction of run-off velocities therefore minimizing scouring. Gabion mattresses and rip rap works at all storm outfalls will provide adequate scour protection. Stepping of open paved drains running through the proposed recreational areas will also reduce critical velocities ,therefore, reducing scouring **D. Upgrading of the Drainage System** The Developer plans the upgrading of the Drainage system in the vicinity of the development site. The medium to long-term solution is for government to upgrade off-site drainage to facilitate developments of higher densities in the project area and its environs. This should include, but not limited to, sizing of the culverts across the Mannings Hill Road down gradient of the site and upgrading the drainage system in Havendale, increasing its capacity to accommodate higher flows.
	Operation/Maintenance
Risk to Groundwater	**Potential Risk** According to hydro-stratigraphic information the project site is located atop the Limestone Aquifer. The regional groundwater table largely exists under unconfined conditions in the Limestone Aquifer. Yates and Yates [1988] report on the migration of bacteria within the subsurface and the risk of contamination to groundwater by human waste/sewage. Contamination of groundwater is dependent on the depth to water within the aquifer, the hydraulic conductivity of water within the aquifer, and the subsequent attenuation time in the soil. Hydrologic analyses of the nearest wells (Lakehurst Corehole and Havendale Exploratory) indicate that the piezometric surface is 78 metres below ground level. The soil formation on site is Bonnygate Stony Loam. These soils are very rapidly drained above the bedrock and are predominantly shallow (1 to 35 cm). This means infiltration rates are high, and the capacity for organisms to be filtered or adsorbed is low. Such conditions favour the extended survival and subsurface transport of enteric bacteria and viruses. Although

INDICATOR	IMPACT & MITIGATION
	the Bonnygate Stony Loam soil unit is characterized by rapid internal drainage there is yet a considerable depth below ground surface to the water table. This may be of significance in attenuating contaminants and protecting groundwater quality. Transport within the aquifer ultimately depends on the velocity of groundwater movement and on the nature of the aquifer. In general, the Troy/Claremont formation (Limestone Aquifer) has hydraulic properties which are very heterogeneous. Rapid compartmentalized flow may occur within Limestone Aquifers in which karst processes are very active. Solution features and preferential flow paths may occur which can result in extremely rapid transport of contaminants over very long distances. Based on the classification of risk by Yates and Yates there is an inadequate buffer to the groundwater. **Risk Management** Having identified potential risks to the groundwater quality, risk management has to focus on an appropriate level of sewage treatment/disposal to tertiary level treatment. Tertiary level treatment includes any mechanical or non-mechanical treatment process which includes removal of nutrients by natural (e.g. Evapo-transpiration bed/reed bed, biological denitrification) or chemical means (e.g. phosphorus precipitation). The development proposes to use septic tank and reed bed system which are sufficient based on assessment of the aforementioned risks. Appropriate safety methods will be put in place to facilitate the handling of chemicals e.g. chlorine, pesticides and insecticides used at the construction site. These methods will include proper storage and labelling practices in order to prevent ground water contamination from spills.

Plate 17: Looking north on Mannings Hill Road the Shingle Hut Gully is culverted across the road.

Plate 18: Culvert pipes in the single Hut Gully normally blocked during heavy rainfall

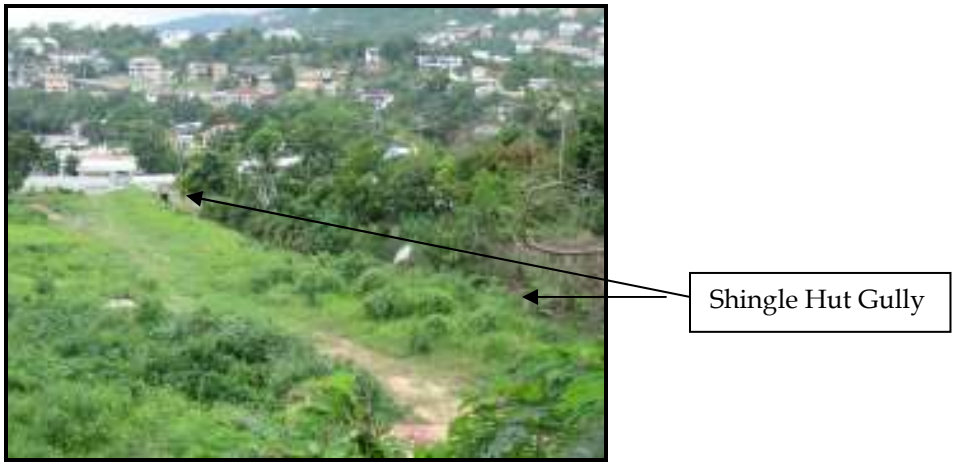


Plate 19 : The Shingle Hut Gully Drains into the Havendale Community in the background

Table 3A: Local Climate: Impacts on Ecology and the Public

ENVIRONMENTAL ISSUES	IMPACT	SIGNIFICANCE	DURATION OF IMPACT	DIRECT/INDIRECT IMPACT
VI. Local Climate Would the project:				
a) Have a substantially adverse effect on climate through the use of concrete and tarmac?	III	II	IV	III
b) Substantially reduce the number of trees in the project area?	IV	III	IV	II
c) Create a new source of substantial light or glare which would adversely affect day or night time views in the area?	II	II	IV	III

Table 3 B: Local Climate: Significant Impacts and Mitigation

INDICATOR	IMPACT & MITIGATION
	Operation/Maintenance
Local Climate	**Impact** It is likely that the micro-climate at the project site will be altered from its present condition due to the scale of the project. Operational aspects that are likely to alter micro-climate include: ▪ Reduced numbers of trees ▪ Increased paved surfaces (heat trapping) ▪ Discharges of humid air from air conditioners ▪ Increased ambient lighting **Mitigation** It is recommended that the developers try to maintain as much tree cover as possible and regrass and revegetate by landscaping - both by the developer and new owners. Use appropriate lighting and placement of lighting to reduce glare.

Table 4A: Hazards: Impacts on Public Safety, Structures and Ecology

ENVIRONMENTAL ISSUES	IMPACT	SIGNIFICANCE	DURATION OF IMPACT	DIRECT/INDIRECT IMPACT
Hazards -Natural Would the project:				
a) Result in substantial damage from flooding caused by torrential rainfall?	I	I	I	I
b) Result in serious loss or damage from the primary and secondary effects of a hurricane?	III	III	III	III
Hazards – Other Would the project:				
a) Expose the population to hazardous materials?	I	I	I	I
b) Expose the natural environment to hazardous materials?	I	I	I	I

Table 4 B: Hazards: Significant Impacts and Mitigation

INDICATOR	IMPACT & MITIGATION
	Operation/Maintenance
Hazards	**Impacts** Following the occurrence of a natural disaster, the following effects can occur: ▪ Water pollution and increased public health risk. ▪ Disruption in essential services: power, water, communications. ▪ Blockage of access roads by debris. ▪ Wind, water or structural damage to property, and effects on business operations and insurance. ▪ Loss of productive time. **Mitigation** As before, the effect level of this impact will vary with the event itself, the vulnerability of the population, and the preparedness of the developers/owners. It is recommended that a Disaster Management Plan be developed for the property, which should cover design and planning, preparedness aspects, and emergency response and recovery procedures at a minimum. As it relates to mitigating the effects of natural hazards on property it is recommended that roofs be slabbed or hurricane straps be used for other roofs.

5.3 IMPACTS ON THE TERRESTRIAL RESOURCES AND MITIGATION

Table 5A: Biology - Impacts on the Terrestrial Environment

ENVIRONMENTAL ISSUES	IMPACT	SIGNIFICANCE	DURATION OF IMPACT	DIRECT/INDIRECT IMPACT
Biological Resources Would the project:				
a) Have a substantial adverse effect, either directly or through habitat modification on any species identified as rare or endangered in local or regional plans, policies or regulations, or by NEPA?	II	II	IV	II
b) Have substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies or regulations or by NEPA?	II	II	IV	II
c) Have a substantial adverse effect on Protected Wetlands as defined under NEPA's Policy for Protected Areas through direct removal filling, hydrological interruption, or other means?	I	I	I	I
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native residents or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	III	II	IV	II
e) Conflict with any local policies or ordinances protecting biological resources such as a tree preservation policy or ordinance?	II	II	II	III
f) Have a substantial adverse effect on any protected areas identified by local policies and regulations or by NEPA?	I	I	I	I

Table 5B: Biology: Significant Impacts and Mitigation

INDICATOR	IMPACT & MITIGATION
	Construction/Implementation
Biology *Flora*	**Impact** I. Direct Impacts The direct impact of the proposed development will produce extensive and irreversible change in the vegetation composition and structure of the area in the short and medium term with a near complete removal of the remaining natural vegetation of the area. This change in land use will intern dramatically alter the fauna of the site by way of a sharp decrease in both numbers of individuals, species diversity, and a complete loss of endemic fauna with the exception of a few such as the Red-billed Streamertail hummingbird, and the lizard *Anolis grahami,* that are both highly tolerant of development and human presence. In general, therefore, the development will only further enhance the area's already poor suitability for many of Jamaica's native, in particular endemic species. II. Indirect Impacts Both the direct and indirect ecological impacts of the proposed development appear to be of greater importance to neighbouring offsite locations because of the development area's close proximity to a naturally occurring seasonal water course that occurs as a step-sided ravine predominantly to the northern and eastern edges of the site. This area, while outside the proposed site, contains a greater numbers of both endemic and economically important trees such as Maccafat (*Acrocomia spinosa*). This area is also more heavily forested and in turn supports a greater diversity of endemic fauna. While not studied in great detail, the observations made during this assessment suggest that development should minimize disturbance on this ravine ecosystem for three reasons: (1) The area provides a natural drainage of surface water in this section of the greater Hope River watershed. Any removal of the vegetation within the ravine or extensive blockage due to dumping may result in an increased risk of water retention with the associated risks to human health and property. (2) The ravine provides a naturally vegetated corridor through which flora and fauna may move or be dispersed to other suitable habitats, and through which seasonal migration may occur. (3) The vegetation of the ravine is part of the green belt of the site which significantly enhances the

INDICATOR	IMPACT & MITIGATION
	Construction/Implementation
Fauna	aesthetics of the area as a whole. III. Aesthetic Enhancement Beyond the maintenance of the ravine there are also opportunities for aesthetic improvements by: (1) Maintaining as many of the larger trees of the site as possible, in particular those that contain collections of orchids among other attractive epiphytes (Plate 20). (2) Incorporating limestone outcrops within the site where possible into the landscaping design. (3) Relocating native plants with landscaping value where possible, in particular the endemic palms (*Thrinax spp* and *Acrocomia spinosa*). **Mitigation and Monitoring** As previously stated, the Ambassador Heights development site is of no significant ecological importance. Mitigation and monitoring should, therefore, focus primarily on the off-site impacts of construction/development. **Impact** Removal of the current forest will completely modify the fauna of the area. The dominant faunal group, the birds, will be among those species most significantly affected. Approximately 50% of the property's birds are forest dependent. As such, the development will produce a change in the avian community from one dominated by forest dependent species, composed of many endemic species and subspecies, to a community comprised of a few species almost totally of non-endemic birds. **Mitigation** Where possible faunal groups, especially endemic species, would be relocated to a similar habit where feasible.

Plate 20: *Magnifera indica* tree supporting a large community of Bromeliads and *Broughtonia sanguinea* orchids.

5.4 POTENTIAL SOCIO- ECONOMIC IMPACTS IMPACTS AND MITIGATION

Table 6A: Aesthetics: Impacts on the Public and Environment

ENVIRONMENTAL ISSUES	IMPACT	SIGNIFICANCE OF IMPACT	DURATION OF IMPACT	DIRECT/INDIRECT IMPACT
Aesthetics Would the Project:				
a) Have a substantially adverse effect on the scenic vista?	II	I	II	III
b) Substantially damage scenic resources, including, but not limited to trees, within a scenic highway?	II	II	IV	II
c) Substantially degrade the existing visual character or quality of the site and its surroundings?	II	II	II	I
d) Create a new source of substantial light or glare which would adversely affect day or night time views in the area?	II	II	IV	III

Table 6B: Aesthetics: Significant Impacts and Mitigation

INDICATOR	IMPACT & MITIGATION
Construction/Implementation	
Scenic Vista	**Impact** Construction of the proposed development warrants removal of the majority of tree species currently on the site. This would impact negatively on the scenic vista of the area; however, this would be in the short to medium term. **Mitigation** The scenic vista of the area will be restored once construction activities begin, bringing a new landscape to the area. Additionally, specific trees will be marked for landscaping purposes and others required will be obtained.
Operation/Maintenance	
Scenic Vista	**Impact** * It is not anticipated that there will be any negative impacts associated with the scenic vista of the site during the operation/maintenance phase as the development will be aesthetically pleasing.

Table 7A: Air Quality: Impacts on Public Health

ENVIRONMENTAL ISSUES	IMPACT	SIGNIFICANCE	DURATION OF IMPACT	DIRECT/INDIRECT IMPACT
Air Quality Would the Project:				
a) Violate any air quality standards or contribute substantially to an existing or projected air quality violation?	II	II	II	III
b) Result in a considerable cumulative net increase of any criteria pollutant based on NEPA ambient air quality standards (including releasing emissions which exceed quantitative thresholds for ozone precursors)?	I	I	I	I
c) Expose sensitive receptors to substantial pollutant concentrations?	II	II	II	II
d) Create objectionable odours affecting a substantial number of people?	I	I	I	III

Table 7B: Air Quality: Significant Impacts and Mitigation

INDICATOR	IMPACT & MITIGATION
	Construction/Implementation
Air Quality	**Impact** In general the impact is short term (limited to the construction phase). The operations of heavy-duty vehicles and equipment are likely to produce increased combustion emissions. Also, there is the potential for increased atmospheric dust from bare soils, stockpiles, uncovered, overloaded trucks and storage equipment. This impact is classified as minor because of: ▪ The strong presence of the northeast trades will disperse the emissions rapidly from the site. ▪ The barrier effects of the escarpments and vegetation. The transport of materials from source to site would entail use of heavy trucks, which have the potential to produce polluting gaseous emissions and dust, depending on the material being transported. The movement of heavy trucks could also lead to additional road wear. These impacts are of short-term duration, but are of particular importance, as the main road leading to the site is a major thoroughfare, which already has a high volume of vehicular traffic and the potential emissions (PM2.5, PM10, CO, SOx). **Mitigation** ▪ Dust carrying equipment and facilities should be wetted frequently to minimize the amounts of dust affecting the site. ▪ Roads (paved and unpaved) should be wetted to lessen the possibility of dust emissions affecting site. ▪ The contractor should ensure that trucks carrying construction and solid materials are covered with tarpaulins to reduce air pollution. Vehicles should be properly maintained and serviced to reduce emissions. ▪ Dust masks and personal protection equipment (PPE) should be provided wherever possible to workers on the site in order to safeguard their health. ▪ In the event that a concrete batching plant is to be set up on site, site specific impacts on air quality and noise should to be assessed.

Table 8A: Noise and Vibration: Impacts on the Public

ENVIRONMENTAL ISSUES	IMPACT	SIGNIFICANCE	DURATION OF IMPACT	DIRECT/INDIRECT IMPACT
Noise and Vibration Would the project:				
a) Generate or expose people to noise levels in excess of standards established in a local general plan or noise ordinance, or in other applicable local standards?	II	II	II	II
b) Generate or expose people to excessive ground-borne vibrations or ground-borne noise levels?	IV	III	III	II
c) Create a substantial permanent increase in ambient noise levels in the vicinity of the project (above levels without the project)?	I	I	I	I
d) Create a substantial temporary or periodic increase in ambient noise levels in the vicinity of the project, in excess of noise levels existing without the project?	III	II	II	III

Table 8B: Noise and Vibration: Significant Impacts and Mitigation

INDICATOR	IMPACT & MITIGATION
	Construction/Implementation
Noise & Vibration	**Impact** Phase 1 Ambassador Heights, residential community adjoins the project site on the southern boundary. During site clearance and earthworks for road construction and trenching, there will be dust and noise nuisance which will negatively impact on the community nearby. These will abate if appropriate measures are introduced during the construction phase. In instances where hard limestone rock is located close to the surface or where large boulders cannot be

INDICATOR	IMPACT & MITIGATION
	Construction/Implementation
	removed by mechanical means, blast method of excavation would need to be employed. The negative effects of blast excavation are noise nuisance, damage to property and injury caused by 'fly rock' and damage to building structures near the blast site caused by excessive blast vibrations. **Mitigation** These effects are not expected to be persistent after the construction period. This impact can be mitigated through the institution of an appropriate schedule of activities during the construction phase which will help to alleviate the impacts of increased noise, dust, etc. likely to result from construction activities above the maximum 70 dB standard level. In addition, construction activities will take place during periods when disturbances to the residents are minimized and equipment will be properly maintained.

Table 9A: Waste and Hazards: Impacts on Public Health and the Environment

ENVIRONMENTAL ISSUES	IMPACT	SIGNIFICANCE	DURATION OF IMPACT	DIRECT/INDIRECT IMPACT
Waste and Hazards Would the project:				
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous material?	I	I	I	I
b) Create a significant hazard to the public or the environment through reasonable foreseeable upset and accident conditions involving the release of hazardous materials in the environment?	I	I	I	I
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one quarter mile of an existing or proposed school?	I	I	I	I
e) Substantially increase solid waste in the project area thereby exceeding the present landfill capacity?	II	II	IV	III
f) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	I	I	I	I
g) Expose people or structures to a significant risk of loss, injury, or death involving wild land fires, including where wild lands are adjacent to urbanized areas or where residences are intermixed with wild lands?	I	I	I	I

Table 9B: Waste and Hazards: Significant Impacts and Mitigation

INDICATOR	IMPACT & MITIGATION
	Construction/Implementation
Solid Waste	**Impact** During site clearance and earthwork activities, construction waste will be generated. This occurs if the material contains high clay content, high quantities of large boulders or limestone blocks that cannot be reused. Construction waste will have to be removed to safe locations without endangering life or property. Construction waste if dumped into the Single Hut Gully will contribute to blockage and increase the potential for flooding downstream. In addition, residential properties on the south eastern section of the site could also be negatively impacted by rocks falling down the slope. If construction waste is improperly stored on site, it can be easily removed/eroded during storm events thereby affecting communities nearby. **Mitigation** Its effects can be effectively mitigated against by implementation of a Solid Waste Management Plan at the construction camp. This plan should cover separation and appropriate storage of the different kinds of waste including oily rags from the servicing of equipment if this is to be done at the construction site. Organic waste, namely vegetation, would be composted on site and used for soil improvement (soil

INDICATOR	IMPACT & MITIGATION
	conditioning) during landscaping. Branches can be put through a wood chipper to prepare soil cover for garden beds, etc. Excess inorganic waste would be stockpiled (away from drainage features) for infilling of lot sites where necessary. Adequately located and maintained temporary latrine facilities would be made available for construction workers. To avoid the harmful effects of poor solid waste disposal adequate arrangement would be made with the NSWMA or with a private contractor to dispose of solid waste at the authorized dumpsite. Some materials can be beneficially re-used (e.g. vegetation debris can be chipped and used as mulch during landscaping). It is expected that any top soil that is removed during grading would be stockpiled properly, and re-used during the final landscaping efforts.

Table 10A: Social Infrastructure: Impacts on Public Services within the Development area

ENVIRONMENTAL ISSUES	IMPACT	SIGNIFICANCE	DURATION OF IMPACT	DIRECT/INDIRECT IMPACT
Social Infrastructure Would the project:				
a) Result in substantial adverse impacts associated with the provision of new or physically altered governmental facilities, or the construction of which could cause significant environmental impacts in order to maintain acceptable service ratios, response times, or other performance objectives for any of the public service?				
▪ Fire Protection?	II	II	IV	III
▪ Police Protection?	II	II	IV	III
▪ Schools?	II	II	IV	III
▪ Health Centres?	II	II	IV	III
b) Provide a substantial number of employment opportunities for neighbouring community members throughout the project lifecycle?	IV	III	III	II

Table10 B: Social Infrastructure: Significant Impacts and Mitigation

INDICATOR	IMPACT
Construction/Implementation	
Social Infrastructure	**Impact** The new development would likely become an extension of the existing community (Ambassador Phase I), however, existing facilities, such as, the police station, school are inadequate. The demand for housing solutions is expected to be maintained, with potential purchasers likely to come from individuals in the Kingston Metropolitan Region (KMR). **Mitigation** There is specific need for the upgrading of facilities, such as, schools, police stations and health centres.
Employment	**Impact** The proposed project provides the opportunity for employment of construction workers and tradesmen for the duration of construction period. New jobs created during the construction phase (about 100) could result from activities in the development of infrastructure, housing solutions and the sewage treatment facility. Another beneficial consequence of the project is the income generated to taxi and mini bus drivers who provide transportation for construction workers. Priority will be given to residents within the immediate community, including Mannings Hill district for employment possibilities created during the implementation of the project.
Operation/Maintenance	
Employment	The opportunity for employment in the operation phase will be insignificant, and limited to gardeners, helpers and security personnel.

Table 11A: Utilities and Services: Impacts on Social Services and Resources

ENVIRONMENTAL ISSUES	IMPACT	SIGNIFICANCE	DURATION OF IMPACT	DIRECT/INDIRECT IMPACT
VII. Utilities and Services: Would the project:				
a) Exceed wastewater treatment restrictions or standards of NEPA?	I	I	I	I
b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	II	II	IV	II
c) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	II	II	IV	II
d) Have sufficient water supplies available to serve the project from existing sources.	II	II	IV	III
e) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?	I	I	I	III
f) Comply with NEPA statutes and regulations as they relate to solid waste?	I	I	I	III
g) Significantly increase energy consumption in the project area which would contribute substantially to the greenhouse gases?	II	II	IV	III

Table 11B: Utilities and Services: Significant Impacts and Mitigation

INDICATOR	IMPACT & MITIGATION
Construction/Implementation	
Physical Infrastructure *Solid Waste*	**Impact** The proposed development areas will produce an unknown quantity of solid waste. This is considered a moderate environmental impact, as the exact quantity is unknown. The effects of this waste production can include: ▪ Increased demand for and consumption of limited landfill space. ▪ Increased demand for municipal collection services. ▪ Increased use of roads by collection trucks which could affect the surface of the road, congestion, and fugitive dust along roads. ▪ Breeding of pests and disease vectors such as flies, vermin and roaches if storage areas are not hygienically maintained. ▪ Visual dis-amenity and odours. **Mitigation** ▪ Domestic waste reduction, re-use and re-cycling. Examples of this is separation of organic waste for composting, recycling of glass bottles, and reuse of cooking oils for diesel production. ▪ Adequate solid waste storage bins and other facilities within the development. Residents should be encouraged to ensure that storage containers are tightly covered to prevent the breeding of mosquitoes and other vermin.
Potable Water	**Impact** The development will demand for potable water for residents. The NWC have indicated their willingness to supply the proposed development. The increased demand will place a burden on a municipal resource that has to be reliably met. **Mitigation** Protection of recharge areas in the source catchments is the most effective means of mitigating against the increased demand, as it will safe guard water production. However, there are other measures that could be implemented by the developer, including: ▪ Re-use of treated wastewater and storm water for irrigation. ▪ Water conservation (e.g. low flow toilets, controlled shower and faucet heads, maintenance and monitoring of water mains).

INDICATOR	IMPACT & MITIGATION
Energy Consumption	▪ There should be on site reserves or individual household reserves of water in the event of disruption of public supplies (due to drought or heavy turbidity). ▪ Indigenous ornamental species that do not require large amounts of water should be used for landscaping as far as possible. This includes hardy species like bougainvillea, palms and lantana. **Impact** Although the power demand of the development can probably be met by JPSCo. the issue pertains to the use of non-renewable resources, and the national fuel bill, as well as, contributions to green house gases, which are ultimately detrimental to the environment. **Mitigation** ▪ The use of renewable resources will be encouraged - including the possibility of solar power. ▪ There should be energy saving lighting installed for all buildings using lights and other energy star rated equipment.

Table 12A: Cultural Resources: Impacts on Historical Features and Resources

ENVIRONMENTAL ISSUES	IMPACT	SIGNIFICANCE	DURATION OF IMPACT	DIRECT/INDIRECT IMPACT
Cultural Resources Would the Project:				
a) Cause a substantial adverse change in the significance of a historical resource?	I	I	I	I
b) Cause a substantial adverse change in the significance of an archaeological resource?	I	I	I	I
c) Directly or indirectly destroy a unique palaeontological resource or site or unique geologic feature?	I	I	I	I
d) Disturb any human remains, including those interred outside of formal cemeteries?	I	I	I	I

Table 12B: Cultural Resources: Significant Impacts and Mitigation

INDICATOR	IMPACT
	Construction/Implementation
Historical Resources	**Impact** It is not anticipated that there will be impacts associated with cultural/historical resources as these are absent from the site.

Table 13 A: Land Use and Planning: Impacts on Community Conservation & Habitat Conservation

ENVIRONMENTAL ISSUES	IMPACT	SIGNIFICANCE	DURATION OF IMPACT	DIRECT/INDIRECT IMPACT
Land Use and Planning Would the project:				
a) Physically divide an established community?	I	I	I	I
b) Conflict with the applicable land use plan, policy or regulation of NEPA (including, but not limited, to a general plan, specific plan, local zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	I	I	I	I
c) Conflict with any applicable habitat conservation plan or natural community conservation?	I	I	I	I

Table 13B: Land Use and Planning: Significant Impacts and Mitigation

INDICATOR	IMPACT
Construction/Implementation	
Community Conservation	**Impact** The project will be located adjacent to and within an established residential community. **Mitigation** Dialogue will be initiated with the citizens to ensure that their interests are protected.

Table 14 A: Population and Housing: Impacts on the Public and Social Infrastructure

ENVIRONMENTAL ISSUES	IMPACT	SIGNIFICANCE	DURATION OF IMPACT	DIRECT/INDIRECT IMPACT
Population and Housing Would the project:				
a. Induce substantial population growth in the area, either directly (for, example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	IV	III	IV	II
b. Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?	I	I	I	I
c. Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?	I	I	I	I

Table 14 B: Population and Housing: Significant Impacts and Mitigation

INDICATOR	IMPACT & MITIGATION
Construction/Implementation	
Population growth	**Impact** Given the number of housing solutions being provided through the project it is expected that the population of Ambassador Heights will experience growth in the region of 480 persons over the short to medium term.

Table 15A: Transportation and Traffic: Impacts on Public Safety and Travel

ENVIRONMENTAL ISSUES	IMPACT	SIGNIFICANCE	DURATION OF IMPACT	DIRECT/INDIRECT IMPACT
Transportation and Traffic Would the project:				
a. Cause a substantial increase in traffic, in relation to existing traffic load and the capacity of the street system (i.e., a substantial increase in either the number of vehicle trips, the volume to capacity ratio on roads, or congestion at intersections)?	III	II	IV	III
b. Exceed, individually or cumulatively, the level of service standards established for the designated roads or highways?	I	I	I	I
e. Result in inadequate emergency access?	I	I	I	I
f. Result in inadequate parking capacity?	I	I	I	I
g. Conflict with adopted policies, plans or programmes supporting alternative transportation (e.g., bus routes)?	I	I	I	I

Table 15B: Transportation and Traffic: Significant Impacts and Mitigation

INDICATOR	IMPACT
Construction/Implementation	
Traffic	**Impact** There will be an increase in traffic volume during the construction phase of the project. The travel of employees to and from work will increase traffic flow especially during peak hours, while the transportation of paving, filling and other construction material, as well as, solid waste may increase traffic flow during both peak and off-peak periods. An increase in traffic flow may inadvertently result in traffic accidents and increase the probability of damage to the existing road infrastructure. **Mitigation** The development of a transport schedule; e.g. during the off-peak hours would help to alleviate the effects of traffic congestion. While the use of flag-men during the construction period could aid in the direction and flow of traffic during peak periods. Trucks and heavy duty equipment to be used can be parked in close proximity to the site so as to reduce the potential of damage to the existing roads and reduce traffic caused by their slow movement.
Operation/Maintenance	
Traffic	**Impact** The increase in traffic along the route will lead to increased peak hour congestion over the long term. Being a suburban area the absence of social services and amenities and employment opportunities signify that the average VKT will be above the city's average. Besides implications related to traffic congestion caused by the additional vehicles will contribute to a deterioration of local air quality and negatively impact the national fuel bill. **Mitigation** • Planning trips carefully ensuring that multiple activities are conducted in each trip. • Carpooling is also another option. • Encourage a modal split that promotes reduced use of petrol.

5.5 CUMULATIVE IMPACTS

Environmental impacts are considered *cumulatively considerable* when the incremental effects of an individual project are significant when viewed in connection with the effects of past projects, the effects of other and current projects and the effects of future projects. The site of the Proposed Action would occur in the low density northern suburbs of the KMA, with similar developments in close proximity. A summary of the geographical extent of the proposal is shown in Table 15 below.

Table 15: Geographic scope of cumulative impacts

RESOURCE ISSUE	GEOGRAPHIC AREA
Visual Resources	Regional and local (on site)
Air Quality	Local
Biological Resources	Local
Land Use Planning	National, regional and local
Geology, Soils and Seismicity	Local
Hazards and Hazardous Materials	Local (within the vicinity of the project)
Hydrology	Local
Noise	Local (within immediate project vicinity)
Employment, Population & Housing	Local (with the parish, and adjacent parishes)
Public Services and Utilities	Regional (potable water, electricity, solid waste, police, fire and postal services)
Transportation and Traffic	Regional and local

Source: Personal interpretation

5.6 RESIDUAL IMPACTS

The residual impacts of the project will be insignificant of which changes in land use will be the most considerable. Land use changes will primarily impact the biological resources due to the replacement of the existing vegetation by a residential development.

5.7 SWIFT BENEFIT/COST ANALYSIS

Benefit/ Cost to Environmental Resources

INDICATORS	BENEFITS TO THE ENVIRONMENT	COST TO THE ENVIRONMENT	MONETARY VALUE
1) Aesthetics	The proposed development will be aesthetically pleasing.	Vast removal of trees in the development area and the resulting loss of faunal & floral habitats.	_
2) Air Quality	_	Air quality would be negatively affected as a result of construction activities (increase in particulates). The impact, however, would not be long-term.	_
3) Waste & Hazardous Material	_	The environment would be negatively impacted if waste and hazardous materials are not properly disposed of.	Cost for preparing a Waste Management Plan
4) Topography & Drainage	_	Both drainage and infiltration capacity would be reduced significantly possibly causing increased surface runoff.	Cost for building on and off site drainage structures
5) Climate	_	Temperatures in the development area may increase slightly due to changes in the micro-climate.	Cost for increased air conditioning temperatures
6) Energy Consumption	Alternate forms of energy will be utilized where feasible e.g. use of solar energy.	Energy consumption would increase drastically within the area.	Cost per kilowatt of energy projected consumption
7) Natural Hazards	Proper building design and construction practices would be encouraged and employed so as to reduce the risk of loss of life and damage to property by natural hazards such as hurricanes, earthquake, fire, landslides etc.	Hazards such as hurricanes and flooding may cause damage to the structures to be located on the property as well as destroy flora and fauna on the property.	▪ Cost to rebuild/repair structures on property (cost depends on the extent of damage) ▪ Cost to replant trees and plants (cost depends on the extent of damage). ▪ Cost of property insurance
8) Other Hazards	The risk of other hazards such as health-ecological and social-organizational hazards may be less anticipated than that of natural hazards, such as, fires and earthquake.	Other hazards such as health– ecological and social-organizational hazards may pose a threat mainly to employees and to residents possibly based on external factors.	_
9) Upset Accidental Conditions	_	Because accidents are unpredictable they may result in loss of life and damage to property.	▪ Cost of liability insurance for employees on the construction site ▪ Cost for Property Insurance (depends on the value of the property).

Socio-economic Benefits/Costs

INDICATORS	SOCIO-ECONOMIC BENEFITS	SOCIO-ECONOMIC COSTS	MONETARY VALUE
1) Police	Possible renovation of the Stony Hill Police Station to meet the increase in demand for services.	Increased pressure on the service of the Stony Hill Police Station.	Cost to employ additional Officers – approximately $40,000 monthly per officer Cost to purchase additional vehicles
2) Post Office	Possible refurbishing and expansion of the Stony Hill Post Office.	Increased volume of mail at the Post Office.	▪ Cost to employ an additional post attendant ▪ Cost to expand the mail holding area (depends of the size of the area)
3) Schools		The capacities of existing schools outside the development area would be increased.	▪ Cost to employ teachers and other members of staff i) $60,000 – 70,000 monthly per teacher (with a degree) ii) $50,000 – 60,000 per month for other members of staff
4) Hospitals		Increased pressure on the infrastructure and services offered by hospitals within the KMA.	_
5) Health Centres		Similar to the hospitals, it is expected that health centres may be impacted.	_
6) Fire	_	Increase in demand for the services offered by the currently under-equipped Fire Station.	Cost to acquire new equipment for the Fire Station.
7)Employment	The proposed development has a moderate job creation potential. Jobs will be created in the pre-construction phase, the construction phase and to a lesser extent in the post construction phase.	Increase in competition between locals and persons outside the development area to gain employment.	_
8) Housing	Increase in the housing stock of the Ambassador Heights /Mannings Hill Area, St. Andrew	_	_
9) Public Utilities	Public utilities such as potable water supply, telephone and electricity would be improved upon within the development area.	Increase in pressure on service providers such as the NWC, the NWA and C&WJ to provide services to the development area.	▪ Cost to the NWC to provide the service ▪ Cost to the developer to obtain the service and to the residents to maintain the service
10) Solid Waste Disposal	_	Increase in solid waste generation during the construction and post-construction phases. Also, increase in pressure on the Riverton City landfill in St. Andrew to accommodate the additional waste.	Cost for the removal of solid waste during all stages both to the developer and to the municipal service provider. _
11) Roads	Roads within the development area will be improved upon and new ones will be constructed.	_	Road infrastructure cost
12) Health & Safety	Measures will be incorporated to ensure that health and safety are maintained.	Health and safety of both employees and visitors may be at risk mainly during the construction phase especially if the necessary precautions are not taken.	▪ Cost to cover medical expenses for injured visitors/employees (cost depends on the severity of injury) ▪ Cost for Liability Insurance ▪ Cost to implement Occupational Health & Safety programme
13) Noise & Vibration	_	There will be an increase in noise levels during the construction period which may affect near-by residents.	Cost for residents affected by the noise to acquire relief (doctor's visit / medication) – approximately $3,500 (minimum for doctor's visit and medication).

5.8 MANAGEMENT AND MONITORING PLAN

The development impacts which require management and monitoring are outlined below.

A: Indicators, Targets and Agency/Individual Responsible

INDICATORS	TARGET	AGENCY/INDIVIDUAL RESPONSIBLE
	A. Construction/Implementation	
1. Aesthetics	Create an aesthetically pleasing site: - Marking of trees to be maintained for landscaping - Additional trees and plants required for the landscaping will be obtained.	Developer/Contractor
2. Air Quality	- Use of dust masks by employees to reduce effects - Use of water trucks to sprinkle property and roads.	Contractor
3. Health & Safety	Implement measures to reduce the risk of harm to health and safety.	Developer/Contractor
4. Noise	Reduce noise levels by: - use of ear muffs by employees	Contractor
5. Solid Waste	Proper and timely disposal of solid waste (including construction waste) from the site.	MPM & NSWMA /Developer
6. Sewage Treatment Facility	Implement measures to prevent the sewage treatment facility from flooding and from odour nuisances.	Engineer/Contractor
7. Traffic Control	Reduce the accumulation of traffic through measures such as: use of flag men and the erection of signs.	Developer/Contractor
8. Building Plans	Ensure adherence to the approved building/development plans.	KSAC/Contractor/ Developer
9. Flood Control Measures	Implement measures to: - reduce run off and prevent flooding. - protect roads from inundation.	Engineer/Contractor
10. Construction Materials	Obtain construction material from the nearest legitimate local sources	
11. Removal of trees	Institute penalties for the unwarranted removal/cutting of trees.	NEPA/Developer
	B. Operation/Maintenance	
1. Effluent Quality	Monthly monitoring of effluent quality from waste water treatment plant based on NEPA guidelines and standards especially during the early stages of operation.	Developer/NWC
2. Education of employees and residents	Thorough education of both employees and residents of: - the importance of proper waste management practices - the operation of sewage treatment plant.	NSWMA and Public Health Department
3. Potable Water	Potable water supply and its quality must be monitored monthly for its reliability and for maintaining at a high standard.	NWC/Developer

B: Monitoring Guidelines

ITEM	INDICATOR	PARAMETER	FREQUENCY	LOCATION
CONSTRUCTION/IMPLEMENTATION				
1	Effluent from temporary waste water facilities	pH, BOD, COD, TSS, TDS	Once every Month	-
2	Water related diseases	Identification of water related diseases and determine adequacy of local vector control and curative capacities etc.	Twice annually	-
3	Soil erosion	Soil erosion rate	Twice annually	-
OPERATION/MAINTENANCE				
1	Treated effluent from STP	pH, BOD, COD, TSS, TDS	Monthly	-
2	Soil erosion	Soil erosion rate	Every six months	-
3	Revegetation	Status of revegetation programme – landscaping (regrassing, planting of trees and ornamental plants)	Initially monthly during construction/implementation phase	Open spaces, vegetation lining of gullies

6.0 REGULATORY AUTHORITIES AND LEGISLATION

The regulatory frameworks within which the proposed project is to be developed are addressed below. The areas of relevance concern environmental quality, health and safety, protection of sensitive areas, protection of endangered species, site selection and land use control at the regional, national and local levels that relate to or should be considered within the framework of the project.

6.1 REGULATORY AUTHORITIES

6.1.1 The National Environment and Planning Agency

Under the Natural Resources Authority Act and the Permits and Licenses Regulations of 1996, the NEPA is responsible for environmental protection on the island. In discharging its responsibilities, NEPA is not only responsible for the environmental protection but also manages the nation's natural resources and enforces the environmental and development planning laws. Its functions include ensuring that developments are undertaken within its environmental guidelines by requiring EIAs, reviewing proposed developments and granting permits and licences.

Besides the NRCA Act, NEPA monitors and enforces laws and regulations such as The Beach Control Act, The Watershed Protection Act and the Wildlife Protection Act.

6.1.2 The Town and Country Planning Authority

This development falls under the Town and Country Planning Act of 1958 (amended 1993 and 1999) and the Local Improvements Act of 1944. The guidelines of the Kingston Development Order (1966) should generally be adhered to. These statutes control the development and subdivision of land. In such cases, normal procedures for building and development applications would be pursued by being channelled through the KSAC and NEPA respectively.

6.1.3 The Ministry of Health & Environment

The Environmental Health Unit (EHU) of the Ministry of Health (MOH) and Environment is the agency responsible for the approval of the proposed sewage treatment and disposal system and setting the discharge limits.

6.1.4 The National Works Agency

Under The Ministry of Transportation and Works, NWA ensures that the drainage and road designs meet the required standard.

6.1.5 National Water Commission

The NWC is responsible for potable water supply and sewerage services.

6.1.6 Water Resources Authority

This government Agency is responsible for the monitoring and ensuring the proper use of the surface and ground water resources of the island.

6.1.7 Kingston & St. Andrew Corporation

The KSAC has responsibility for the provision of certain public services including public health, fire protection, abattoirs, cemeteries, street cleaning, parks and play fields and markets. The Corporation is also responsible for solid waste disposal; however, NSWMA ensures collection and disposal.

6.1.8 Ministry of Local Government and Environment

This ministry has responsibility for coordinating the functions of the local authorities such as the Parish Councils and the NSWMA.

6.1.9 National Land Agency

This government agency has the responsibility of managing all information as it relates to land (services) and would verify land ownership by the project proponent.

6.1.10 Office of Disaster Preparedness and Emergency Management

This Government agency's overarching responsibility is disaster risk reduction through its hazard preparedness and mitigation measures.

6.2 RELEVANT LEGISLATION

Legislation relevant to the establishment of a residential development in KSA is outlined below.

6.2.1 The Natural Resources Conservation Authority (NRCA) Act, 1991

The NRCA Act (1991) is the overriding legislation governing environmental management in Jamaica. It requires that all new developments (or expansion of existing projects) which involve the sub-division of ten (10) or more lots be subject to EIA.

The regulations require that fifteen (14) copies of the EIA Report be submitted to the Authority for review. Therefore, a preliminary review period of ten (10) days is required to determine whether additional information is needed. After the initial review, the process can take up to ninety (90) days for approval. If on review and evaluation of the EIA the required criteria are met, a permit is granted. In the event that the EIA is not approved, there is provision for an appeal to be made to the Minister.

Specifically, the relevant section(s) under the Act that addresses the proposed project are:

Section 10: Empowers the Authority to request EIAs for the construction of any enterprise of a prescribed category.

Section 12: Addresses the potential for contamination of ground water by trade effluent and sewage.

Section 15: Addresses the implementation of stop orders and fines associated with the pollution of water resources.

Section 16: Authorizes the government to intervene in order to prevent the contamination of ground water.

Section 17: Addresses the authority of the government to request in writing, any information pertaining to the:

- performance of the facility

- quantity and condition of the effluent discharged
- the area affected by the discharge of effluent.

6.2.2 Natural Resources Conservation (Permits and License) Regulation, 1996

- Water treatment facilities including sewage and industrial wastewater require permits.
- Regulation 8 sets out the application process for obtaining a license to discharge pollutants.
- Regulation 9 empowers the NRCA to require owners for operators of existing facilities to upgrade their facilities to the "current standards applicable to new facilities" within a specified time.

6.2.3 The Watershed Protection Act, 1963

This Act governs the activities operating within the island's watersheds, as well as protects these areas. The watershed designated under this Act is the Hope River Watershed Management Unit.

6.2.4 The Public Health Act, 1974

This Act falls under the ambit of MOH. Provisions are also made under this Act for the activities of the EHU, a division of the MOH. The EHU has no direct legislative jurisdiction, but works 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. In addition, there are various sections of this legislative instrument that govern and protect the health of the public. Relevant sections under the Public Health Act of 1985 are:

Section 7 - (1) A local Board may from time to time, and shall if directed by the Minister to do so, make regulations relating to nuisances and,

Section 14 - (1) The Minister may make regulations generally for carrying out the provisions and purposes of this Act, and in particular, subject to Section 7 but without prejudice to the generality of the foregoing, may make regulations in relation to air, soil and water pollution.

6.2.5 The National Solid Waste Management Act, 2001

The Regulatory Agency, the NSWMA will be responsible for the implementation of the National Solid Waste Management Act.

In Part II Section 4-1 the Authority shall –

(a) Take all such steps as are necessary for the effective management of solid waste in Jamaica in order to safeguard public health, ensure that waste is collected, stored transported, recycled, reused or disposed of, in an environmentally sound manner and promote safety standards in relation to such waste."

In Section 23 – (i) Every person who:

a. Operates or propose to operate a solid waste disposal facility:
b. Provides or proposes to provide solid waste collection or transfer service; or
c. Otherwise manages solid waste, "Shall apply in the prescribed form and manner to the authority for the appropriate licence."

Part V Section 42 – (i) 7. The Authority may provide the occupier of any premises, on his request, with receptacles to be used for:

a. Compostable waste which is to be recycled
b. Non - compostable waste which is to be recycled; or
c. Waste which is not to be recycled"

Subject to subsection (4), the Authority may, in relation to a request for receptacles:

a. Where possible, provide them free of charge; or
b. Provide them at such cost, and on such terms as to payment, as may be agreed with the occupier.

Part VII Section 45 - Every person who:

a. Disposes of solid waste in any area or in any manner not approved by the authority;

b. Operate a solid waste disposal facility, provide solid waste collection or transfer service or otherwise manages solid waste, without a valid licence or operating certificate under this Act or any regulation hereunder; commits an offence and shall be liable on summary conviction before a Resident Magistrate to a fine not exceeding one million dollars or to imprisonment for a term not exceeding nine months or to both such fine and imprisonment.

6.2.6 The Wildlife Protection Act, 1945

The Wildlife Protection Act of 1945 is administered by NEPA and provides regulation for the protection and conservation of animals, birds and fishes.

6.2.7 Town and Country Planning Act, 1958

The Town and Country Development (Kingston) Confirmed Development Order, 1966 falls under this Act and guides physical development in the Parish.

Section 5 of the Town and Country Planning Act authorizes the Town and Country Planning Authority to prepare, after consultation with any local authority, the provisional development orders required for any land in the urban or rural areas, so as to control the development of land in the prescribed area. In this manner, the Authority will be able to coordinate the development of roads and public services and conserve and develop the resources in the area. Any person may, under Section 6 of the Act, object to any development order on the grounds that it is:

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

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

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

- clearly defined details of the area to be developed;
- regulations regarding the development of the land in the area specified;
- formal granting of permission for the development of land in the area.

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

6.2.8 Town and Communities Act, 1843

The Town and Communities Act of 1843 govern the code of conduct in communities.

6.2.9 The Noise Abatement Act, 1997

Subject to subsection (2) and section 5, no person shall, on any private premises or in any public place at any time of day or night-

(a) sing, or sound or play upon any musical or noisy instrument; or

(b) operate, or permit or cause to be operated, any loudspeaker, microphone or any other device for the amplification of sound, in such a manner that the sound is audible beyond a distance of one hundred metres from the source of such sound and is reasonably capable of causing annoyance to persons in the vicinity so, however, that where during the period specified in subsection (4) such sound is audible beyond that distance in the vicinity of any dwelling house, hospital, nursing home, infirmary, hotel or guest house, such sound shall be presumed to cause annoyance to persons in that vicinity.

No person shall operate a loudspeaker- (a) later than 11 o'clock in the night at a public meeting; and (b) later than midnight at a political meeting held between nomination day and the day next but one before Election Day, both days inclusive.

6.2.10 The Parish Councils Building Act, 1908

Construction of buildings in towns and any areas which may be delimited by the parish councils (Local Authority) is controlled under this legislation. The Parish Councils/KSAC are allowed to impose suitable conditions with regards to size, elevation, and structural integrity of buildings. To date regulations cover the principal towns of all the parishes. In those areas which have been delimited under the Building Act permission is to be obtained from the (Council/KSAC) before construction commences. The extent of the building area for which permission is required from persons desirous of constructing buildings in the Kingston area is larger than that delimited under the Town and Country Planning Act. It should be noted that sections of the parish of St Andrew are outside the jurisdiction of the Kingston and St Andrew Building Act.

In summary in areas where both acts occur an applicant needs both a planning permission and a building permit[3].

6.3 INTERNATIONAL AGREEMENTS AND COVENTIONS

The following are the International Agreements and Conventions which Jamaica has ratified and should be considered in the various phases of the development.

6.3.1 Agenda 21

This is an international programme developed at the United Nations Conference on the Environment and Development which provides proposals for the work on sustainable development on all areas of society. This programme, however, is not legally binding.

6.3.2 Convention on Biological Diversity

This convention is concerned with the protection and sustainable use of the world's biological diversity and equitable sharing of the benefits arising from the sustainable use of heritable resources.

[3] Samuels, Blossom. 1999. Caribbean Disaster Mitigation Project: Landslide Hazard Mitigation and Loss-reduction for the Kingston Jamaica Metropolitan Area, Site visited 2008 October 14.

6.3.3 Rio's Forest Principles

This document promotes sustainable forest management. The Intergovernmental Forum on Forests (IFF) implements the forest principles. Similar to Agenda 21, this document is not legally binding.

6.3.4 Habitat Agenda

This programme promotes sustainable development in urban areas and contains a global action plan for the sustainable development of cities.

6.3.5 CITES

This is the Convention on International Trade in Endangered Species of Wild Fauna and Flora which resulted from the concerns of world species endangerment due to unregulated international trade. This convention prohibits and regulates international trade in endangered species and is managed by the Natural Resources Conservation Authority which is guided by the Endangered Species Act, 2000.

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APPENDICES

APPENDIX I

TERMS OF REFERENCE AND CONFIRMATION LETTER

TERMS OF REFERENCE FOR ENVIRONMENTAL IMPACT ASSESSMENT FOR A PROPOSED DEVELOPMENT – AMBASSADOR HEIGHTS, ST. ANDREW

1.0 Introduction

The introduction will describe in general terms the reason for the Environmental Impact Assessment, within the guidelines established by the National Environment and Planning Agency. A synopsis of the development will also be included in this section and the location where the report will be made available for viewing.

2.0 Background

The Ambassador Heights development area is located in northern St. Andrew on the south-eastern coast of Jamaica. Specifically, the development area is part of suburban St. Andrew within the Hope River Watershed Management Unit.

The site is located on the Mannings Hill Road, approximately 7.25 km (4.5 miles) north of the Half-way-tree and 3.6 km (2.2 miles) south east of the community of Mannings Hill**.** The Mannings Hill Road to Half-way-tree Road forms the western boundary of the site.

In the currently proposed development plan, an area of 29 acres will be developed into 123 primarily residential lots. Lots are also zoned for open space and waste water treatment.

3.0 Terms of Reference

1.1 Scope of the Project

11.4.1 Task 1 General description of the project including:

- maps, design plans and photographs both aerial and land based
- purpose and justification
- history of the project and project area
- alternatives to the proposed project
- how the project relates to the existing conditions
- public utility requirements - sewerage, water and electricity in short to long term
- site preparation
- scheduling of development activities, methods, materials
- waste disposal associated with the project including method of wastewater treatment and disposal
- habitat considerations – need for translocation of site fauna species
- description of the construction method
- description of the mitigation measures to be employed during the proposed works
- proposed timelines and scheduling of tasks

Task 2 An overall evaluation of the existing environmental conditions, values and functions of the proposed development area.

This would involve a detailed description of the Physical and Biological Resources along with a description of the Socio-cultural Environment.

a. *Information on the physical environment would be examined based primarily on rainfall, temperature, prevailing winds, soils, hydrogeology, geology and topography. Site geology will be covered to include lithology, faults, landslides etc. while groundwater will cover groundwater levels, quality, flow directions etc.*

Potable Water Supply

Water demand for the general area will be assessed based on population data and consumption rate for the various demand sectors (domestic - per capita demand, industrial and agricultural) for the development and in the general area. The present and projected water demand will be compared with the existing supply (including National Water Commission's capacity) and other proposed developments in the general area. The result of this analysis will determine the additional quantity of water required and the source development options if necessary.

Storm Water Runoff

Storm water runoff to and from the site will be assessed using the Rational Method. Storm water runoff will be assessed for return periods of 5, 10, 25 and 100 years in order to provide information useful in the engineering design of hydraulic structures (drains, culverts, low impact development (LID) features, such as, detention ponds etc.) on and adjacent to the site. As such, the plan showing drainage structures along with road layout would be submitted to the National Works Agency for approval of the proposed action. The subsequent response would be included in the appendix of the EIA.

Surface Water

The EIA process will include the identification and assessment of surface hydrology and its relationship to site geology, water sources, drainage patterns, risk and history of flooding. Drainage will be addressed with respect to existing natural drainage channels, any proposed man-made drainage/water features or any proposed changes in topography. Issues with respect to increased surface runoff and sediment loading will also be included.

Groundwater Pollution Risk Analysis

The risk of groundwater pollution as a consequence of the development will be assessed based on analysis of groundwater depth, lithology, percolation rate and method of waste disposal at the site. Appropriate safety methods put in place to facilitate the handling of chemicals used during the constructional and operational phases of the development life cycle, such as, proper storage and labeling practices will be described.

Risk Assessment Analysis

Risk assessment analysis of potential natural hazards to which the site may be predisposed such as flooding, earthquake, hurricanes, and erosion etc. will also be included in the EIA document.

b. An ecological assessment of the existing natural communities found at the site of the proposed subdivision will be conducted. The study will compile ecological data by characterizing the major ecological community types.

Survey of Flora

This will include a vegetation survey and analysis inclusive of a map showing site flora. Field investigations (survey) will include community structure, primary and secondary human disturbances and flora identification. Community classifications will be based on the dominant plant types and substrates that compose them. Plant species will be identified in the form of a species list where possible; any alien invasive species of plants found will be clearly identified. A survey will not only identify existing vegetation but also vegetation loss and hence loss of habitat for the fauna in the area.

Survey of Fauna

The fauna will be surveyed by either direct observation or searching for indicators, such as burrows, tracks, and general observation of the property and river. Species and indicators encountered on the site proposed for development will be reported. The physical and vocal characteristics of avifaunal species, which cannot be immediately identified, will be described in detail; and verified. Species of economic importance will also be identified.

c. Socio-cultural Environment

The socio-cultural environment will be studied based on:

- Aesthetics – short to long-term sensory effects to residents
- Public Facilities and Services – roads, traffic, utilities and social services
- Public Health and Safety – the identification of risks and their assessment as they relate to the project and the management of any risks, such as flooding, that may affect residents
- Sewage disposal options
- Effects on the local economy
- Effects of the development on the local population
- Cultural resources – A historical study of the area will identify resources to be protected.
- Community perception and concerns with regards to the proposed development
- Cultural practices which will be investigated

A survey of adjacent areas will be conducted to determine land management practices, such as, compatible and incompatible uses and existing and proposed uses. The project's development

proposal will be analyzed under local planning guidelines, such as, the Town and Country Planning Act (1958).

Waste Disposal

Waste water - A detailed map drawn to scale will be included in the document clearly showing the location and dimensions of the plant in relation to other areas on the property.

The chosen method of sewage treatment will be assessed based on layout and design with a view of determining the capacity of the facility and its ability to effectively handle the volume of effluent the proposed development will produce. The sewage treatment proposal will also be assessed with a view of determining its effects on underground and surface water including the coastal environment. The impact of the system on the development and on the water bodies etc. will be examined.

The relevant approval from the Environmental Health Unit of the Ministry of Health will be included in the appendix of the EIA.

Solid waste – The methods of solid waste disposal, for example, both during construction (spoil) and operation (garbage) will be examined to determine sustainable practices, such as, its removal to safe locations without endangering life or property and removing its potential for contributing to the flooding of adjacent waterways and areas, for example, the nearby Shingle Hut Gully and the Havendale community.

The report will include the schedule arrived at with a private contractor for the disposal of solid waste at a legitimate site (Riverton City waste disposal facility) during the constructional phase and the Metropolitan Parks and Market schedule during the operational phase along with the delivery routes.

11.4.1 Task 3 Potential Environmental Impacts and Mitigation Measures

Any impacts (including triggering impacts) to the ecosystem components as a result of the project during the construction and the operational phases will be noted and mitigation measures recommended where necessary. These impacts and those off-site will be quantified where possible.

The identification of impacts will focus on the following areas:

a. Wildlife (avi-fauna) and vegetation - any obvious change in species composition and distribution, habitat change/fragmentation, displacement, corridor impairment, endangered, endemic species and nocturnal species.
b. Landform – physical changes), for example, the erosion potential of site, features of special interest and landslides/slippage
c. Pollution – pollution of surface and groundwater and its potential impact on the environment. Activities that will trigger pollution will also be included.

d. Flooding and drainage considerations including the potential impact on the natural drainage and the minimization/reduction of sheet flow of water from on the site and the nearby adjacent properties.
e. Waste Disposal – solid waste disposal and sewage disposal methods - on site and potential impact on surface and groundwater and the sea.
f. Landscaping – effects of landscaping on flora and fauna e.g. the need for creating an area for translocation of fauna. Landscaping plans inclusive of the proposed replanting of trees to replace those lost by construction/clearing activities.

Impact mitigation will focus on design elements, alternative construction techniques and long-term operational practices, as well as, mitigation measures associated with the protection of the road from damage during the transport of construction material, traffic management at the site entrance during construction and measures to limit the impact of construction on the existing/man made and natural areas.

Impacts will be described based on whether they are direct or indirect, their level of significance (low, moderate, high), and duration. An analysis of proposed mitigatory measures for each potential impact, preferred alternative(s), and the costs estimated where possible along with suitable justification.

Cumulative Impacts - Changes within the area over time because of the project along with those being experienced from existing site activities would be noted. Including changes to gullies, drains, sinkholes, slopes potable water supply. The likely impacts of imported materials and any invasive species will be discussed along with the control methods.

Residual Impacts - Given the mitigation measures recommended, environmental changes that may result from project implementation would be described.

11.4.1 Task 4: Identify the Legislative and Regulatory Framework

The relevant regulations, local and national government agencies, and their roles concerning the project permit and approval requirements will be identified.

Legislation, such as:

- Natural Resource Conservation Act, NRCA (1991)
- Watershed Protection Act (1963)
- Public Health Act (1974)
- National Solid Waste Management Act (2000)
- Town and Country Planning Act (1958)
- Water Resources Act (1995)
- Wildlife Protection Act (1945)

Authorities, such as:

- National Environment and Planning Agency
- Ministry of Transport and Works

- National Water Commission
- Water Resources Authority
- Kingston and St. Andrew Corporation (KSAC)
- Ministry of Health and Environment
- Office of Disaster Preparedness and Emergency Management (ODPEM)

11.4.1 Task 5: Public Community Participation

Local stakeholders will be interviewed in order to facilitate community inputs in the process.

11.4.1 Task 6 Monitoring and Management Plan

Areas for monitoring during and after the construction phase will be identified. The various phases of the development will be highlighted, detailing what is to be done in each phase and the expected duration of the follow-up phases.

Follow-up activities will be recommended where necessary. The responsible persons/agencies will also be identified.

NATIONAL ENVIRONMENT & PLANNING AGENCY

10 & 11 Caledonia Avenue, Kingston 5, Jamaica W.I. Tel: (876) 754-7540 Fax: (876) 754-7595-6 toll free help-line: 1-888-991-5005
E-mail: ceo@nepa.gov.jm Web Site: http://www.nepa.gov.jm

Ref. No.: **2008-02017-EP00005**

September 24, 2008

Mr Greshford Dixon
6 RUSSELL HEIGHTS
KINGSTON
ST. ANDREW

Dear Mr. Dixon

Re: Comments on the Terms of Reference (TOR) for the Environmental Impact Assessment for EIA

The National Environment and Planning Agency (NEPA) offers no objection to the Terms of Reference (TOR) submitted with cover letter for the Environmental Impact Assessment (EIA) in connection with the captioned application.

You are however, advised to include in task 2 sub-section storm water runoff, the 50 year return period as well as to include the Office of Disaster and Preparedness Emergency Management in task 4 has one of the Authorities.

On this basis, you should proceed with the execution of the EIA. Please note that on completion, fourteen (14) copies (two (2) of which should be perfect bound) on double side and an electronic copy of the EIA report are to be presented to this office.

Do not hesitate to contact us for clarification on any matter.

Yours sincerely

Leonard Francis
for Chief Executive Officer.

cc: Ms. Frances Blair - Manager, Applications Secretariat Branch, NEPA
Beverline Brown-Smith-President, EPN Consultants Limited

APPENDIX II

NATIONAL WORKS AGENCY'S APPROVAL LETTER

NATIONAL WORKS AGENCY

140 Maxfield Avenue, Kingston 10, Jamaica Tel: (876) 926-3210-9 · Fax: (876) 926-2572

ANY REPLY OR SUBSEQUENT REFERENCE SHOULD BE ADDRESSED TO THE CHIEF EXECUTIVE OFFICER AND THE FOLLOWING REFERENCE NUMBER QUOTED:
Ref. No.:

KMR Regional Office
11 Naylor Park Road
Kingston 10
Tel: 926-6476
929-7320, 960-1536
Fax: 929-7321

Central Regional Office
33 Caledonia Road
Mandeville, Manchester
Tel: 962-2338
Fax: 961-6177

Western Regional Office
Hunters Main Road
Hunters, St. James
Tel: 940-7337
940-4406, 573-3158
Fax: 940-7073

North Eastern Regional Office
West Street
Port Antonio
Portland
Tel: 993-2121
Fax: 993-9645

15th July 2008

The Government Town Planner
National Environment and Planning Agency
10 Caledonia Avenue
KINGSTON 5

Dear Sir:

Re: Terms of Reference for an Environmental Impact Assessment for Proposed Residential Development at Ambassador Heights, St. Andrew by Greshford Dixon – Ref. No 2008-02017-EP00005

With reference to your letter dated 16th May 2008, received 26th May 2008, regarding the caption; we are to advise that after careful review, the National Works Agency is satisfied with the content of the Terms of Reference, however the following additional information should be embodied in the Environment Impact Assessment:

1. Identification of routes to be used for waste disposal and delivery to the construction site.
2. Mitigation measures to protect the road from damage during the transportation of construction material.
3. Traffic management at site entrance during construction.
4. Measures to limit the impact of the construction on the existing / man made and natural drainage in the area.

Advisory:

All maps and plans should be legible and prepared at a reasonable scale.

Yours truly,

WINSTON HARTLEY
Physical Planner

PATRICK ROSE
Director, Planning and Research
for Chief Executive Officer

Copied to: The Town Clerk - KSAC
The Parish Manager – National Works Agency, KMR
EPN Consultants Ltd Suite No. 7, Main Plaza – 83 ½ Red Hills Rd, Kgn 20

"Developing Safe, Reliable and Quality Roads"

APPENDIX III

METHODOLGY FOR STORM WATER RUN OFF ENGINEERING

METHODOLGY FOR STORM WATER RUN OFF ENGINEERING

Calculation of peak run-off

The run-off impact assessment entails a determination of pre-development and post development run-off from the main drainage areas for different return periods (5yr, 10yr and 25yr). Given the relatively small catchment areas, the Rational Formula was used for the calculation of run-off or peak discharge, where;

Peak Discharge Qp= 0.0028CIA
C- run-off coefficient
I – average rainfall intensity, mm/hr
A – total drainage area in hectares

Methodology

The entire subdivision area was divided into seven sub-catchment areas (A-G) and three (3) main drainage areas for computational purposes. All sub-catchments drain directly into main gully running along the northern and eastern boundaries except for sub-catchments D and G (total area 9610.0 SM) that drain unto the main road.

Design Criteria:

The primary culvert drain provides for storm events exceeding 25 year return period while secondary drainage features (local) systems consider adequate drainage for more frequent storm events (T=5yrs return period). The meteorological data for the total catchment was obtained from the National Meteorological Service. The Forest Hill rainfall station was chosen as representative for the average 24 hour rainfall in the area of the subdivision. 24 – hr maximum rainfalls for different return period are as follows:

RETURN PERIOD, T	2 - YR	5 - YR	10 - YR	25 - YR	50 -YR	100 - YR
Maximum 24 – hr rainfall	145 mm	203 mm	256 mm	323 mm	373 mm	422 mm

Comparing Kirpich's and Manning's formulae an average concentration time Tc = 7 minutes was used to calculate rainfall intensity.

Kirpich's equation: $Tc = 0.0078 \frac{L^{0.77}}{S^{0.385}}$

Short duration Frequencies (rainfall intensities) are calculated as follows:

$$\mathbf{I} = \frac{4.73\ (I24HR)}{(Tc + 12.25)^{0.65}}$$ where

Tc = concentration time (in minutes)
I 24 hr = 24hr maximum rainfall

Proposed Drainage System

The following summarizes the proposed surface water drainage system:

- The surface run-off generated within the project site is channelled along road side drains (kerb channels) and then via a system of storm inlets and culverts.
- Culverts will accommodate storm flows of 1:10 years return period. Specially designed drop inlets will serve to dissipate energy given anticipated high velocities due to the steep topography.
- Final disposal of site run-off will be into the existing main gully. This main gully can accommodate major storm events (exceeding 50 – yr return period), however, the capacity of the down gradient culverts which crosses the Mannings Hill main road needs upgrading.

APPENDIX IV

COMMUNITY SURVEY INSTRUMENT

QUESTIONNAIRE

AMBASSADOR HEIGHTS DEVELOPMENT, ST. ANDREW

CONDUCTED BY_____

TIME_____

DATE_____

COMMUNITY/ED_____

Gender: Male [ ] Female [ ]

1. In which age range do you fall?

   a. 15-24 [ ] b. 25-34 [ ] c. 35-44 [ ] d. 45-54 [ ] e. 55-64 [ ] f. 65 & over [ ]

2. Is the house you occupy?

   a. Owned [ ]
   b. Rented [ ]
   c. Leased [ ]
   d. Other [ ] _____

3. What type of housing unit is this?

   a. Separate house- Detached [ ]
   b. Attached [ ]
   c. Part of a commercial building [ ]
   d. Other [ ]
   e. Not stated [ ]

4. What is the main type of material used in construction the outer walls?

   a. Concrete and Blocks [ ]
   b. Wood and Concrete [ ]
   c. Stone and Brick [ ]
   d. Wood and Brick [ ]
   e. Wood [ ]
   f. Other [ ]

5. How many rooms does this household occupy?

   Not stated [ ]

6. How many persons are within this household?

		Not stated [ ]

7. What type of school did you last attend?

a. Primary	[ ]	b. All age	[ ]
c. Junior High	[ ]	d. New Secondary	[ ]
e. Comprehensive	[ ]	f. Traditional High School	[ ]
g. Technical	[ ]	h. Vocational	[ ]
I. University	[ ]	J. Other Tertiary	[ ] _____

8. What is your occupation? _____

9. Are you employed Yes [ ] No [ ]

10. What is your monthly income?

a. Less than 20,000 [ ]
b. $20,000 - $49,000 [ ]
c. $50,000 - $99,999 [ ]
d. $100 000 and over [ ]

11. Which of the following public services need improvements?

a. Police	[ ]	b. Garbage collection	[ ]
c. Water supply	[ ]	d. Road maintenance	[ ]
e. Transportation	[ ]	f. Other, please specify: _____	

12. What, if any, do you consider to be the most urgent community needs? _____

_____

13. Are you aware of any important features of the Ambassador Heights property related to?

a. birds Yes [ ] No [ ] _____
b. animals Yes [ ] No [ ] _____
c. vegetation Yes [ ] No [ ] _____
d. hazards/risks Yes [ ] No [ ] _____
e.g. flooding
e. historical monument Yes [ ] No [ ] _____

14. Do you think the proposed development will have the following effects on the area?

POSITIVE	YES/NO	NEGATIVE	YES/NO
□ Increase in housing solutions		□ Increase effects of flooding etc.	
□ Development of the area.		□ Exclusion of person who currently use the property	
□ Increase in property value.		□ Increase in crime rate	
□ Improvement in infrastructure e.g. drainage, roads		□ Loss of biodiversity (e.g. plants, marine life)	
□ Job creation		□ Increase in traffic congestion.	

APPENDIX V

RESULTS FROM COMMUNITY SURVEY

Gender	
Male	42%
Female	58%
Total	100%
Question 1. What age range do you fall	
15-24 years	22%
25-34 years	13%
35-44 years	22%
45-54 years	13%
55-64 years	9%
65 & over	11%
No response	10%
Total	100%
Question 2. House you occupy?	
Owned	73%
Rented	18%
Leased	9%
Other	0%
Total	100%
Question 3. Type of housing?	
Separated/ Detached	96%
Attached	4%
Commercial Building	0%
Other	0%
Not Stated	0%
Total	100%
Question 4. Construction of outer walls?	
Concrete and Blocks	78%
Wood and Concrete	13%
Stone and Brick	0%
Wood and Brick	0%
Wood	8%
Other	0%
No response	1%
Total	100%
Question 5. Average number of rooms this property has?	5

Question 6. Average number of person within the household?	4
Question 7. Last school attended?	
Primary	11%
All age	13%
Junior High	0%
New Secondary	4%
Comprehensive	4%
Traditional High School	31%
Technical	4%
Vocational	0%
University	22%
Other Tertiary	4%
No response	7%
Total	100%
Question 8. Occupation?	
Analysis/Programmer	2%
Business Man	8%
Business Woman	4%
Customer Service Representative	2%
Guard	2%
Hair Technician	2%
Mason	2%
Nurse	2%
Painter	2%
Retired	7%
Real Estate	2%
Self Employed	9%
Student	13%
Teacher	2%
Welder	2%
No response	19%
Total	100%
Question 9. Are you employed?	
Yes	58%
No	36%
No response	6%
Total	100%
Question 10. Monthly income?	
Less than $20,000	24%
$20,000- $49,000	7%

$50,000- $99,999	18%
$100,000 and over	7%
No response	44%
Total	100%
Question 11. Services that needs improvement?	
Police	
Yes	40%
No	60%
No response	100%
Garbage collection	
Yes	46%
No	54%
Total	100%
Water supply	
Yes	57%
No	43%
Total	100%
Road maintenance	
Yes	76%
No	24%
Total	100%
Transportation	
Yes	29%
No	71%
Total	100%
Question 12. The most urgent community needs	
Drainage	4%
Employment	4%
Improve water supply	18%
Improve lighting	4%
Policing	7%
Recreational facility	7%
Roads need to be repair	29%
No responses	27%
Total	100%
Questions 13. Important features of the Ambassador Height Property	
Birds	
Yes	55%
No	27%

No response	18%
Total	100%
Animals	
Yes	31%
No	49%
No response	20%
Total	100%
Vegetation	
Yes	49%
No	31%
No response	20%
Total	100%
Hazards/Risks	
Yes	24%
No	49%
No response	27%
Total	100%
Historical Monument	
Yes	7%
No	64%
No response	29%
Total	100%
Question 14. The effects the development may have on the area?	
Positive	
Increase the housing solution?	
Yes	75%
No	18%
No response	7%
Total	100%
Development of the area?	
Yes	67%
No	24%
No response	9%
Total	100%
Increase in property value?	
Yes	42%
No	40%
No response	18%
Total	100%

Improvement in infrastructure?	
Yes	47%
No	37%
No response	16%
Total	100%
Job creation?	
Yes	67%
No	27%
No response	6%
Total	100%
Negative	
Increase effects of flooding?	
Yes	53%
No	36%
No response	11%
Total	
Exclusion of person who currently use the property?	
Yes	33%
No	51%
No response	16%
Total	100%
Increase in crime rate?	
Yes	42%
No	42%
No response	16%
Total	100%
Loss of biodiversity?	
Yes	64%
No	22%
No response	14%
Total	100%
Increase in traffic congestion?	
Yes	67%
No	22%
No response	11%
Total	100%

APPENDIX VI

AVIFAUNA SURVEY POINT COUNT

	Common Names	Points At Which Surveys Were Conducted											
		1	2	3	4	5	6	7	8	9	10	# of individual of this species	Percentage of points with species
1	American Kestrel				1		1			1		**3**	
2	White-crowned Pigeon	1						1	3	1		**6**	
3	Common Ground Dove		1	3		1	2		1	2	1	**11**	
4	Zenaida Dove	1		1		1						**3**	
5	White-winged Dove					1	1	1				**3**	
6	**Jamaican Parakeet**	2						3		1	1	**7**	
7	Antillean Palm Swift		5					4	1			**10**	
8	Red Billed Streamertail	1				2			1	1		**5**	
9	**Jamaican Tody**				1		1					**2**	
10	**Jamaican Woodpecker**		1				1					**2**	
11	**Sad Flycatcher**		1									**1**	
12	Loggerhead Kingbird			1				1	1		1	**4**	
13	**White-chinned thrush**		1	1	1				1			**4**	
14	Northern Mockingbird			1		2		1				**4**	
15	Common Yellowthroat			1		1		1	2			**5**	
16	Ovenbird										1	**1**	
17	Black-throated Blue Warbler									1	1	**2**	
18	Prairie Warbler			1				1				**2**	
19	American Redstart		1			1		1				**3**	
20	Bananaquit	1			1		2		2	1		**7**	
21	Orangequit			2							1	**3**	
22	**Yellow-shouldered Grassquit**	1									1	**2**	
23	Black-faced Grassquit			1	1			1	3	1	1	**8**	
24	Jamaican Euphonia		1				1					**2**	
25	Jamaican Oriole	1		1							1	**3**	
26	Greater Antillean Grackle		3		1			1				**5**	
	Total # of Individuals by point	**8**	**14**	**13**	**6**	**9**	**9**	**16**	**15**	**9**	**9**	**108**	
	Total # of species by point												
	Forest dependent species, shown in bold.												

	Common Name	Scientific Name	Local Name	National Status
1	American Kestrel	Falco sparverius	Lizard Hawk or Killy-Killy	R1
2	White-crowned Pigeon	Columba leucocephala	Ball Plate	R1
3	Common Ground Dove	Columbina passerina	Ground Dove	R1
4	Zenaida Dove	Zenaida aurita	Pea-dove	R1
5	White-winged Dove	Zenaida asiatica	White-wing	R1
6	Jamaican Parakeet	Aratinga nana	Parakeet	R1
7	Antillean Palm Swift	Tachornis phoenicobia	Swallow	R1
8	**Red-billed Streamertail**	Trochilus polytmus	Doctorbird	E1
9	**Jamaican Tody**	Todus todus	Robin Redbreast	E1
10	**Jamaican Woodpecker**	Melanerpes radiolatus	Woodpecker	E1
11	**Sad Flycatcher**	Myiarchus barbirostris	Little Tom Fool	E1
12	Loggerhead Kingbird	Tyrannus caudifasciatus	Loggerhead	R1
13	**White-Chinned Thrush**	Turdus aurantius	Hopping Dick	E1
14	Northern Mockingbird	Minus polyglottos	Nighting Gale	R1
15	*Common Yellowthroat*	*Geothlypis trichas*		W1
16	*Ovenbird*	*Seiurus aurocapillus*		W1
17	*Black-throated Blue Warbler*	*Dendroica caerulescens*		W1
18	*Prarie Warbler*	*Dendroica discolor*		W1
19	*American Redstart*	*Setophaga ruticilla*		W1
20	Bananaquit	Coereba flaveola	Yellow-belly	R1
21	Orangequit	Euneornis campestris	Bluequit	R1
22	**Yellow-shouldered Grassquit**	Loxipasser anoxanthus	Squit or Yellow-back Grasssquit	E2
23	Black-faced Grassquit	Triaris bicolor	Squit	R1
24	**Jamaican Euphonia**	Euphonia Jamaica	Cho-cho Quit	E1
25	Jamaican Oriole	Jamaican Oriole	Banana Katie	R1
26	Greater Antillean Grackle	Quiscalus niger	Cling-cling	R1
	Key:			
	R - Resident		1 - Common in suitable habitat	
	E - Endemic Species		2 - Uncommon	
	W - Winter Migrant			
	N.B. Endemic species, shown in bold. Migratory species in italics.			

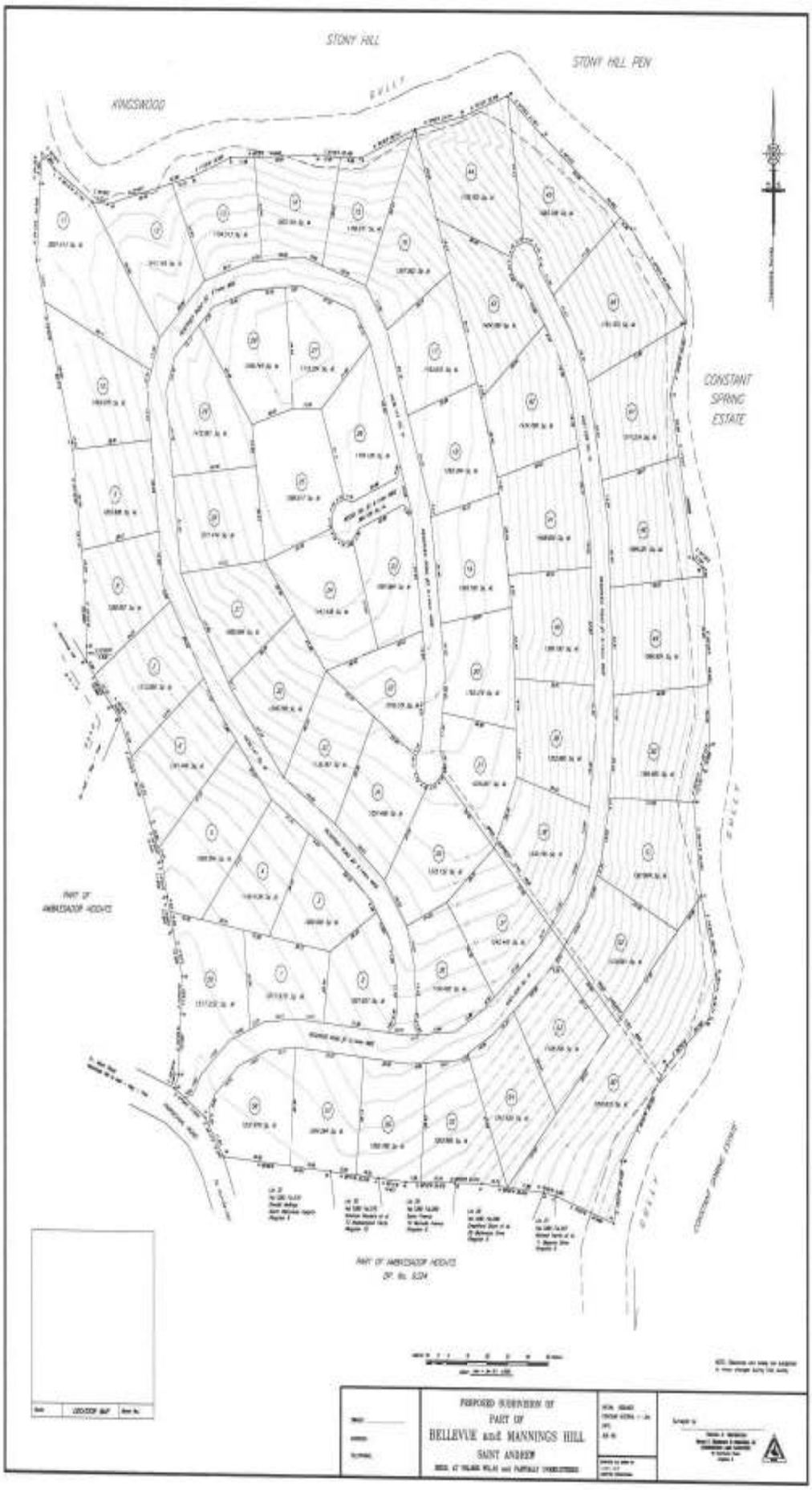
APPENDIX VII

VEGETATION SURVEY AT AMBASSADOR HEIGHTS

Trees		**DAFOR**	**Shrubs/Herbs/Grasses**		**DAFOR**
Scientific Names	**Common Names**		**Scientific Names**	**Common Names**	
Cassia emarginata	Senna Tree	D	Melinis minutiflora	Molasses/Wynne Grass	D
Cecropia peltata	Trumpet Tree	A	Lantana camera	Lantana	F
Mangifera spp.	Mango	A	Sida acuta	Broom weed	F
Blighia sapida	Ackee	A	Wedelia trilobata	Creeping ox-eye	F
Albizia lebbeck	Woman Tongue	A	Citrus	Lime/Lemon	F
Musa sp.	Banana/Plantain	F	Bryophyllum pinnatum	Leaf of life	F
Spathodea campanulata	African Tulip Tree	F	Croton sp.	Croton	O
Citrus spp.	Citrus	O	Heliconia psittacorum	Heleconia	O
Fagara martinicensis	Prickly Yellow	O	Broughtonia sanguinea	Braughtonia Orchid	O
Bauhinia divaricata	Bull Hoof or Moco John	O	Tillandsia recurvata	Bromeliad	O
Meliccoca bijuga	Guinep	O	Chainy Root	Smilax bablisiona	R
Bambusa vulgaris	Bamboo	O	Bidens pilosa	Spanish Needle	R
Acacia sp.	Casha, Acacia	O	Hibiscus	Hibiscus rosa-sinensis	R
Delonix regia	Poincianna	O	Euphtorium pdoratum	Jack-in-the-bush	R
Cocos nuficera	Coconut	O	*Manihot esculenta*	Cassava	R
Persea americana	Pear	O	Panicum maximum	Guinae Grass	R
Simarouba glauca	Bitter Damson	R	Unidentified Grass sp. 1		R
Spathelia sorbifolia	Mountain Pride	R	Unidentified Grass sp. 2		R
Pimenta jamaicensis	Wild Pimento	R			
Acrocomia spinosa	Maccafat Palm	R			
Fagara spinosa	Licca Tree	R			
Pithecellobium unguis-cati	Bread and Butter	R			
Luceanea sp.	Lead Tree	R			
Thrinax spp.	Thatch Palm	R			
Haematoxylum campechianum	Logwood	R			
Bursera simaruba	Red Birch	R			
Artocarpus altilis	Breadfruit	R			
Piscidia piscipula	Dogwood	R			
Guazuma ulmifolia	Bastard Cedar	R			
Annona sp.		R			
Nectandra sp.		R			

APPENDIX VIII

SUBDIVISION PLAN


STONY HILL
STONY HILL PEN
KINGSWOOD
GULLY
CONSTANT SPRING ESTATE
PART OF AMBASSADOR HEIGHTS
PART OF AMBASSADOR HEIGHTS
PROPOSED SUBDIVISION OF
PART OF
BELLEVUE and MANNINGS HILL
SAINT ANDREW