# MARTHA BRAE THEME PARK



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### EXECUTIVE SUMMARY:

# Project Introduction Overview:

SJ Productions and Entertainment Limited is embarking on the construction of a first class Theme Park and live entertainment facility on lands in Martha Brae Trelawny. The intention is to integrate entertainment with learning, while ensuring that sustainable growth within a niche market. The development will consist of three major components: A Nature Park, Live Entertainment Amphitheatre and Modern Theme Park facility.

The attraction represents the culmination of a vision and represents a product that will showcase Jamaica's culture and history, using first world technology and management systems. The project will focus on obtaining the safest ride technology, hiring the most competent staff and implementing the most rigorous training process available. The project will seek to partner with major film and music production entities and seek to become the premier international stage show venue for the Caribbean, hosting BET, Jazz and other international offerings.

The overall theme park area is roughly divided into 5 major types of development areas as shown in the following figure 1.2. These areas consist of the Amphitheatre, the Water Park Area, Dry Ride area, the Natural area and the support services. The Amphitheatre is intended as a self contained open air entertainment area that is used as a cultural and music event space. The capacity for the theatre is intended to be approximately 2500 patrons for capacity and contain a series of support facilities including stage area, lightingsound control room, back stage area, events change rooms, support areas, lounge areas, small food and beverage areas, washrooms, and access for delivery and set up.

The water park area forms a significant component to the park as a longer term holding area for patrons and set up as potentially a separate ticket area from the rest of the park. The water park would typically contain enough area to incorporate the development of a wave pool area, kiddy zone, activity pools, spa pools, several water rides and attractions consisting of tube slides, body slides, raft rides, kiddy rides, a selection of more comprehensive marketing and thrill rides.

The third area of the park is the dry and cultural rides areas, that consists of a selection of family oriented dry rides and attractions from roller coasters to bumper cars, offering the entire family a wide range of rides and attractions. The dry area of the park would contain a cultural component that would be a linking feature to the park allowing visitors a ride experience with a backdrop of Jamaican culture and heritage. The dry park area would contain its own integrated food, beverage and support facilities to allow it to operate separate from the other components of the park as required.

The fourth area of the park consists of the natural component of the theme park, consisting of botanical gardens, aviary, fish ponds, butterfly and flower gardens. These features of the park combine to establish a scenic natural backdrop to the cultural areas of the park and provide an educational focus to the park and round out some of the appeal for this multiple focus attraction.

The final component to the development concept is the support system for the park which consists of the overall development parking, access, entrance, egress, drop off, ticketing, support buildings, service areas, plaza spaces, and circulation. The segments of these components of the park weave together the individual components into a comprehensive and tangible development proposal and workable park solution.

# Development Program:

The facilities are being developed with the following threshold numbers:

- Peak in park attendance (1,691)
- Entertainment Units 2536
- Car parking 461 Guest Vehicles, Staff 50, Bus 7.5 (3.4 Acres)

- 1.39 Entry Booth, 1.39 Entry Turnstiles, 1.39 exit Turnstiles
- Washrooms (Men and Women's)
- Shade Areas, Seating,
- Retail (estimated 2787 Sq feet)

The main components of the facilities are as follows:

- Show area (amphitheater, shows, culture, music, costumes, events, entertainment)
- Rides and Attractions (Adult and Children's rides, wet and dry)
- Food and Beverages (Dining, night life, cuisine, formal restaurants and fast food)
- Merchandise (retail opportunities, walk in stores, carts)
- Nature Preserve (Natural, botanical, animals etc)
- Educational (Cultural and Historical Pavilions)

#### Attractions areas

#### <u>Wet area</u>

- Change rooms, washrooms, lockers, showers (Men's and Women's)
- Entrance, ticketing, control area, queuing area, plaza
- Rental area, Merchandise, cash, entry exit, turn styles,
- Staff Change rooms, lockers, showers, staff room, lunch room
- Mechanical, electrical and pump room, chemical storage, dosing room.
- Maintenance room, office, electrical transformation station
- Balance tanks
- Food and beverage area, seating, kitchen, storage, back of the house
- Life guard stations
- Seating, tables and chairs, loungers, Kiosks, rental areas
- Outdoor showers
- Wave pool, beach, rental cabanas, mechanical area
- Kiddy themed area, interactive play zone, water walk, sprays toys.
- Lazy river, activity pools, Water basketball, volleyball.
- Tube and body slides, tube storage, take off platforms, queuing areas

- Family Raft Ride, Tube storage, conveyor, queuing area, take off platform
- Speed Slides, take off platform, queuing area
- Surf Hill racer mat ride, take off platform, queuing area
- Feature rides and attractions, take off platform, queuing area
- Decks, seating areas, water falls, features, theme areas, shade areas,
- Quite areas, beverage areas, remote washrooms, kiosks

# Dry Areas

- Ticketing, Cash control, entry, ticket deposit, ride attendants, queuing areas, exits
- Maintenance, storage, workshop,
- Food and beverage areas
- Washrooms, theme areas, streetscape,
- Seating, lounge areas, access paths, Maintenance paths
- Electrical, transformation.
- Kiddy ride area, Family ride area, Teen and adult ride area.
- Dark Ride, show area, Thrill Zone, Pirate Adventure
- Log ride, water ride
- Imax Theater
- Coaster (s)

# Environmental Assessment Overview:

This report presents the findings of the Environmental Impact Assessment (EIA) conducted for the proposed construction and operation of the Martha Brae Theme Park to located in Falmouth, Trelawny. To facilitate the study hydrological and watershed assessment of the areas conducted to supplement physical assessments of Physiography, Soils, Geology and Hazard Vulnerability, within the study area. Water quality, noise, air quality, biological and socioeconomic assessments were also performed. An analysis of project alternatives is discussed.

# LEGAL AND SDMINISTRATIVE FRAMEWORK:

# <u>AGENCIES:</u>

- 1. Trelawny Parish Council
- 2. National Water Commission
- 3. The Solid Waste Management Authority
- 4. Water Resources Authority
- 5. Environmental Health Unit (Ministry of Health)
- 6. National Works Agency (NWA)
- 7. National Environment and Planning Agency (NEPA)
- 8. Town and Country Planning Authority (TCPA)
- 9. Jamaica Tourist Board (JTB) and Tourism Product Development Company Ltd. (TPDCo)

# <u>ACTS:</u>

- 1. The Natural Resources Conservation Authority Act (1991)
- 2. The Town and Country Planning Act (1948)
- 3. Water Resources Act (1995)
- 4. The Public Health Act (1974)
- 5. Endangered Species Act (1999)
- 6. Floodwater Control Act
- 7. Countries Fire Act (1942)
- 8. Quarries Control Act (1983)
- 9. The Solid Waste Management Authority Act (2001)

The majority of identified negative impacts were short-term, minor, local impacts which are insignificant and/or easily mitigated. Where relevant (and appropriate), suitable mitigation measures have been recommended. These could occur during the construction and operational phase of the project and include: (i) noise and vibrations, and (ii) traffic congestion. The two major negative impacts are, however, short-term, local impacts and are therefore considered small/insignificant impacts, during the construction phase of the project.

Regarding potential suspended solid runoff, soil erosion and siltation of the river channel could lead to an impaired flow regime, localised and declined water quality within lower Martha Brae River. Recommended mitigation measures include, (i) the provision of catch or diversion drains, (ii) installation of silt fences, (iii) monitoring of the sand and excavated material levels within the river channel (coupled with appropriate action in the likelihood of possible overtopping/flooding), and (iv) proper storage/stockpile of construction and waste material, outside the river's channel.

Regarding the potential traffic congestion, the construction of the theme park may necessitate the use of Flaggers during the transportation of large pieces of equipment. To reduce traffic congestion (and to ensure a steady vehicular flow), it is recommended that vehicles approaching the construction site, from the east, be made to use the Wakefied interchange and prevent turning right into the site.

Following construction and commissioning of the park, it is recommended that adequate signs be erected to warn prospective patrons and other road users of the need to reduce speed on approach of the site and the need to observe the appropriate directional signs.

# POSITIVE IMPACT:

Several positive impacts are expected from the development of Martha Brae Theme park, as proposed. These positive impacts are given below:

# Generation of Employment in the Construction Phase

During the construction phase employment will be generated for skilled and unskilled labourers as well as some professionals. Employment opportunities should continue for the duration of the project. Opportunities will be created for the supply of various types of construction materials.

# Land Use Planning

In accordance with the recommendations of the Town Planning Development (TPD) 1997 Plan this proposed housing development will fulfil requirements for an area zoned for future development use. This will ensure that the land does not remain idle, become occupied illegally or be used for any illegal activity. Planned developments are also easier to police as road networks are structured and named and entrances and exits are designated.

# CUMULATIVE IMPACTS:

# Change of Land Use

Most of the area was originally under agriculture but based on the TPD plan (1997) Development Plan a large section is slated for residential and urban use. This development will be a part of this change in land use. This is not expected to be a negative impact as many of these lands have not been actively under agriculture and the need for attraction and economic activity in the area is large.

# Traffic

Traffic congestion on the Falmouth Bypass road is expected to increase significantly with in the vicinity of the site during construction and operation, as the vehicles from these houses will utilize this road. Properly engineered access and egress for the development should prevent congestion at the entrance/exit.

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# **DESCRIPTION OF THE PROJECT**

#### **1.0 DESCRIPTION OF THE PROJECT**

#### 1.1 Preface:

The National Environment and Planning Agency (NEPA) received an application from SJ Productions and Entertainment, for an Environmental permit to construct the Martha Brae Theme Park Project in the parish of Trelawny. NEPA administers the Natural resources Conservation Act (1991), which allows the authority, to request an Environmental permit for the undertaking of any activity within certain prescribed categories under sections 9, 10 and 12. NEPA has determined that this application must be supported by and Environmental Impact Assessment. The EIA will highlight the environmental impacts and the mitigation strategies that are required to ensure that the project meets all the legal and regulatory requirements (See Appendix for Terms of Reference)...

#### 1.2 <u>Project Background:</u>

SJ Productions and Entertainment Limited is embarking on the construction of a first class Theme Park and live entertainment facility on lands in Martha Brae Trelawny. The intention is to integrate entertainment with learning, while ensuring that sustainable growth within a niche market. The development will consist of three major components: *A Nature Park, Live Entertainment Amphitheatre and Modern Theme Park facility*.

The attraction represents the culmination of a vision and represents a product that will showcase Jamaica's culture and history, using first world technology and management systems. The project will focus on obtaining the safest ride technology, hiring the most competent staff and implementing the most rigorous training process available. The project will seek to partner with major film and music production entities and seek to become the premier international stage show venue for the Caribbean, hosting BET, Jazz and other international offerings.

# 1.3 <u>Project Location</u>:

The site is located on the outskirts of the town of Falmouth which was established in the late 18<sup>th</sup> and early 19<sup>th</sup> century and is widely acknowledged as a model Georgian Town.

Its greatest value lies in the fact that it has been extremely well preserved and its smaller buildings have remained virtually intact, unlike the highly acclaimed Williamsburg, where many of the smaller buildings had to be reconstructed after extensive research and excavation.



Figure: 1.1 Location of the proposed Martha Brae Theme Park

Falmouth played a very important role in the island's history, not only for its links to the sugar industry and international trade, but also in the movement towards the abolition of slavery and emancipation. For a time, it rivaled Kingston in importance. In fact, Falmouth holds the enviable distinction of being the first town in the Western Hemisphere to have a piped water supply and the Persian waterwheel at Martha Brae stands as a visible reminder of this fact. At a time when the yardstick of one's wealth was evaluated in terms of sugar estates, the parish of Trelawny, of which Falmouth is capital, boasted the largest number in the island - some 102.

The cultural links between Falmouth and Colonial Britain dates back to the late 18<sup>th</sup> century, when Edward Barrett subdivided lands laying the way for the establishment of the town. He retained a townhouse there and is the great grandfather of Elizabeth Barrett –Browning one of England's most celebrated poets, best known for her work "How do I love thee: let me count the ways".

Falmouth Trelawny lies on the northwestern coast of the island and is bordered on the west by St. James, on the east by St. Ann and by St. Elizabeth and Manchester on the south. Spanning an area of just over 874 square kilometers, the parish was formed from the eastern part of St. James in 1770 and has its place in Jamaican history as being the parish with the most sugar estates and factories. Falmouth is approximately 35 kilometers from the Donald Sangster International Airport in Montego Bay.

Falmouth the capital town of Trelawny played an important part of Jamaica's history. The town served as the exit point for sugar and the landing point for many essential goods needed by the estates of the interior and was considered the busiest port on the north coast. During the period when the sugar industry was thriving, the town prospered and supported many businesses including more than one weekly newspaper. With the advent of steamships and the decline of the sugar industry however, the town of Falmouth began to deteriorate and, to date has not been able to re-capture its former glory days.

Falmouth is considered a sleepy and quiet town but its rich cultural heritage is clearly reflected in the remarkable remnants of Georgian architecture laid out in the late 1700s as a model deserving of international recognition. Isolated from the rapid development that has affected other tourist towns along the North Coast, the town of Falmouth has maintained most of its cultural and historical integrity.

# 1.4 <u>Tourism Potential</u>

The potential of the town and its environs for entertainment, cultural and heritage tourism has long been recognized and over the years there have been a number of studies and other initiatives aimed at tapping into this resource. At the international level, it is felt that Falmouth merits being named a world Heritage Site under the provisions of the UNESCO World Heritage Convention and formal nomination is to be prepared. However, there is a mandatory requirement for a management body to ensure that the restoration of the town is being undertaken.

In 2004, Falmouth for the third consecutive year has been nominated to The World Monument Watch List of the 100 Most Endangered Sites. This list recognizes both heritage significance and threats to integrity. Locally, the Jamaica National Heritage Trust declared the Falmouth Historic District a National Monument in 1996. Despite this, however, there has been very little concrete action. The project will provide Falmouth with the kind of attraction that it needs to initiate growth in its quiescent tourism market.

# 1.5 <u>Project Overview</u>

The theme Park will consist of two components: a Nature Park and a Theme Park. This is against the backdrop to what will become the premier theme attraction in the English speaking Caribbean. The characteristics of Falmouth with its authentic Georgian heritage, provides a fitting platform on which the project will be staged.

# 1.5.1 Site Planning

The overall site area allocated for the park, has been structured into zones of development that relate to the needs for developing the overall theme park, its infrastructure of road access and parking, as well as the need to expand the development in future for some of the component segments of the overall development. The main portion of the land area is occupied by the theme park as shown in figure 1.2.

Figure 1.2: Plan View of Martha Brae Theme Park



The park expansion is allocated near the water park area of the theme park and the dry ride portions of the theme park. The secondary expansion is allocated for parking as these components will have to be increased in size over time or alternate means of controlling this need for parking are put in place by way of public ground transportation (trains), increased bus use and schedule changes to determine when the peak use times are for each type of park use and allocating the timing of events to suite the needs of the theme park infrastructure. The remaining areas for the allocated lands are located along the highway area of the park, where the extensive frontage along the highway provides a means of setting up development lots for compatible future uses.

These lots may be used as a means of land banking and establishing the means of expanding the park over time and controlling the surrounding land uses. The preservation of these lots for future use may allow the higher and better use of these lots in future when the overall park in developed in detail. The value of these lots will be reflected in the surrounding level of development and the recreational focus on the land uses.

#### 1.5.2 Development Concept:

The overall theme park area is roughly divided into 5 major types of development areas as shown in the following figure1.2. These areas consist of the Amphitheatre, the Water Park Area, Dry Ride area, the Natural area and the support services. The Amphitheatre is intended as a self contained open air entertainment area that is used as a cultural and music event space. The capacity for the theatre is intended to be approximately 2500 patrons for capacity and contain a series of support facilities including stage area, lighting-sound control room, back stage area, events change rooms, support areas, lounge areas, small food and beverage areas, washrooms, and access for delivery and set up.

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The final component to the development concept is the support system for the park which consists of the overall development parking, access, entrance, egress; drop off, ticketing, support buildings, service areas, plaza spaces, and circulation. The segments of these components of the park weave together the individual components into a comprehensive and tangible development proposal and workable park solution.

#### 1.5.3 Master Development Plan

The Master Development Plan is shown in figure 1.3 illustrates the development program to scale, for the park as described within the content of the feasibility and market studies conducted by International Theme Park Services. For descriptive purposes the master plan is segmented into 9 zones that relate to the types of use and the development program for the theme park. These individual components consist of the following items: 1-The Amphitheatre, 2-Parking, 3-Entrance Plaza, 4-Dry Park with Cultural Exhibits, 5-Food Venues/Events Plaza, 6-Cultural Exhibits and Rides, 7-Garden Area, 8-Water Park, 9-Park Area.

# 1.5.3.1 Amphitheater

The first zone of the Theme Park attraction is the amphitheatre which is shown in detail in figure 00 following. The amphitheater is intended to be a formed open air event space dedicated to a variety of entertainment events and programs for music and culture. The theater is a fully self contained event area that is surrounded by a continuous perimeter enclosure that enables this portion of the part to operate as a separate event space that can be ticketed and charged separately. The proposed theater space is composed of a terraced row seating area that is broken into six sections, served by seven stair systems that feed off of the perimeter walkway at the top of the amphitheater.





he theater is accessed from its own central entry plaza with a multi use entry building that

houses the ticket office, merchandizing, staff offices, operations, sound and lighting as well as lounge space with limited food and beverage services. The second level of the entry building would typically house the operations and sound missing components of the theater allowing for the direction of the lighting and sound and ensuring the performances are backed up with a high level of service potential and staging world



class performances. This area should also incorporate a laser light system for adding to the performances and musical events staged at the theatre. These types of light can be an integral part of the performance in and of themselves. There are two other lounge areas at the top left and right of the theater that also provide beverage service and house other

support and operational considerations as well as lighting. The entire front area of the theatre is a landscaped pedestrian area for staging patrons' entry and exit into the event area and providing some beverage service during breaks in the events.

The event stage is the focus of the amphitheater and it is composed of a large raised stage area



which should contain a variety of movable components for raising and lowering certain sections of the stage for programmed events. The stage should have a full lower area for queuing performers and various components of a multi media event. The stage also employs a cover that is also movable to allow it to be extended over the stage during inclement weather or retracted should this be desirable. The rear portion of

the stage would house the full operational considerations for the shows and performers, including all the sound systems, electrical considerations, backdrops, curtains, loudspeakers, lights, change areas, visual and theme items, wardrobe, make up rooms, and set change and storage areas. The rear of the stage is set up for a full gated and controlled vehicular access for delivery of the support items, band equipments and any stage items. The rear vehicle access will accommodate some parking and vehicle storage for larger events and concerts requiring the equipment and support vehicles of several individual performance groups. The stage is illustrated with a continuous backdrop that stretches to the edges of the seating which would allow the theme items to be included as a backdrop to the central stage and also allow for the installation of the service items under portions of the seating. The area immediately in front of the stage is provided as a space for either an orchestra area for theatrical performances or for a dance area for musical events.

#### 1.5.3.2 Parking and Vehicular Access

The parking and vehicular access is an integral component of the overall theme park development as it is a critical component to the ability of people to access and enter the park in a convenient and trouble free way. The parking lot area have been structured to deal with the immediate parking requirement of the theme park and water park, including the provision of parking for cars and tour buses. The Amphitheater attendance has not been fully allocated in the parking calculations as it could exceed very quickly the amount of available land to deal with the potential parking. Since the amphitheater can potentially hold very large volumes of people it is assumed that alternate parking will have to be arranged for these types of events on adjacent land areas and parcels.

The main parking lot area is conveniently located to be central to the overall development of the theme park and associated uses. The parking area is accessed by a double lane divided feeder road with central median and integrated turning lanes to the various secondary connection roads. We have assumed that there will be required changes to the Coastal highway which might involve the integration of signage to facilitate the merging the traffic from the theme park road onto the highway.

The main parking area is broken into eight main parking sections that hold 68 cars per zone. These areas are divided by a curbed, landscaped and treed median that should be also integrated with land drainage systems to deal with rain fall that can be substantial

during storm events. The trees in the median will serve to provide shade and cover to the cars that are parked in the lots, which could be located in these areas for several hours while park patrons attend various events and attractions at the park. Provisions should be made to secure the parking to ensure that the vehicles are safe from vandalism and unauthorized entry. The layout has been planned for a continuous enclosed fence and gated access to parking to ensure that there is a measure of control and security for the parking lot. The fencing and gates will also ensure that there is no unauthorized parking within this parking lot as most often there is a requirement to pay for parking when attending events or the theme park.

The parking area is also set up for bus parking near the entry to the park with full drop off areas and multiple parking zones in anticipation of the various resorts and cruise ship areas being serviced with some sort of transportation system to the park to attend certain events and performances along with the theme park and Water Park. There are approximately 30 parking spaces defined for buses both in a designated parking area and within the disembarkment area of the drop off zone. This should provide ample parking for the short term parking of these transporters as they are most often not allowed to park for extended periods of time on site. Most of the large buses drop off their passengers and park remote to the park before returning at a predetermined time to retrieve its passengers and continue back to the resorts and cruise ship areas. Due to the anticipated heavier load of bus traffic, the medians and turn areas have been defined for large vehicle use and allowing for the provision of access by fire trucks and emergency vehicles.

The layout of the parking lot in the figure 1.4 shows the anticipated routes for the cars in red and the bus traffic in blue arrows. Connected to the various areas of the parking lot are a series of paved walkways to link the parking zone directly to the entrance to the park for ease of entry and exit of patrons.

The main parking lot also links to a secondary parking lot adjacent to the amphitheater which is intended as overflow parking and staff parking for the many personal who will be employed at the park. This area of parking contains provisions to park approximately 155 cars for staff and or patrons to the park. As part of the internal parking and vehicular circulation for the park, each of the park areas are linked with vehicle access and secured connections into the park for service vehicles and emergency use. As noted in the figure 1.4 there are two main secondary entries into the park for service and delivery each of which are served by a manned security station and gate.

The vehicle and pedestrian drop off zone to the park is illustrated in the figure following. The drop off zone is integrated with the entrance plaza and provides room for 3 buses and car traffic to transport passengers near to the entry of the park and disembark the passengers in a vehicle friendly zone prior to securing the ticketing and entering the park. The entry plaza is a pedestrian precinct and should be attended by security personnel directing vehicle movement and determining who can access the entry plaza. The intent would be to have the entire plaza portion of the park paved to reflect its pedestrian priority and signal to drivers the need to control speed and look out for pedestrians. Ideally the drop off zone should only be accessible by buses, taxis, VIP cars and the occasional emergency vehicle as required. All other traffic should be relegated to the parking areas.

The drop off and entrance plaza is ringed by a flag court that adds color, movement and a vertical element to the entry to both direct people to the entry but also add some theme flair to the entrance. The entry and ticketing should also be highly themed to portray an aspect of local culture and add to the attractions anticipation and sense of excitement to the patrons. A suggestion of what can be done to highlight this is shown in the attached figure following that provides for an exciting entry and highly visible introduction to the park. The entry plaza is also large in scale and fitted with enhancing landscaping and lighting as well as an attractive fountain to add comfort to the space and address is function as a point of entrance and egress and keeping in mind that patrons will be spending extended periods of time here prior to entering the park and after exiting the park. This space functions as a meeting and orientation space for patrons who are entering with groups and organizing themselves before they enter the park and similarly when they leave the park and are waiting for group members and transportation.

Figure 1.4: Site Layout showing Major areas in the Park



The Entrance plaza is integrated with the surrounding security fence that contains the park and controls access to the park. The most immediate component that the patron's area first met with is the entry and ticketing area of the main gate, which is set up with ticket booths for patrons to pay for the entry fee and be issued with tickets. This area should also be integrated with a group sales area and security to ensure visible control of this area and ensure the safely of guests and protect the entry receipts.

The ticketing area would be integrated with a canopy for shade and movable barrier fences to set up queue lines and controlling crowds and setting up proper exit and entry. Turn styles are indicated to track customer counts, control entry and be integrated with a fully automated ticketing system for the park to link to payment methods, ticket categories, time of use, access to various venues and special events.

Linked to the entry functions is the provision of administrative offices on two levels, management, nursing station, head security office, retail, merchandising and some food and beverage and some secondary retain integrated into a secondary plaza and fountain plaza beyond the entry gate. The administrative functions of one of the main buildings of the entry plaza is a key to the operational and business functions of the park and need to be up front and accessible as they will be ongoing business items being dealt with even when the main part of the park is not open to the public.

The retail opportunities are located immediately adjacent to the entry and exit of the park and allow for the provision of souvenir purchase opportunities to patrons of the park and provide easy access to goods that can be purchased on entry and on exit. The types of merchandise would be unique items that would allow impulse purchases from visitors to the park.

The internal entry plaza is an orientation plaza and would typically contain directional signage for the park as well as areas for seating, space for gathering and shade for sun protection. The space functions as a means to control and orient visitors once they have entered the park and allows them to gather their groups and move toward the areas of the park that they have paid for attendance and items that are of personal interest. There is a

secondary ticking booth for the dry park to allow general entrance to the overall park and to allow patrons that ability to purchase this item of the park separately.

# 1.5.3.3 Dry Park Attractions

The dry park portion of the proposed Martha Brea theme park stretches across the central zone of the theme park area in two lobes, flanking both sides of the entry and containing a variety of dry amusement park rides and support services. The two zones of the dry park are connected with a themed cultural ride that circulates the patrons around the park on a boat like ride that is pulled forward on a track system that beings the visitors through

a cultural display of local culture, history and events.

The southern lobe of the dry park is shown in the figure following, and depicts some of the larger amusement park rides as well as the water zone of the dry park. A separate splash play area has been defined in this dry portion of the park as a means of bringing in a water attraction for small



kids into the dry park which may be ticketed separately from the water park.

The wet area is a shallow wading pool with surrounding deck that would contain an interactive play zone for young kids and early teen under the supervision of parents and a life guard. The area is intended as a means of providing a rest area for the dry park and an area that kids can participate in a small water play environment if they are not ticketed to attend the overall water park.

These types of attractions are necessary in hotter climates where there is a need to provide some mitigation of the hot temperatures and keep patrons in the park for a longer period of time. The surrounding deck provides opportunities to lounge and relax away from the other active area of the park. Adjacent to the spray park is a bumper boat area, another popular ride for amusement parks especially those located in the hotter areas of the world. The area is set up for multiple riders and an attendant area is provided for rider entry and exit. Options are available for the type of bumper boats in term of their propulsion system and rider controls.

The boats should employ a remote control system for the attendant to power down the boats for clearing the track area and disembarking the riders in an orderly and timely manner.

The support services provided to this area of the dry park in include a food and beverage area with outdoor seating, deck area and washrooms. The area is set up with wide connecting paths that extend into deck area to allow for capacity crowds and ease of movement. The paths serve to connect the various rides and attractions and also allow for the use of service vehicles. Several areas



of the park are connected via bridges that extend over the water based cultural ride which can be further enhanced to allow for the local and cultural theme to be further explored.

The overall setting of the park would be as natural as possible, allow for abundant vegetation covers to cool the site and provide shade for the patrons for the park. The tree and shrub cover should also showcase natural beauty of the landscape and tie into the garden and botanical portions on the park both in theme and in content. The vegetative cover will also mitigate the need for some of the rain water controls and provide an attractive setting for the overall park. The signage, lighting, trash containers etc should also be linked to the overall theme of the park. The conservation and natural themes would help to promote conservation of resources on site and add to programs for recycling and waste management in the park.

This area also contains its own set of midway type games and a video arcade in the central zone of the dry park area. These games can be in the form of pay per use, redemption type games or free use depending on the ticketing arrangement on the entry. The games would typically be the more popular variations and be changed on a regular basis to ensure that the latest and most popular models are here for use. This would

encourage the continued use of the arcade games and allow patrons new video game attractions on a regular basis to enhance the appearance and maintain interest in this part of the park. These types of games are good revenue sources for the park and provisions have been made in the plan for expansion of this area. It is anticipated that the games area be roofed and partially enclosed to provide a darker environment of gaming. The



structures would be securable and provide protection from the elements for the games and attractions inside of the two buildings. It is assumed that an attendant area would be required to ensure that the provision of tokens for game use are easily provided and vending of redemption rewards are available if the arcade is set up this way. This area of the dry park is also set up with washrooms as a normal component to the services required for the park. The washrooms should be incorporated into the overall theme of the park.

Contained within this lobe of the dry park are the following ride components:

- 1. Pirate Ship
- 2. Street Fighter
- 3. Splash Coaster
- 4. Splash Battle
- 5. Ferris Wheel
- 7. Tea Cups
- 8. Bumper Boats
- 9. Caribbean Family Adventure tree house interactive water play house.

- 10. Eureka Family Ride
- 11. Crazy House Family Ride
- 12. Spinning Wild Mouse Coaster

# (1) Pirate Ship

The Pirate ship is a themed ride adventure for the park and is located where it would be highly visible to the outside of the park as well as to visitors and passers by on the main coastal highway. The ride contains 10 rows of lineal seats the sit up to 32 passengers.



back and forth it becomes almost vertical in some instances to give the riders a great thrill. Due to the nature of the ride the riders are limited to 1.22 meters in height which eliminates all of the smaller children.

The footprint of the ride is relatively small and rider capacity good. The Pirate ship is a classic amusement park ride that is both attractive and strong visually. At night the structure is well lit with an arrangement of lights that animate the structure of the ride and add to its visual appeal.

It is popular with the amusement park



attendees and is a good performer from the standpoint of the park users. The ride has a programmable duration of between 90-120 seconds and runs at a ride speed of 39 feet per second.





# (2) Classic Ferris wheel

The second major ride in this area of the dry park is Classic Ferris wheel, which has been placed in a prominent location next to the drop off zone of the entry and at the section of the park closer to the main highway to act as a visual icon to the park.

The Ferris wheel comes in a variety of sizes and heights with varied configurations for rider gondolas; however the recommendation for this theme park is the 20 meter unit. At this size the ride will have a great ability to draw people to the park and will have an

impressive view of the surrounding landscape.

The 20 meter wheel is fixed with sixteen -6 passenger gondolas for a high capacity ride count. The maximum number of passengers is limited to 60 adults or 90 children who can be loaded into 3 gondolas at a time for a five stop



loading and unloading system. The ride is also fixed with a considerable amount of colored lighting for visually spectacular night lighting. The Ferris wheel ride is a classic family ride providing appeal to all age groups and family groups. Several version of the ride can be developed as shown in the following illustrations. Many themes are available for the ride units like including a Venetian style or air balloon or the more classic

octagonal gondolas. A prefabricated station for unloading and offloading passengers and luminous sign available upon request from the ride supplier will be incorporated.

# (3) Tea Cups

The third classic ride defined for the park is the Tea Cup Ride. The tea cup ride contains a three module



layout with nine tea cups total ride units with 5 rides per cup. The ride is another family

attraction that provides a wide range of use for the various age groups and the family market. The ride can be themed separately and provide with a lighting package.

The Rotating platforms, for the ride are 12 meters in diameter with 3 satellites mini

platforms each one with 3 cups 5 passengers each for a total of 9 cups (14 meters diameter 4 satellite models are available for additional capacity at a higher cost).

Many different theme types are available for the cups and central subject (Flower, barrel, cup mushroom, and cannibal pot). The roof can also be a thatched type available on request. The tea cups have a rider Capacity 900 passenger's hour in the 9 cup format.



#### (4) Spinning Wild Mouse

The spinning wild mouse is an innovative and exciting ride concept based on the traditional roller coaster and a mine car. The Ground dimensions are roughly 41.2 x 20.3 meters, 14.5 meters height, with approximately 361 lineal meters of track development.

It holds a total of 8 rider units that hold a total of 32 passengers.



Track drawing optimized in order to obtain a great smooth pleasure with sharp curve and amazing descent without shock. Rail construction with backbone (rectangular hollow section) in the height track straight sections, pipe diameter 114,3mm gauge 900mm.Column hot deep galvanized with Loading /unloading station, many different theme available for wagon. The ride has an approximate rider Capacity of 900 passengers per hour, based on average loading and unloading conditions and optimum ride timing.
#### (5) Splash Battle Coaster

The new splash battle coaster is included in the ride mix for the dry park and is intended as an exciting and innovative addition to the dry park making use of water for fun and interaction. The ride allows a series of riders and the surrounding patrons waiting for the ride to participate in a water battle in the confines of a water coaster experience.



The ride while new has proven to be popular

and entertaining, especially in the hotter locations around the globe where there is a need to cool off within these dry parks. It is a unique combination of wet and dry ride in a dry park setting.

The ride as noted in figure 00 following shows some of the features and play value of this attraction.

## Dry Park Continued

The second lobe of the dry amusement park is shown in the park layout figure 1.4 and is

located to the north of the entry to the park. It is connected to the first lobe of the dry park both by the integrated path system and the cultural themed ride that links these to portions together as part of the themed cultural component. This portion of the park contains a series of complimentary rides to the ones indicated in the lower portion of the park. They include the following:

- 1. Flume Ride
- 2. Sky Drop
- 3. Flying Swing Carousel
- 4. Merry Go Round
- 5. Bumper Cars
- 6. Kiddies Canoe Ride

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## (1) Log Flume Ride

The log flume ride is one of the more traditional rides for an amusement park and is one of the more poplar features of a medium or large sized park. The location of this ride in the top lobe of the dry park extends the impact of the dry park to the north section of the dry area and draws importance and patrons to this side of the park. The ride is a visually spectacular addition to any park of the medium and large size range. The footprint of these are generally custom in configuration and involves the integration of an elevating devise in the initial stage of the ride and a gravity portion not dissimilar to a roller coaster that takes riders through a series of turns and drops to culminate in a final drop with a massive splash down zone. The ground dimensions will vary according with final layout, but generally are consisting of 280 meters track development, and capacity), the required pumps, includes a personalized park name on logs.

A custom designed loading unloading station can be developed on request in accordance to the park requirements. The ride lends itself to theme work on a larger scale and fits well in small and medium sizes parks.

## (2) Sky Drop:

The Sky Drop is a newer category ride for the dry amusement park, and is more on the line of the thrill ride component to the park providing the more experienced

park attendee with a ride more in keeping with their need for thrill. As shown in the







figures below the ride is highly visible and a thrilling addition to any medium and large size park. Its 40 meter top height makes it highly visual and another icon to the park and a significant addition for the overall development. The ride accommodates approximately 400 riders per hour in a 12 seat configuration.

The ride incorporates 12 seats with over head lap bar, magnetic brake, nitrogen cylinder

for amazing acceleration. The ride contains a colored light fixed on top and an available lighting package for the overall structure of the ride.

The platform for loading unloading station covered is provided and can be themed to suit locations. Its standard configuration is combined in a metal frame and an overlay with chequered aluminum, aluminum enclosing fences and aluminum stairs.

## (3) Flying Carousel

The Flying Carousel is another classic ride for the amusement park industry incorporating a family oriented thrill ride into a themed package of ride entertainment. These types of rides have been a

stable in the amusement park industry and have provided good service and rider response for many years. From 32 seats, FRP panels around main column, under the roof and around the crow of the roof with decoration hand painted chosen according to the themed area or per customer request. Great illumination with cabochon very impressing in night







time. Move up of the main crown along the column with inclination and rotation. Swing of the seats. Passengers per hour 800.Standard version 48 seats.

## (4) Bumper Cars

The bumper car ride is a highly poplar ride for dry parks and consists of a building structure complete with roof on 6 columns.

The rough dimensions are 12meters by 24, includes cabochon illumination around the coloured roof panels on 4 sides, neon



illumination on the vertical columns, and



a net below the roof. A one meter walkway is defined all around

the main floor of the ride for viewing. The ride package includes 24 Wild Cat metallic cars with colour poles and trolley, complete with a safety belt, rectifier unit and 5 speed control panel board. With the defined cars the ride complex has a Capacity 1000 pass/hour.



## (5) Merry Go Round

The classic carousel merry go round is a park staple for ride offerings in dry parks. The ride employs a 10.5 meter platform diameter with wooden floor, a single deck with 36 seats, classic drawings with Venetian landscape or other like subjects on all roof panels, and below the roof and on main central panels. The ride employs Clear cabochon illumination on the main column, around all wall panels, and around the roof. It also comes with a coloured canvas cover with illuminated cone on top. The ride capacity is 1000 passengers per hour for the ride and it is a good family oriented addition to any dry amusement park.

The merry go round still remains as a strong performer in the amusement park industry both for its appeal to the young children and the nostalgic value that it has among parents that retain the memories of this ride from a young age. The ride can have a custom set of animals that can be arranged to suite the theme of the park and the overall appeal for the ride.

#### (6) Kiddies Canoe Ride

The Kiddies ride defined for this area is indicated in figure 00 following and is defined as a small children's boat ride consisting of a  $13,20 \times 9,60$ "B" shape Fibreglass reinforced channel of approximately 23 meters in length. The external panels are decorated, and the ride is supplied with a combination of 3 log + 3 canoe type boats and includes a , loading unloading platform 2 pumps



and a minor bit of theme work and decoration consisting of an apache tent. The ride is consistent with small children's use and is intended to balance out the ride offerings for the family type market.

The kiddies' canoe ride adds a bit or water ride appeal to the dry park and is especially good for children on very hot days where they can cool off and participate in a ride

experience at the same time, under the supervision of their parents.

#### (7) Mini Family Ride Swing

As a reduced version of the larger flying Carousel this 12 seat, 3 meter diameter unit includes a central structure covered with fiberglass, 2 colors complete with illumination, and a platform covered with chequered aluminium. The ride has a capacity of about 250 passengers per



hour and is intended as a children's ride that is both safe and thrilling for the younger riders.

#### (8) Cultural Ride

The theme ride that connects the two lobes of the dry park is the cultural and entertainment ride for the park which is structured as an entertaining and historical trip

through the history and culture of Jamaica. The ride is intended as a small boat ride that allows 4-6 person vehicles to move around the park within a linear and looped ride experience. Through the duration of this journey riders will be subjected to a series of themed sets displaying animated aspects of local culture, history, events and music. The



ride system would be narrated through the journey to provide an informative narrative component to the entertainment value of the ride. The ride would be suitable for tour groups, schools and those visitors that want to obtain a bit of informative about local culture within both an entertaining and informative fun learning environment.

The ride is set up to run as a component of the dry park or can be operated without allowing visitors into the dry park area. The ride starts out from an attendant area at the rear of the retail building at the entry of the park and terminates at the same location at the opposite side of the ride channel.

The ride transports its riders back in time, taking them through a visual interpretation of Jamaican history starting in the first lobe of the dry park delving into the Spanish town of early days, then into the town site of Port Royal, and initiating a musical invention at the a mini Stage celebrating a Reggae festival. The ride continues with a showcase of the Jamaican experience in the 1700s and the famous Christmas Day Rebellion. The ride continues out of the fist lobe of the dry park and past the entry portion of the park and into the second lobe of the dry park extending this trip through time.

The celebratory aspect of the ride continues with the declaration of freedom, and then moves swiftly into the Jamaica of the 1900s. The ride continues into the natural component of the park to get a taste of the natural beauty of the islands before emerging into more modern times with themes demonstrating the triumphs of the Olympics and the celebration of independence. As part of the experience the ride also moves around a central plaza that forms a themed outdoor market area that showcases local foods and a separate craft market and sports museum. These components are intended to be experienced on foot, but a taste of the content of these areas is given to the rider to encourage further exploration of these components of the park which potentially could be ticketed separately from the other components of the park. The time line and layout of these two areas of the ride are show in figures of the dry park.

#### The Garden and Natural Area

This portion of the theme park is a major component of the park as a diversification of the attraction and the appeal that it would present to the user profile of the visitors both local and imported via cruise ship and tourist visitation from other sources of transportation. The garden is composed of local Caribbean botanical species chosen for their distinctive characteristics, colour, size, shape, unique smells and other features that would be of unique interest and distinctly Jamaican in character.

The natural area also contains a couple of indoor components, one of which would house a bird aviary, set up as a natural environment, lush and tropical in its character with species of plants selected for their natural beauty. The structure is indicated as a domed roofed building with its own ticking areas, support use areas and interpretive



areas, support use areas and interpretive areas.

The unique aspect of the display is a combination of bird species that are allowed to fly around within the confines of the structure and a series of individual displays that allow for other non–compatible bird species to be displayed within the confines of the building.

The display would be supported by a knowledgeable staff of capable attendants and a professional with some knowledge or ornithology to provide a setting of entertainment, supporting themes of ecology, preservation, conservation and global responsibility. The building would include an interpretive component and a gift shop for very unique natural

and environmentally oriented products and merchandise.

The second indoor area suggested for the park is a smaller structure of similar style and construction but on a much smaller scale that the aviary. This facility is the tropical butterfly display that would



showcase a unique variety of live tropical butterflies. The building would be a highly climate controlled environment to allow the best possible living environment of the butterflies and a showcase for visitors to directly experience the seldom seen display of colour and beauty.

The overall garden is set up as a highly decorative visual display feature for the theme park. The layout is botanical in structure and is serviced by a system of criss-crossing paths that allow visitors to tour the beauty and splendor of the garden spaces, its floral displays that are both natural and manicured in their presentation, reminiscent of some of the British garden traditions.



The garden would link to the other areas of the park through the use of landscape as a

means of connecting spaces. The setting created by the garden would be both educational and relaxing in nature, providing display and interpretive information in zones of the park on natural themes and also making provisions for spaces for gathering and relaxation. The individual sections of the park are defined with a continuous



seating edge to control access to the planning areas, provide spaces for interpretive displays and continuous seating walls throughout most areas of the garden space.

The garden also features a couple of water features that would be suitable for fish to add an element of surprise to the park and an interesting interactive component for kids. The pools could be kept relatively shallow, contain a fountain feature for visual delight and be stocked with a hardy fish like Koi that could withstand variable temperatures and conditions and still thrive. Small coin operated fish food stations could be provided to allow kids to purchase food pellets to toss into the ponds and feed the fish as well as contribute to the revenue stream of the park.

The educational sub-themes of the garden area could be used to promote environmentalism, Rain forest conservation, species preservation, endangered species, natural systems, stewardship, climate change, global systems and other themes that are relevant, enlightening, and educational and presented in a fun way.



A separate branch of the garden extends to a water feature for the park and extends into in via a docking system. The pond area services to contain run off water from the park and also provide a source of irrigation water for the garden are of the theme park. The docking system allows for paddle boats to be put onto the water in a pay per use rental system.

The setting around the water is a quiet area for relaxation and can be programmed for separate events and groups and for corporate use.

#### 1.5.4 Water Park

The water park potion of the proposed theme park is intended as a key component for the family and tourism market and also as a means of enhancing the attraction of the theme park to cater to local requirements.

The water park is situated to the rear of the park adjacent to the river and is set up to run as a separate ticketed entity within the



amusement park. This will allow visitors to make a choice to attend either the dry park of the theme park or the water park and pay separately or on a combined ticket. The separate pay will allow the overall park to run more effectively and make the staffing requirement more efficient. The wet park will mainly be a day operation and depending on the season can be closed in early evening while the dry park can open later and stay open much later at night. On special event days or if the park is rented out for corporate use the flexibility to have the one park venue closed for a special event while the other portions of the park remain open is a good asset for operations and making the flexibly of use built in to accommodate these other types of programming. This level of flexibility will allow the park to generate more revenue from the corporate use and special events use. On a slow week day the water park can be provided for the exclusive use of a school for a reduced rate ticket. This type of event could also be sponsored corporately so the cost for the school would be neutral or lower while the park would be enhancing its revenues on a day that would otherwise be reduced in revenue. The exposure for the school kids will further enhance the park by making them a return customer for the park and a potential season ticket holder.

The water park is entered off the plaza space of dry park and access is obtained by a coded wrist band that would indicate the zone of the park that the patrons are allow to use and can even be linked to specific time periods by colour or even a optical reader system. The wrist band system can also be linked to the cash control system to allow patrons to place "credits" on their wrist band for use as a means to pay for food, beverages and for various items at the gift shop. The entry to the park is gated to ensure that patrons are checked in and out of the water park through central turn styles. There are change rooms, showers and washrooms for both men and women at the entry to the park and lockers situated in the entry plaza for storage of cloths. It might be worthwhile to set up a check in service in this regard to ensure that the patrons have secure protection of their cloths and valuables.

The access to the water park extends out of the plaza through a series of paved paths and a bridge that passes over the lazy river. The paths extend further through the park connecting to all of the various features areas and components in a logical and integrated system. The paths would be wide enough to allow the use of small golf cart sized service vehicles and maintenance carts.

The structure of the park has been orchestrated to deal with the full family group and the various age groups that would be typically found in the family unit, as well as the tourist market who would be potentially more familiar with this type of feature but would have higher expectations for the type of use and entertainment provided by the park. The water park is essentially composed of four main components that have specific levels of customization for entertainment value and appeal to the various age groups. A significant amount of the park is dedicated to entertaining children of all ages as they tend to be one of the main reasons for attendance in these types of parks. Children of all ages are brought to these parks as a form of recreation and a special outing for birthdays and other like events.

Because of this focus on the young the park has been planned for a large children's area with a multi level interactive play structure, water slides for younger kids, wading pool, large surrounding deck space, and a large adventure pirate ship that is beached onto the sands of the entry into the lazy river. The play structure would be both visually impressive incorporating an appropriate theme and numerous water play features for all age groups and levels of ability. A suggested pirate theme as shown in the figure above

provides an idea as to the theme work and qualitative aspects of the water play environment.

The many features of the play structure provides hours of water play adventure and fun allowing virtually all age groups to make



use of the play environment, but more importantly the adults and their children in concert. The children's area also includes a themed children's river area with butterfly shade structure and a spray animals, a set of kiddies' ramp and ultra flume slides are also provided, and large shade areas and themed tree play house structures for kids to overlook the play zone. The children's area is within the central zone of the water park and is contained in this area by the surrounding lazy river and considerable landscape areas that would soften the look of the water park and provide much needed shade and enhance the visual appeal.

The second major component of the water park is the *wave pool* and beach area that is

also contained in the central portion of the park and connected to the lazy river feature. The wave pool is a key component to the park, providing a large beach area for adults to relax and sun bathe and also a great capacity feature allowing patrons of all ages to take part in the a safe water play and swim environment that simulates the ocean with wave



patterns and motion. The wave pool is a very popular feature to float around on the water on an inflatable tube and bob in the waves as a form of fun, interaction and relaxation. The user of tubes has been a consideration not only in the wave pool but also for the various other rides and recreation areas that make up the park allowing the maximum use of the water park for these inflatables that can be incorporated in the park as a rentable item and a secondary source of revenue.

The wave pool beach is intended to be a sand beach in keeping with a natural type look and providing ample room for beach chairs, shade structures and possibly rental cabanas as shown in figure 00 flowing.

The beach area also incorporates a shallow play zone for kids with a variety of spray items to allow close proximity for adult relaxation areas and kiddies play areas for supervision purposes.

The wave pool incorporates a surrounding of artificial rock work and enhanced with a stage platform for performances and entertainment. Often these stage venues provide an event space that attract patrons and keep them in the park for more of an extended period of time. The event space enhances the park's ability to attract customers and keep them there for greater



periods of time, which translates into higher revenues especially in the food and beverage portions of the water park.

The third main component to the water park is the lazy river which, and like the wave pool it is one of the holding components to the water park. Patrons can enter the lazy river from a number of entry points along the length and using the inflatable tubes float around the entire water park area. The river in this way is used as a secondary transportation system, whereby the park patrons can make there way around the park to the various other areas and to the rides and attractions, stepping out using one of the many exit and entry points to the river. The river also breaks off into a number of lagoon areas which form into activity pools for informal swimming and active games like volleyball and basketball. The river is covered in a number of locations with artificial rock work to create dark ride areas that can be themed with water falls, sounds and lighting to give a unique effect to the park.

The path of the river starts and exits through the wave pool and is controlled through a series of water jets to propel the riders along the length of the river. In certain areas the river is connected to the splash pools of the tube rides where they can continue on into the river after terminating their ride on the slides.

The river also connects into the central zone of the river to access the play areas and support areas of the water park. On the exterior exits the river connects the riders to the various waterslides that are stationed around the park. The river also beaches out in the central zone of the water park where it meets with the children's area, providing a controlled and easy access to the river by the young children who would be accompanied by and adult. The river is also somewhat of a barrier around the park and in several locations bridges are shown to allow visitors to move freely around the park without interfering with the movement of patrons on the river.

In several locations along the river there are interactive components and other features such as waterfalls, water jets, tipping buckets and other interactive features. The features can either be triggered by the active participation of the users or more high tech solutions suggested with proximity and motion sensors providing the means to trigger water sprays and falls. The lazy river and the connections of some of the rides to its length provide somewhat of a continuous recreation system around the park and linking the various areas.

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## **1.6 UTILITIES:**

## (1) Water Supply:

Approximately 69% of the households in the parish in 2001 received water from the National Water Commission (NWC). Approximately 18% were supplied by private means, 8.3% from springs and rivers, 3.9% had other means of receiving their water supply and 1.8% did not report the source of their water supply. In 2001, the percentage of households ( $\approx$  87%) receiving water from the NWC in the study area was higher than that obtained in the parish. Seven percent ( $\approx$ 6%), of the households received water from private means, 0.4% did not report the means of their water supply, 5.4% had other means and 0.9% received water from a spring or river ..

Potable water will be supplied to the development by the National Water Commission through an existing transmission line that supplies an adjacent property, the Funeral Home. It is envisioned that a minimum of two (2) days domestic storage will be provided for the development using storage tanks on site. The Martha Brae Water supply scheme has been upgraded to service the additional needs of this new development. Section 2.3.8 outlines details of the water supply schemes available to the Falmouth community.

Public Source	CATEGORY	TRELAWNY (%)	STUDY AREA (%)
	Piped in Dwelling	26.3	48.2
	Piped in Yard	13.9	10.7
	Stand Pipe	26.0	27.4
	Catchment	2.3	0.6
Private Source	Into Dwelling	6.0	3.9
	Catchment	11.6	2.5
	Spring/River	8.3	0.9

Table 1.1: Water supply by categories as a percentage of total households for the parish and the study area (2001)

Public Source	CATEGORY	TRELAWNY (%)	STUDY AREA (%)
	Piped in Dwelling	26.3	48.2
	Piped in Yard	13.9	10.7
	Stand Pipe	26.0	27.4
	Catchment	2.3	0.6
	Other	3.9	5.4
	Not Reported	1.8	0.4

(Source: STATIN 2001)

Based on this demand, it is not anticipated that there will be any problems in the supply of water to the development by the National Water Commission.

#### (2) Sewerage

Sewage generated by the development will be treated onsite using Septic tanks and evapotranspiration bed. The final layout of the facilities will determine the number of system to be employed on the site as well as the inclusion of pumping facilities to take sewage from the lower areas. The details of the system will be the subject of a separate Permit application, and as such the requisite details will be provided. The following is a brief description of the process (See appendix 6).

## Process Description

Evapotranspiration is the net water loss caused by the evaporation of moisture from the soil surface and transpiration by vegetation. For continuous evaporation, three conditions must be met. (1) There is a latent heat requirement of approximately 590 cal/g of water evaporated at  $15^{\circ}C$  (2) A vapor pressure gradient is needed between the evaporative surface and the atmosphere to remove vapor by diffusion, convection, or a combination of the two, (3) There must be a continuous supply of water to the evaporative surface.

Evapotranspiration is also influenced by vegetation of the disposal field. Theoretically, evapotranspiration can remove high volumes of effluent in the late spring, summer and early fall, especially if large silhouette and good transpiring bushes are used.

## Evapotranspiration (ET)

The ET system is the most commonly used evapotranspiration system used. The main components are (1) a treatment unit, usually a septic tank and (2) an ET bed with wastewater distribution piping, a bed liner (unless the soils are determined to be impermeable), fill material, monitoring wells, overflow protection and a surface cover. Vegetation has to be planted on the surface of the bed to enhance the transpiration process. The clarified effluent from the septic tank flows into the lower portion of a sealed ET bed that has a continuous impermeable liner (or dense impermeable sub-soils) and carefully selected sands. Capillary action in the fine sand causes the wastewater to rise to the surface and escape through evaporation as water vapor. In addition, vegetation transports the wastewater from the root zone to the leaves, where it is transpired as a relatively clean condensate. This design allows for complete wastewater evaporation and transpiration with no discharge to nearby soil.

## (3) Electricity:

The Jamaica Public Service Company Ltd will provide electricity to the facility and given the importance of the facility to the Falmouth economy, no major problem is envisioned. The cost of the internal infrastructure is usually borne by the developer which normally includes the installation of power lines, transformers and lights. The facility will also be equipped with standby generators for the numerous of equipment that will be installed on site.

#### (4) Solid Waste:

The Western Parks and Market (WPM) Waste Management Limited does solid waste collection within the study area. Presently, collection is done on a daily basis by a truck which can hold 7-8 tonnes (7,000 – 8,000 kg) of compacted solid waste. This service is provided free (partial covered by property taxes) for the households within the area. The waste is transported to the Retirement dump located in St. James, approximately 45 km

( $\approx 28$  miles) from the proposed development. It is estimated that households in the study area generated approximately 5,631kg ( $\approx 6$  tonnes) of solid waste in 2001. Based on the growth of the population, it has been estimated that at the time of this study, approximately 4,365 kg ( $\approx 4.4$  tonnes) of solid waste was being generated and it is expected that within the next twenty five years, if the population growth rate remains the same to be 4,658 kg ( $\approx 4.7$  tonnes).

The 2001 census data indicated that approximately 20% of the households in the parish of Trelawny and 24% of the study area had their garbage collected by public means (WPM Waste Management Limited). It showed that the preferred method of disposal was by burning ( $\geq$  70%). The data also showed that most households ( $\approx$  71.4%) in the study area burned their garbage as a means of disposal. All the other categories of garbage disposal in the study area were lower than in the parish. However, the high percentage (71.4%) of households burning their garbage as a means of disposal is a cause for concern, as it has the potential to impact on ambient air quality by contributing to air pollution.

The operators of the facility will make arrangement with private contractors to collect and dispose of their solid waste at the Retirement Disposal site in St. James. The access to the site will be made between the NSWMA operators of the waste disposal site and contractor for tipping fees and other conditions.

DISPOSAL METHOD	TRELAWNY (%)	STUDY AREA (%)
Public Collection	20.5	24.5
Private Collection	0.2	0.3
Burn	70.1	71.4
Bury	2.5	0.7
Dump	5.4	3
Other Method	0.2	0.1
Not reported	1	0

Table 1.2: Method of garbage Disposal by Households in Trelawny

(Source: STATIN Population Census)

## 5. Roads, Transportation and Traffic

The proposed development site is located approximately 8 km ( $\approx$  5 miles) east of Falmouth (capital of Trelawny) and approximately 39 km (24 miles) east of Sangster International Airport (Montego Bay) and approximately 41 km (25 miles) east of the City of Montego Bay (Jamaica's second City). Depending on the traffic conditions, it takes anywhere between half an hour to an hour to drive to Montego Bay.

The North Coast highway upon completion will replace the Duncan's to Montego Bay main road. This highway upon completion will also reduce the time to travel to Montego Bay. The surfaces of these roads are in a relatively good state of repair. Access to the proposed site will be a left turn for patron travelling eastbound on the North Coast Highway and Via the Wakefield interchange for patrons travelling westbound. Signs will be erected from the Hague intersection advising motorist to continue past the site and exiting at the interchange and making two right turns and head eastward to avoid any turning across the highway. Transportation within the study area is provided by a fleet of taxis, "robot taxis" (unlicensed), buses and private cars. There is an absence of a formal transportation centre in the town of Falmouth, which leads to traffic snarls and congestion. Currently taxis and minibuses stop at areas along the round-a-bout in the centre of the town.

# 1.7 Terms of Reference:

The National Environment and Planning Agency (NEPA) received an application from SJ Productions and Entertainment, for an Environmental permit to construct the Martha Brae Theme Park Project in the parish of Trelawny. NEPA administers the Natural resources Conservation Act (1991), which allows the authority, to request an Environmental permit for the undertaking of any activity within certain prescribed categories under sections 9, 10 and 12. NEPA has determined that this application must be supported by and Environmental Impact Assessment. These terms of reference outlines the information required to address the many components of the EIA that will highlight the environmental impacts and the mitigation strategies that are required to ensure that the meets all the legal and regulatory requirements.

The Environmental Impact Assessment should:

- Provide a complete description of the existing site proposed for development. Detail the elements of the development, highlighting areas to be reserved for construction and the areas which are to be preserved in their existing state.
- Identify the major environmental issues of concern through the presentation of baseline data which should include social and cultural considerations. Assess public perception of the proposed development.
- 3) Outline the Legislations and Regulations relevant to the project.
- 4) Predict the likely impacts of the development on the described environment, including direct, indirect and cumulative impacts, and indicate their relative importance to the design of the development's facilities.
- 5) Identify mitigation action to be taken to minimise adverse impacts and quantify associated costs.
- 6) Design a Monitoring Plan which should ensure that the mitigation plan is adhered to.
- 7) Describe the alternatives to the project that could be considered at that site

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

#### Task #1: Description of the Project:

The aim of this task is to provide a comprehensive description of the project, noting areas to be reserved for construction and landscaping, areas to be preserved in their existing state as well as activities and features which will introduce risks or generate impact (negative and positive) on the environment. This should involve the use of maps, site plans, aerial photographs and other graphic aids and images, as appropriate, and include information on location, general layout and size, as well as pre-construction, construction, and post construction plans. For projects to be done on a phased basis it is expected that all phases be clearly defined the relevant time schedules provided and phased maps, diagrams and appropriate visual aids be included.

#### Task #2: Description of the Environment

This task involves the generation of baseline data which is used to describe the study area in terms of the physical environment, biological environment and socio-economic and cultural constraints. Methodologies employed to obtain baseline and other data be clearly detailed. Baseline data should include:

#### (A) Physical Environment:

- i. A detailed description of the existing *geology* and *hydrology*. Special emphasis should be placed on *storm water run-off*, drainage patterns, effect on groundwater and availability of potable water. Any slope stability issues and ground conditions that could arise due earthquakes and other seismic conditions that could arise should be thoroughly explored.
- ii. *Water quality* of any existing wells, rivers, ponds, streams or coastal waters in the vicinity of the development. Quality Indicators should include but not necessarily be limited to nitrates, phosphates, fecal coliform, and suspended solids. The potential for pollution and/or contamination of sediment due to the lavish use of fertilizers in golf courses should be evaluated.
- iii. Climatic conditions and air quality in the area of influence including particulate emissions from stationary or mobile sources,  $NO_x$ ,  $SO_x$ , wind speed and direction, precipitation, relative humidity and ambient temperatures,

- iv. Noise levels of undeveloped site and the ambient noise in the area of influence
- v. Obvious sources of pollution existing and extent of contamination.
- vi. Availability of solid waste management facilities.

# (B) Biological Environment:

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

- i. Vegetation survey of riverine and coastal environment
- ii. Avifauna Survey of riverine and coastal areas
- iii. Wetland Survey
- iv. Rear, endangered or endemic species
- (C) Socio-economic & cultural:

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

i. Municipal resources available: electricity, water, sewage solid waste collection and disposal, roads, telephone, emergency response among others.

- Consultation with the Local Planning Authority (Parish Council, Health Department) and Survey community Concerns especially as it relates to disposal of sewage.
- iii. Regional land use and economic activities
- iv. Tourism demographics: stop over visitors, cruise ship arrivals
- v. Competing attractions

Task #3 - Legislative and Regulatory Considerations

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

These tasks will be grouped under the following categories:

- i. Development Controls
- ii. Environmental Protection
- iii. Health and safety

## Task #4 - Identification of Potential Impacts

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

- a) Change in drainage pattern
- b) Flooding potential
- c) Landscape impacts of excavation and construction
- d) Loss of natural features, habitats and species by construction and operation
- e) Pollution of potable, coastal, surface and ground water
- f) Air pollution

- g) Capacity and design parameters of proposed sewage treatment facility.
- h) Socio-economic and cultural impacts.
- i) Risk assessment
- j) Noise assessment

The EIA report will distinguish between significant positive and negative impacts, direct and indirect, long term and immediate impacts, cumulative, unavoidable or irreversible. Identify avoidable as well as irreversible impacts. Characterize the extent and quality of the available data, explaining significant information deficiencies and any uncertainties associated with the predictions of impacts. A major environmental issue is determined after examining the impact (positive and negative) on the environment and having the negative impact significantly outweigh the positive. It is also determined by the number and magnitude of mitigation strategies which need to be employed to reduce the risk(s) introduced to the environment. Reference will be drawn to the nearby developments and the carrying capacities

## Task #5 Mitigation

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

## Task #6 Monitoring

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

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

- a) Introduction outlining the need for a monitoring programme and the relevant specific provisions of the permit license(s) granted.
- b) The activity being monitored and the parameters chosen to effectively carry out the exercise.
- c) The methodology to be employed and the frequency of monitoring.
- d) The sites being monitored. These may in instances, be pre-determined by the local authority and should incorporate a control site where no impact from the development is expected.
- e) Frequency of reporting to NEPA
- f) The Monitoring report should also include, at minimum:
- g) Raw data collected. Tables and graphs are to be used where appropriate
- h) Discussion of results with respect to the development in progress, highlighting any parameter(s) which exceeds the expected standard(s).
- i) Recommendations
- j) Appendices of data and photographs if necessary.

## Task #7 - Project Alternatives

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

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

# **DESCRIPTION OF THE ENVIRONMENT**

## 2.0 DESCRIPTION OF THE ENVIRONMENT

## **2.1 Physical Environment**

## 2.1.1 Climate

The climate of the proposed site is typical to the rest of Jamaica, given its latitude of 18 degrees north of the equator, with a dry and wet season. The data was sourced from the National meteorological service.

## (1)Temperature:

Temperatures in coastal areas are comfortably warm, becoming cooler in the hilly and mountainous regions in the center of the island. Apart from rapid fluctuations associated with afternoon showers and/or the passage of frontal systems, the island's temperatures remain fairly constant throughout the year under the moderating influence of the warm waters of the Caribbean Sea. Mean maximum temperatures are highest between June and October of each year.

In coastal areas, daily temperatures average 26.2 degrees Celsius (79.2°F), with an average maximum of 30.3°C (86.5°F) and an average minimum of 22.0°C (71.6°F). Inland, temperature values are lower, depending on elevation but, regardless of elevation, the warmest months are June to August and the coolest December to February. The diurnal range of temperature is much greater than the annual range and exceeds 11.0°C or 20°F in mountainous areas of the interior. Night-time values range from 18.9 to 25.6°C (66 to 78.1°F) in coastal areas. At elevations above 610 meters (2000 feet), minimum temperature of the order of 10°C (50°F) have been reported occasionally when active cold fronts reach the island.

## (2) Relative Humidity:

Afternoon showers are the major cause of most daily variations in relative humidity. Highest values recorded during the cooler morning hours near dawn, followed by a decrease until the early afternoon when temperatures are highest. Although relative humidity in coastal areas average 84% at 7 a.m. temperatures at this time are in the mid 20's (°C), therefore, little or no discomfort results. At 1 p.m. the average relative humidity

on the coasts is 71% while values in the plains will average about 77% reflecting the effects of afternoon showers in the nearby hills

#### (3)Wind:

For most of the year, the daily wind pattern is dominated by the Northeast Trades. By day on the North Coast, the sea breeze combines with the Trades to give an east-northeasterly wind at an average speed of 15 knots (17 miles per hour), and along the South Coast, an east-southeasterly wind with an average speed of 18 knots (21 miles per hour). In the period December to March, however, the Trades are lowest and the local wind regime is a combination of trades, sea breeze, and a northerly or northwesterly component associated with cold fronts and high-pressure areas from the United States.

By night, the trades combine with land breezes which blow offshore down the slopes of the hills near the coasts. As a result, on the North Coast, nighttime winds generally have a southerly component with a mean speed of 5 knots (6 miles per hour) and on the South Coast, a northerly component with a mean speed of 7 knots (8 miles per hour). By day, from June to July, mean onshore winds often reach a maximum of up to 23 knots (26 miles per hour) along the North Coast and 26 knots (30 miles per hour) along the South Coast during mid-afternoon. However, winds are generally lighter inland and towards the west. Calms, therefore, attain their highest frequency in the western extremity of the land and in the two intervening periods between the full development of the land and sea breezes

## (4) Sunshine:

Variations of sunshine from month to month in any area are usually small, approximately one hour. Differences, however, are much greater between coastal and inland stations. Maximum day-length occurs in June when 13.2 hours of sunshine are possible and the minimum day-length occurs in December when 11.0 hours of sunshine are possible. However, the mean sunshine in mountainous areas is less than 6 hours per day, while in coastal areas it is near 8 hours per day. The shorter duration in the hilly areas is caused mainly by the persistence of clouds

#### (5) Rainfall:

Of the weather parameters, rainfall is the most variable. Island wide, during the period 1951 to 1980, annual rainfall ranged from a maximum of 2593 millimeters (102.09 inches) in 1963 to a minimum of 1324 millimeters (52.13 inches) in 1976 with an average of 1940 millimetres (76.38 inches) annually. The hundred-year (1881-1990) mean annual rainfall is 1895 millimetres (74.61 inches). Historically, the wettest year on record was 1933 with an annual rainfall of 2690 millimetres (116.54 inches) whilst the driest year was 1920 with an annual rainfall of 1299 millimetres (51.14 inches).

Some mountainous areas in the island's northeast receive more than 5080 millimetres (200 inches) annually, whilst coastal areas to the southeast and south-centre receive less than 889 millimetres (35 inches) annually. Yearly, most areas of the island have two distinct wet seasons, May to June and September to November; these wet seasons occur as regularly yearly cycles.

Most of the rainfall during the May to June period is as a result of the periodic march of solar radiation intensity, which peaks at that time. During the period September to November the rainfall is more directly the result of the lifting and movement of the sub-tropical high-pressure cell in the Atlantic Ocean. Such behaviour deepens the easterly Trades, allowing instability zones to develop; as such, a significant portion of the rainfall during this period is produced by upper- and low-level troughs, tropical waves, tropical depressions, tropical storms and hurricanes. The driest period is usually December to March. Most of the rainfall during this period is associated with cold fronts migrating from North America. Whether during the dry or rainy season, however, other rain-producing systems are influenced by the sea breeze and orographic effects which tend to produce short-duration showers, mainly during mid-afternoon.



Figure: 2.1 Rainfall distributions (mm) by Parish 1951-1980)

Rainfall Distribution (MM) by Parishes (1951-1980)

Figure: 2.2 Annual Rainfall Values (mm) for the Island of Jamaica



Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Island

0



Figure: 2.3 Annual Rainfall values for the Parish of Trelawny

# 2.1.2 Topography:

The site is relatively flat throughout with elevations of between 4 and 6 meters above sea level, giving an almost uniform slope. The slope is broken just south of the site by the parochial road leading from Hague to Martha Brae. From there the land rise from 45 meters until it reaches an elevation of 173 meters at Hague. In a wider context, this site is situated behind a very attractive coastline, which is positioned on a shallow reef. This reef system protects the coastline from erosion and coupled with the adjacent swamps provide ample protection from storm surges. The significant drainage feature on this is the Martha Brae River that flows to the west of the site.

## 2.1.3 Geology and Soils:

Rocks in the vicinity of the site date back to the Pleistocene and Miocene periods, the oldest being the dense chalk-like rocks of the Montpelier Formation, in the Florence hall and Holland areas. The Montpelier Formation is a member of the White Limestone Group. Rocks belonging to this group have a loose, soft, chalky matrix. It is inter-bedded with dark brown silt and clay material, which, along with weathered limestone fragments, comprise the thin, soft, soil observed onsite. Overlying top soils are generally clayey/loamy in texture. They include Fontabelle Clay and Bonnygate Stony Loam, which, respectively, have low and high potentials for soil erosion.



Figure 2.4: Regional Soils map for the Martha Theme Park & Environs

At the southern extremities of the site the rocks are exposed in several outcrops. These rocks are well exposed throughout this area with only a very thin layer of overlying soil in the order of 0.25 to 0.75 meters thick. This characterizes the type of vegetation that occupies the southern fringes of the site. On a wider scale and to the west and northern sections of the site, coastal formations made of alluvium, mangrove, elevated reefs and deposits also occur in the river valley. The lithological characteristics of this site are highly variable with significant changes over short distances. Generally, the limestone exposed on the southern section of the site is hard and massive with no major large scale structural features. For this small area, faults and joints characterize the areas of soluble limestone rock and this enables percolation of rainwater.

## 2.1.4 Hydrology:

Trelawny has the highest occurrence of ground water reserves in the western region of the island and this is found in the central east-west band, which extends to St. Ann. The Martha Brae in Trelawny flows underground and northwards for a part of its upper course. As one of the most powerful rivers in the island, the Martha Brae has an annual surface rate of flow of 429.4 x1  $0^6$  m<sup>3</sup>/year. The watershed covers a total area 622.2 km<sup>2</sup>, of (535.75 km<sup>2</sup> in Trelawny and 86.44 km<sup>2</sup> in St. James.

# Figure 2.5: MARTHA BRAE WATERSHED MAP



In this watershed basin limestone aquifer and aquicludes cover roughly equal portions of the basin. The aquifer covers the southern half of the basin with minor patches of basal aquiclude in the south-eastern and western parts. The northern half of the basin consists of limestone and alluvium aquicludes. The limestone aquifer is recharged by rainfall which amounts to approximately 1,696 mm annually and discharges into the Martha Brae River. There is practically no subsurface flow either into or out of the limestone. The watershed area that will functionally impact on this site comprises the following characteristics, as calculated for the Martha Brae Truss and Rock Bridges.

# Watershed Data:

Drainage Area	30,190 hectares	
Length	31,000 meters	
Height	250 meters	
Average Slope	0.00806	
Land Use:		
Woodland	40%	
Trees and scrubs	25%	
Plantation	14%	
Sugar Cane	6%	
Mixed Cultivation	8%	
Pasture	7%	
Twenty Four Hour (24 H) Rainfall Depth:		
Return Period	Depth	

Table 2.1Data describing the condition of the Watershed

Return Period	Depth
100 Year	302 mm
50 Year	271 mm
25 Year	238 mm
10 Year	168 mm
5 Year	117 mm

Peak Discharge:

<b>Return Period</b>	Jamaica 2 Method	Index Flood method
100 Year	2142.6 m <sup>3</sup> /s	206.6 m <sup>3</sup> /s
50 Year	1877.1 m <sup>3</sup> /s	175.2 m <sup>3</sup> /s
25 Year	1592.2 m <sup>3</sup> /s	146.6 m <sup>3</sup> /s
10 Year	618.1 m <sup>3</sup> /s	92.8 m <sup>3</sup> /s
5 Year	320.9 m <sup>3</sup> /s	65.7 m <sup>3</sup> /s

#### 2.1.4.1 Flooding:

There has not been any flooding experienced at the theme Park site. While it is close to the Martha Brae River, flooding events are subjected to the area immediate to the River Bank. During Hurricane Ivan, Dennis and Wilma, only areas within 50 meters of the river were temporarily inundated. The new bridge immediately south of the site provides an excellent guide post to deal with potential flooding events. However, periodic flooding is a serious challenge in communities of "Mangrove", Holland and Zion just south west of Falmouth. From time to time, there are reported cases of minor flooding in the lower market street of Falmouth, due mainly to poor maintenance of existing drains. The wetlands surrounding this site are connected to the sea by a series of canals, with the major canal known as the "drag line". The Dragline was constructed in the early 1950's to allow water to flow from sea to the wetlands, because road building and housing construction has disrupted the natural flow. There is a small pond located in the southeastern corner of the site and appears receive storm water generated on the site. Some amount of groundwater. This site also depicts discharge of groundwater in a similar manner to the salt Marsh system, 4 km west of the site. No flooding is expected at the site as no major drainage system traverses it.

## 2.1.5 Water Quality Analysis

Water quality analyses were made of samples taken at three locations along the Martha Brae River to assess the baseline water quality conditions. The stations were selected based on their locations relative to the proposed location of the theme park facilities. The stations are shown in the figure 2.6 below.

Figure 2.6: Water Quality Sample Stations



## 2.1.5.1 Nitrogen

Nitrogen is one of the most abundant elements. About 80 percent of the air we breathe is nitrogen. It is found in the cells of all living things and is a major component of proteins. Inorganic nitrogen may exist in the Free State as a gas  $N_2$ , or as nitrate NO<sub>3</sub>-, nitrite NO<sub>2</sub>-, or ammonia NH<sub>3</sub>+. Organic nitrogen is found in proteins and is continually recycled by plants and animals. Nitrogen-containing compounds act as nutrients in streams and rivers. Nitrate reactions [NO<sub>3</sub>-] in fresh water can cause oxygen depletion. Thus, aquatic organisms depending on the supply of oxygen in the stream will die. The major routes of entry of nitrogen into bodies of water are municipal and industrial wastewater, septic tanks, feed lot discharges, animal wastes (including birds and fish) and discharges from car exhausts. Bacteria in water quickly convert nitrites [NO<sub>2</sub>-] to nitrates [NO<sub>3</sub>-].

In general the levels of nitrates present in the samples were relatively low for all stations sampled. This may be an indication of the drought that was being experienced in the area. Historical data obtained at the bridge show that there can be fluctuations during
heavy rainfall. The project is not expected to contribute any additional nitrate to the river system.



Figure 2.7: Nitrate Values for Stations on Martha Brae River

## 2.1.5.2 Dissolved Oxygen

Dissolved oxygen analysis measures the amount of gaseous oxygen ( $O_2$ ) dissolved in an aqueous solution. Oxygen gets into water by diffusion from the surrounding air, by aeration (rapid movement), and as a waste product of photosynthesis. Total dissolved gas concentrations in water should not exceed 110 percent. Concentrations above this level can be harmful to aquatic life. Fish in waters containing excessive dissolved gases may suffer from "gas bubble disease"; however, this is a very rare occurrence. Adequate dissolved oxygen is necessary for good water quality. Oxygen is a necessary element to all forms of life. Natural stream purification processes require adequate oxygen levels in order to provide for aerobic life forms. As dissolved oxygen levels in water drop below 5.0 mg/l, aquatic life is put under stress. Oxygen levels that remain below 1-2 mg/l for a few hours can result in large fish kills.

Figure 2.8: Dissolved Oxygen for Points along the Martha Brae River



The lower the concentration of dissolved  $O_2$ , the greater the stress levels experienced by aquatic organisms. The management of waste at the theme park will be critical to the maintenance of ambient level of dissolved Oxygen in the river. *The values as outlined in Figure 14 show that Dissolved Oxygen is Normal for that site*.

# 2.1.5.3 Temperature

Human activities should not change water temperatures beyond natural seasonal fluctuations. To do so could disrupt aquatic ecosystems. Good temperatures are dependent on the type of stream you are monitoring. Lowland streams, known as "warm water" streams, are different from mountain or spring fed streams that are normally cool. In a warm water stream temperatures should not exceed 31 degrees Celsius because high temperatures reduce available oxygen in the water. *The data presented in figure 15 of between 22 – 23.5oC is consistent with river water*.

Figure 2.9: Temperature Reading at the Site



# <u>2.1.5.4 pH</u>

The pH value is a measure of the acidic or basic (alkaline) nature of a solution. The concentration of the hydrogen ion  $[H^+]$  activity in a solution determines the pH. Mathematically this is expressed as:  $pH = -\log [H^+]$ . The pH value is the negative power to which 10 must be raised to equal the hydrogen ion concentration. A pH range of 6.0 to 9.0 appears to provide protection for the life of freshwater fish and bottom dwelling invertebrates.

Figure 2.10: pH Measurements



The most significant environmental impact of pH involves synergistic effects. Synergy involves the combination of two or more substances which produce effects greater than their sum. This process is important in surface waters. Runoff from agricultural, domestic, and industrial areas may contain iron, aluminum, ammonia, mercury or other elements. The pH of the water will determine the toxic effects, if any, of these substances. For example, 4 mg/l of iron would not present a toxic effect at a pH of 4.8. However, as little as 0.9 mg/l of iron at a pH of 5.5 can cause fish to die. *The values obtained at this site falls within the normal average stated above*.

## 2.1.5.5 Coliform (Bacteria)

Total coliform bacteria are a collection of relatively harmless microorganisms that live in large numbers in the intestines of man and warm- and cold-blooded animals. They aid in the digestion of food. A specific subgroup of this collection is the fecal coliform bacteria, the most common member being Escherichia coli. These organisms may be separated from the total coliform group by their ability to grow at elevated temperatures and are associated only with the fecal material of warm-blooded animals.

Figure 2.11: Total and Fecal Coliform Measurements for the site



The presence of fecal coliform bacteria in aquatic environments indicates that the water has been contaminated with the fecal material of man or other animals. At the time this occurred, the source water may have been contaminated by pathogens or disease producing bacteria or viruses which can also exist in fecal material. Some waterborne pathogenic diseases include typhoid fever, viral and bacterial gastroenteritis and hepatitis A. The presence of fecal contamination is an indicator that a potential health risk exists for individuals exposed to this water. Fecal coliform bacteria may occur in ambient water as a result of the overflow of domestic sewage or non-point sources of human and animal waste. *Historical data from the bridge site has shown that coliform values are elevated during rainy months. The values recorded and displayed in figure 17, are consistent with dry season condition.* 

## 2.1.5.6 Phosphorus

Phosphorus is one of the key elements necessary for growth of plants and animals. Phosphorus in elemental form is very toxic and is subject to bioaccumulation. Phosphates ( $PO_4$ ) are formed from this element. Phosphates exist in three forms: orthophosphate, metaphosphate (or polyphosphate) and organically bound phosphate. Each compound contains phosphorous in a different chemical formula. Ortho forms are produced by natural processes and are found in sewage. Poly forms are used for treating boiler waters and in detergents. In water, they change into the ortho form. Organic phosphates are important in nature. Their occurrence may result from the breakdown of organic pesticides which contain phosphates. They may exist in solution, as particles, loose fragments, or in the bodies of aquatic organisms.

Figure 2.12: Phosphate values for Martha Brae River



Rainfall can cause varying amounts of phosphates to wash from farm soils into nearby waterways. Phosphate will stimulate the growth of plankton and aquatic plants which provide food for fish. This increased growth may cause an increase in the fish population and improve the overall water quality. However, if an excess of phosphate enters the waterway; algae and aquatic plants will grow wildly, choke up the waterway and use up large amounts of oxygen. This condition is known as eutrophication or over-fertilization of receiving waters. The rapid growth of aquatic vegetation can cause the death and decay of vegetation and aquatic life because of the decrease in dissolved oxygen levels. *The values indicated in figure 18 are consistent with historical data for the site, which is characterized by low phosphate values*.

#### 2.1.5.7 Biochemical Oxygen Demand

Biochemical Oxygen Demand, or BOD, is a measure of the quantity of oxygen consumed by microorganisms during the decomposition of organic matter. BOD is the most commonly used parameter for determining the oxygen demand on the receiving water of a municipal or industrial discharge. BOD can also be used to evaluate the efficiency of treatment processes, and is an indirect measure of biodegradable organic compounds in water. Imagine a leaf falling into a stream. The leaf, which is composed of organic matter, is readily degraded by a variety of microorganisms inhabiting the stream. Aerobic (oxygen requiring) bacteria and fungi use oxygen as they break down the components of the leaf into simpler, more stable end products such as carbon dioxide, water, phosphate and nitrate. As oxygen is consumed by the organisms, the level of dissolved oxygen in the stream begins to decrease Water can hold only a limited supply of dissolved oxygen and it comes from only two sources- diffusion from the atmosphere at the air/water interface, and as a byproduct of photosynthesis.

If elevated levels of BOD lower the concentration of dissolved oxygen in a water body, there is a potential for profound effects on the water body itself, and the resident aquatic life. When the dissolved oxygen concentration falls below 5 milligrams per liter (mg/l), species intolerant of low oxygen levels become stressed. Eventually, species sensitive to low dissolved oxygen levels are replaced by species that are more tolerant of adverse conditions, significantly reducing the diversity of aquatic life in a given body of water. If dissolved oxygen levels fall below 2 mg/l for more than even a few hours, fish kills can result.

Figure 2.13: Biochemical Oxygen Demand



Historically, BOD for this site range from a low of 1 mg/L during the dryer months to 20 mg/L during the wet months. The values in Figure 19 are consistent with the dry months when sampling took place.

## 2.1.5.8 Total Suspended Solids

Total suspended solids (TSS) include all particles suspended in water which will not pass through a filter. Suspended solids are present in sanitary wastewater and many types of industrial wastewater. There are also non-point sources of suspended solids, such as soil erosion from agricultural and construction sites.

As levels of TSS increase, a water body begins to lose its ability to support a diversity of aquatic life. Suspended solids absorb heat from sunlight, which increases water temperature and subsequently decreases levels of dissolved oxygen (warmer water holds less oxygen than cooler water). Some cold water species, such as trout and stoneflies, are especially sensitive to changes in dissolved oxygen. Photosynthesis also decreases, since less light penetrates the water. As less oxygen is produced by plants and algae, there is a further drop in dissolved oxygen levels.

For point sources, adequate treatment is necessary to insure that suspended solids are not present at levels of concern in waters of the state. Treatment typically consists of settling prior to discharge of the wastewater. Settling allows solids to sink to the bottom, where they can be removed. Some types of wastewaters, such as non-contact cooling water, are naturally low in suspended solids and do not require treatment.





For non-point sources, control measures should be implemented to reduce loadings of suspended solids to streams, rivers and lakes. For construction sites, controls such as silt fences and sedimentation basins are designed to prevent eroding soils from reaching surface waters. Most people consider water with a TSS concentration less than 20 mg/l to be clear. Water with TSS levels between 40 and 80 mg/l tends to appear cloudy, while water with concentrations over 150 mg/l usually appears dirty. The nature of the particles that comprise the suspended solids may cause these numbers to vary. *The values obtained for the site in Figure 20 are indicative of clear water and given the extended period of dry weather, the values are consistent with historical data.* 

## 2.1.5.9 Turbidity

Turbidity refers to how clear the water is. The greater the amount of total suspended solids (TSS) in the water, the murkier it appears and the higher the measured <u>turbidity</u>. The major source of turbidity in the open water zone of most lakes is typically <u>phytoplankton</u>, but closer to shore, particulates may also be clays and silts from <u>shoreline</u> erosion. Dredging operations, channelization, increased <u>flow rates</u>, floods, or even too many bottom-feeding fish (such as carp) may stir up bottom sediments and increase the cloudiness of the water.



Figure 2.15: Turbidity

High concentrations of particulate matter can modify light penetration, cause shallow lakes and bays to fill in faster, and smother <u>benthic</u> habitats - impacting both organisms and eggs. As particles of silt, clay, and other organic materials settle to the bottom, they can suffocate newly hatched larvae and fill in spaces between rocks which could have been used by aquatic organisms as habitat. If light penetration is reduced significantly, macrophyte growth may be decreased which would in turn impact the organisms dependent upon them for food and cover. *The values obtained were within the NEPA guidelines and given the prolonged drought and limited discharges into the river, turbidity was low.* 

#### 2.1.6 Noise Assessment

Noise interferes with the perception of wanted sound and is likely to be physiologically harmful. Sound is usually applied to a form of energy that produces a sensation perceived by the sense of hearing in humans, while vibration is a "non audible" phenomena that is recognized by touch or feeling. Sound levels are measured by a logarithmic function of acoustic pressure as decibels (dB). Audible ranges of acoustic pressure are expressed as dB (A). Calm environments normally correspond to sound of 30 to 50 dB (A). Beyond 70 dB (A), sound becomes disruptive. Exposure to disruptive noise levels can affect human welfare both physiologically and psychologically. This exposure can be a source of annoyance, and may create communication problems leading to elevated stress levels. It may also be associated with behavioral and health effects. In addition, it may cause fatigue, temporary and permanent lessening of hearing acuity, sleep disorders and even contribute to learning disability in children. Vibrations from vehicular noise can have detrimental effects on structures in proximity to a construction site.

Noise level readings were taken by using an EXTECH 407735 Sound Level Meter. The meter was turned on and the response was set to slow, the weighting to A and the range to Low. The calibrator was turned on for approximately 10 seconds to allow it to stabilize. The decibel range (dB) was set at 94dB and the adjusting screw adjusted until the meter reads 94 dB. The meters were calibrated each time they were turned off. If at the time of calibration the meter reading did not register 94dB, then the potentiometer (small hole with a screw on the left side of the meter) was adjusted. A wind screen (sponge) was placed over the microphone to prevent measurement errors due to noise caused by wind blowing across the microphone. Records of the high and low dBA readings and the constant noise level at all stations indicated in the figure were recorded.

Figure 2.16: Noise Assessment Sample sites



Figure 2.17: Noise Readings for the Martha Brae Site



There are no activities at or near the site, as the construction of the Martha Brae Bridge has been completed. Only vehicle generated noises, which in most case s are short lived,

can create nuisance at the site. There are no communities near the site except the newly constructed Primary School on the other site of the Highway. Care should be taken to reduce noise that will be generated during the construction of the facilities. The use of heavy equipment will be monitored very closely to ensure that, there is no disruption during the school session.

# 2.1.7 Air Quality Assessment

Ambient air quality reading sites were taken at the 3 locations where activities are likely to generate fugitive dust and where background baseline data will be important, using a portable Casella Cel MICRODUST PRO which provides assessment of real-time particulate concentration in mg/m<sup>3</sup>. The instrument provides graphical representation of concentration as well as point readings. The instrument was calibrated for measurements between 0-25 mg/m<sup>3</sup> the factory default setting. The instrument therefore measures respirable particulate concentrations (PM<sub>10</sub>), particles less then 10  $\mu$ m size. The sites were mapped using GPS and overplayed on topographical map as shown in the figure below.

Figure 2.18: Air Quality Sample Sites



Figure 1.19: Air Quality Measurements



The air quality data indicated in figure 21 will form the baseline levels that will be used in the monitoring during the execution of the project. These values are within the NEPA/OSHA guideline for Occupational Health and Safety during the construction phases of projects. The operation of the rides will be guided by the Industry standards for theme and amusement parks.

## 2.1.8 Natural Hazards & Risks

The site is susceptible to three main hazards: hurricanes, earthquakes and flooding, like the rest of Jamaica. However, the site is approximately 2 km inland from the coast and appears to be well sheltered from hurricanes and storm surge. No major faults are known to occur in the vicinity. The area lies within an earthquake zone which has experienced only 3 events of intensity greater than VI (modified Mercalli) in the period 1878-1978. No major flooding has been reported within the immediate vicinity save and except for the regular overtopping of the banks near the two Martha Brae truss and new highway bridges, and the land surrounding the latter has a low flood risk potential. Evidence of recent flooding has occurred in areas unsuitable for residential living, as these areas are recognized wetlands.

## 2.1.8.1 Hurricanes

The site is vulnerable to hurricanes and just like the rest of Jamaica, lies in the path of tropical weather systems that form in the Atlantic and Caribbean basin from June to November each year. These systems range in intensity from tropical waves to full blown hurricanes of varying strength. These tropical weather systems move westwardly through the Caribbean region. These weather systems generate intense sustained rainfall and elevated wind speed that is most intense when they develop into hurricanes. The low atmospheric pressures and high winds associated with hurricanes generate elevated sea levels and high energy waves referred to as storm surges. Hurricane pathway that are likely to affect the North coast of the island include those that track south of the island as well as those that make landfall on the south or east and travel across the length of the island. Others like hurricane Allen which track north of the island, can create significant damages. The Following figures give an indication of the most recent tropical cyclones that have impacted the island.

Figure: 2.20: Hurricane Charley (1951)



Figure 2.21: Hurricane Allen (1980)



Figure 2.22: Hurricane Gilbert (1988)



Figure 2.23: Tropical Storm Charley (2004)



Figure 2.24: Hurricane Ivan (2004)



Figure 2.25: Tropical Cyclones (2004)



(Source: National Hurricane Center)

## 2.1.8.2 Earthquakes

Jamaica lies in a seismically active area close to the northern boundary of the Caribbean tectonic plate and is therefore susceptible to earthquakes. The island has experienced destructive earthquakes generated offshore and on land associated with active geological features. Probabilistic analysis of historic seismic activity in Jamaica has been carried out by Periera et al (1986) for earthquakes magnitude 6 or greater that have occurred throughout the island since 1899. The project site lies in an area of relatively low activity but is still susceptible to damaging ground shaking from earthquakes with historical magnitudes 3.

Figure 2.26: Felt earthquakes in Jamaica 1880 to 1960, Modified Mercalli Intensity (MMI) VI or greater (after Shepherd and Aspinall, 1980). The two largest concentrations of felt reports are at Kingston and between Mandeville and Black River in western Jamaica. Both of these areas are coincident with some of the largest topographic features on the island, the Blue Mountains and the Santa Cruz/ Don Figuerero Mountains, respectively.



Figure 2.27: One hundred years of seismicity near Jamaica. The size of the circles is proportional to magnitude and solid black circles represent events with no magnitude reported. Earthquake locations prior to 1950 are less certain than more recent events and are shown as gray shaded circles. Large events have the year of occurrence listed.



Figure 2.28: Location of active on land fault zones and rate of slip (in parentheses, in mm/yr for 'best' and 'worst' case models) as used in to model ground shaking for Jamaica.



# 2.2.0 Biological Environment

# 2.2.1 Flora

The site is part of the Winns and Stoglons Morass through which the Martha Brae River passes. The site is degraded, sparsely populated and occupied mainly by invasive plant species. Several abandoned fish ponds are present in the area just east of the river. Species diversity is limited and intrusion for roads and other development characterizes the site. Only a few mature trees occupy the footprint of the site, the dominant cover is grass as depicted by the short list in Table 2.1.

Figure 2.29: South to North view of the site showing the typical vegetative Cover



Two species of Mangroves are the dominant types along the riverine zone, the White (*Laguncularia racemosa*) and the Button Mangrove (*Conocarpus erectus*). Also present in the area are the swamp ferns (*Achrostichum aureum, Typha domingenis*) and several species of herbaceous shrubs and climbers. In terms of percentage cover, these are the dominant species. The aggressive species, *achrostichum* has invaded the mangrove

territory, establishing itself as the dominant species in pure stands. There are also similar patches of *Typha*.



Figure 2.30: Typical Cluster of secondary vegetation on the site

Figure 2.31: Landscape dominated by grasses on the site with the Highway to the South







Figure 2.33: The invasive species, *Cladium jamaicense* (Saw Grass) converging on an abandoned fish pond.



Figure 2.34: The Martha Brae River showing well vegetated banks



Figure 2.35: Clusters of Acacia sp., the dominant vegetation on the site



Table 2.2: Plants found at the Martha Brae site

Scientific Name	Common Name
Typha domigenesis	Bulrush
Languncularia Recemosa	White mangrove
Cladium jamaicense	Saw Grass
Conocarpus erectus	Button mangrove
Rhizopora mangle	Red mangrove
Acacia farnesiana	-
Acacia tortuosa	-
Haemotoxylum campechianum	Logwood
Melicoccus bijugatus	Guinep
Tamarindus indica	Tamarind

# 2.2.2 Fauna:

An evaluation of the fauna associated with the Martha Brae River estuarine system was conducted on March 18 and 25 using 'point sampling' methodology, where bird species seen or heard within the location was documented. Data from a previous study by Webber et al 1998 was also used to complete the list indicated in Table 2.2.

The natural wildlife fauna of the area is composed mainly of birds. A number of freshwater birds were observed particularly in the water logged areas. These included Sand Pipers and Common Stilts feeding in the shallow waters. Other types of birds such as Herons were also observed. The few cluster of trees on the sites provided ideal nesting and feeding habitats for migratory birds. The avifauna is largely comprised of waterfowl and other species associated with coastal/wetland ecosystems. Several species of insects have been reported from the project area and are typical of marine areas and coastal systems. No endangered species were reported from a study by Webber et al (1998). A list of species identified from that 1998 study is given in the table 2 below.

# Table 2.3: List of Dominant Bird Species Identified in the wetland at and nearMartha Brae Theme Park Site.

Scientific Name	Common Name	Habitat	Range and Status
Caladris spp.	Sand Pipers	Several species common on mudflats and beaches, some uncommon winter visitors and transients	Several species throughout C. and S. America and the West Indies
Himantopus mexicanus	Common Stilts	Common resident in fresh and saline ponds	Bahamas, Greater Antilles, northern Lesser Antilles, N., C. and S. America. Large flocks of visitors and transients from N. America increase Jamaican populations in winter
Tachornis phoenicobia	Antillean Palm Swift	Lowlands, common near human habitations, over golf courses, dry swamps and cane fields	Very common resident
Loxipasser anoxanthus	Yellow- shouldered Grass quit	Common in hills and mountains	Locally common resident, An endemic genus and species
Tyrannus dominicensis	Gray Kingbird	Open wooded areas, cultivations and gardens	North America, Bahamas, West Indies and mainland coasts around the Caribbean
Columbina passerina	Common Ground Dove	Dry limestone forest edges and clearings, in the plains and foothills, but less common in the mountains	Very common and widespread resident. Jamaica. <i>C. jamaicensis</i> is an endemic subspecies.
Bubulcus ibis	Cattle Egret	Pastures and open areas	Very common resident. Worldwide
Egretta thula	Snowy Egret	Common resident in wetlands	N. America and the West Indies. Local populations are increased by migrants in the winter
Quiscalus niger	Greater Antillean Grackle	Cow pastures, cultivated land and around human habitations especially where they are fed.	Jamaica. <i>Q.n. crassinostris</i> is an endemic subspecies.
Vireo modestus	Jamaican Vireo	Bushy areas, forest edges and roadsides at all elevations	Very common. Jamaica. An endemic species
Columba leucocephala	Saffron Finch	Open grassy areas, gardens, from sea level to the mountains (except the highest). Often seen on roads, near cattle ponds at feeding stations and chicken farms	Common resident. S. America and introduced to the Hawaiian islands, panama, Puerto Rico and Jamaica
Coerebo flaveola	Bananaquit	Ubiquitous. Found wherever flowering plants occur	Abundant and widespread resident. Jamaica. <i>C.f. flaveola</i> is an endemic subspecies.

Scientific Name	Common Name	Habitat	Range and Status
Tringa flavipes	Lesser Yellow Legs	Beaches, Salinas or mudflats	Fairly common winter visitor. N. America wintering south to S. America
Dendrocygna arborea	West Indian Whistling duck	Mangrove swaps at Parottee, Black River Lower Morass, Negril morass, Falmouth Swamp, Salt Island lagoon.	Resident, probably locally common but extremely shy and rarely seen. Bahamas, G. Antilles and northern W.I. islands
Mimus Polyglottus	Northern Mocking Bird	Found in winter up to about 600 m, but goes to higher elevations in the summer	Very common resident. <i>M.p.</i> <i>Orpheus</i> Bahamas and G. Antilles, also N. America
Pelecanus occidentalis	Brown Pelican	In coastal waters, on reservoirs, fish farms and marshy areas	<i>P.o. occidentalis</i> West Indies. Also n, C and s America
Ardea herodias	Great Blue heron	Common winter visitor in wetlands, a few may spend the summer	N. America, wintering in W. I. and C. America south to northern S. America
Tyrannus dominicensis	Loggerhead Kingbird	Open wooded areas, cultivations and gardens	N. America, Bahamas, W. I. and mainland coasts around the Caribbean
Tiaris bicolor	Black faced Grassquit	Gardens and open situations	<i>T.b. marchii</i> Jamaica, Hispaniola and adjacent island. Other subspecies throughout the Caribbean except mainland Cuba

## 2.3 Socio-economic Environment

The project site as described above is within the Falmouth area and four other communities (Rock, Martha Brae, Coopers Pen and Hague). These have an impact or will be impacted by the development of the project. Community features and information considered relevant to the Project will be addressed in the report for each community. The information is grouped under the headings: Demographics, Land Use & Livelihoods, Developments Underway and Heritage. Where necessary, a comment is included. Issues pertinent to the Project, but shared in common with this part of Trelawny are dealt with separately under the headings Public Health & Safety, Water Consumption and Flooding. Surveys were conducted in the communities got get their perception on the project as well as to capture their concerns, perspective and response to the implementation of the project.

## **2.3.1** Communities in the Project Area:

The communities comprise a mix of both villages and rural towns, and include the important commercial and government agencies that operate in or close to them. These communities are:



Figure 2.36: The Martha Brae Theme Park and it environs

# 2.3.2 Coopers' Pen

Coopers Pen is a small coastal village located about 3 km east of the Project site. The community developed initially as an informal settlement, but has been regularized, in recent times. The impetus to its growth has been the Starfish Trelawny hotel, which occupies the coastline.

# (1) Demographics

From observation and information offered by residents, the population is about 500 with about 65% under the age of 40. The average size household is estimated at 6 persons and females are estimated to head 65% of households. The dependency ratio is likely to reflect that 6-7 persons out of every 10 are economically dependent on the rest. This would still be lower than the parish actual of 75%. The profile therefore, of Coopers Pen is of a relatively poor, lower income coastal community, with a high proportion of youth and female headed households. This demographic profile is generally representative of the coastal communities found in the Parish.

# (2) Land Use and Livelihoods

The main land use is residential. Land use density within the community is dominated by Starfish Resort, with both community residences and the much smaller fishing beach accounting for the remainder. Agricultural production is of minimal importance, though no clear sense of illicit drug cultivation emerged. A striking contrast is the co-existence of the hotel property and the surrounding sub standard residential housing. Coopers Pen itself comprises an older, sea-fronting section which includes a fishing beach and a newer unplanned community on land, edging the new north coast highway. Livelihoods inside the community come mainly from a mix of poorly constructed corner shops, entertainment venues and eateries. Unemployment and underemployment are reported as being very high.

Figure 2.37: Coopers Pen Community



The presence of the theme park was seen as an important source of income for the community, as tourism spending filtered down through souvenir & food vending, transportation. Lying west of the community is FDR Pebbles, operated by the FDR chain of hotels. This property comprises, 96 rooms, employs approximately 250 staff, mainly drawn from outside of the community because of the hospitality skills needed. Sixty five percent (65%) of the males interviewed welcomes the project and sees it as a great opportunity for the females to get a job, thus making the way of living much easier for the various householders.

## (3) Heritage

There are no special heritage features within the community. However there are in fact several interesting heritage sites in close proximity that, if enhanced, could be of benefit to the Project.

• At Spring Gardens Estate, just beyond the entrance to Retreat Heights, are preserved elements of an old sugar estate.

- A few miles beyond Spring Estate, are the remains of a once very imposing fortified great house known as Stewart Castle built around 1750. It is under the care of the National Heritage Trust.
- Further along, in the environs of Duncans, several points of historical interest await the visitor.

# 2.3.3 Rock

This unplanned community lies about four kilometers the East of the proposed development. Formerly an important port, it now supports a number of small and micro businesses, fishing beach, but is essentially a residential dormitory of Falmouth.

# (1) Demographics

The population is about 500 persons, although the STATIN data puts the 2001 population of the 3 Electoral Divisions containing the entire strip as well as Hague and Martha Brea at 1,600. The population profile is reported as being very similar to Coopers Pen, being relatively young, with a high percentage of females, and with the majority of households headed by females. It can be inferred that a similar dependency ratio as that of Coopers Pen, applies.

The assessment of land use, livelihoods, public health and safety, which follow, suggest that because of proximity, some positive benefits may arise from the Project as a result of both indirect income and direct employment generated. This however, is unlikely to translate into really consequential and sustainable development for this community unaided by much focused integrated planning between the developers and government agencies as suggested below. An indirect, but real threat that the Project poses for Rock, is the risk of outside settlers further burdening the inadequate housing and other social infrastructure in the community.

# (2) Land Use and Livelihoods

The main land use is residential although there is a small fishing beach, which also provides temporary berthing for pleasure boats. The community lies along the original main road, with a ramp up onto the North Coast Highway. Like Coopers Pen, the village comprises a mix of poorly presented shops, entertainment venues and eateries, but also including auto repair shops, barbering and hair dressing establishments.



Figure 2.38: The Rock Community

The fishing beach, which community memory puts at over 100 years of age, comprises a small sandy beach. About 10 fishing boats are berthed, several giving the appearance of being un-seaworthy. There are about 15 regular fishers. The Lagoon is said to contain Mullet, Shad, Grouper, Snapper and Jack. Fishing is regarded as an important part of the economy of the community. Residents estimated that about 60% of the community relied on fishing for some part of their income. Fishing, construction work and tourism were given as the main sources of livelihoods but unemployment and underemployment were reported as being very high.

## (3) Heritage

The beach contains traces of a little known historical landmark, the remnants of an old sugar wharf discernable on the beach. This dates back to the days when Rock was the port for the original parish capital of Trelawny, Martha Brae. Rock was originally settled by an American John Mitchell, who gave the name, 'Florida' to the coastal strip to the east. Associated with this period, is also a prominent stretch of old wall, which borders a guest house by the name of Taylor's Bodmint. The property also forms part of the land settled by Mitchell. The beach was also the departure point for Jason Whyte, a teenaged community member, who came to national prominence after drifting alone for days, after the death of his father on a fishing trip. Eventually rescued by a passing ship, Jason returned to a heroes welcome, and although no longer residing in Jamaica, remains both the subject of a book, and a national icon of heroism.

#### 2.3.4 Hague

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

#### (1) Demographics

The population of this community is about 600. The average size household is reported to be about 6 persons, and females are estimated to head 60% of households. Demographically, the profile of Hague is one of a relatively under serviced lower middle income community, with pockets of low income settlements.

Figure 2.39: The Hague Community



# (2) Land Use and Livelihoods

The main land use is residential. Land use density within the community is dominated by the large housing scheme mentioned above. Agricultural production appears to be of minimal importance to the community, though the large agricultural show ground is maintained. There are two important manufacturing entities located in the community. The largest is Windmill Garment Manufacturers & King Pepper Products a food processing establishment. However, employment in these companies is mainly drawn from the parish and not the community.

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

#### (3) Developments Underway

There is a current PRIDE project underway at Cave Island, above and to the eastern side of The Hague housing scheme. When completed it will provide just fewer than 400 serviced lots, which will be a great improvement over the existing. To date it has handed over 286 titles. It represents one initiative that will contribute to upgrading housing conditions in the wider Project area.

Of the five (5) communities Hague community members are comprised mainly of working class people, with a number of retired and returning residents. Members of this community value and welcome the prospect of this development, seeing it as contributing to the value of the real estates in and around the area. Residents viewed the development as one that will provide clean controlled fun for the entire family focusing mainly on the youths and the unemployed persons in and around the communities.

## 2.3.5 Martha Brae

Martha Brae is another dormitory residential community to Falmouth. It lies about 6 miles South West of the Project area. Once the north coast highway is completed, the traveling time between the Project area and Martha Brae will be under 5 minutes. The community is of historical importance, being the former capital town of Trelawny, and considered the site of a Spanish settlement called Melilla. It is one of the main gateways to southern Trelawny, an agriculturally and heritage endowed part of the Parish. The community itself is surprisingly compact and lacking in civil infrastructure, belying its well known name and historical associations.

#### (1) Demographics

The population of this community is about 1,000. The average size household is reported to be about 5 persons, and females are estimated to head 60% of households. The population is reported by members, to comprise mainly the middle aged and the very young. Young adults tend to leave the community for more developed urban centers.

Figure 2.40: The Martha Brae Community



# (2) Land Use and Livelihoods

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

The center of rafting activity lies just on the outskirts of the community. The main attraction is a 90 minute 3-mile raft ride on the Martha Brae, as it winds through the Martha Brae River valley on its way to the lagoon. Rafters Village, which is the starting point of the journey, is well appointed and spacious parkland, offering a variety of attractions to the visitor. The facility can accommodate up to 140 visitors on the river, at any one time. It is an important source of employment in this part of Trelawny,

providing income earning opportunities to about 35 raft captains and about as many supporting personnel.

The William Knibb Memorial High, Holland High and Hague Primary and infant Schools are located just within the community. They anticipate graduating about 20-30 students annually once the programme is underway.

## (3)Heritage

Access from the Project to several well known heritage sites and points of interest, will lie through Martha Brae. The community therefore has some potential for developing community based tourism attractions and vending opportunities to take advantage of its location. These sites include:

- The old town bridge across the Martha Brae River and the old Falmouth Company's disused Persian Wheel preserved beside it.
- Potosi with its crumbling sugar works and plantation relics.
- The ruins of the Retreat Great House and
- The sugar works of Hampstead Estate.
- The eighteenth century restored plantation house of Good Hope Property and it's many other well preserved estate buildings. Until recent times Good Hope was operated as a hotel.
- The Windsor Cave, about 10 miles from Martha Brae, is one of Jamaica's longest traversable cave systems (about 1.5 miles in length) and a once popular and much promoted visitor attraction.

Martha Brae should benefit from the Project, particularly as rafting should prove an important attraction to the theme park customers. It is a community of lower middle income occupational skills, so it could provide a source of clerical, administrative and technical skills to the Project.

Members of the community foresees this project as one that will bring forth many job opportunities to create or improve the standard of living within the community. Both skilled and unskilled members of the community questioned the possibility of being trained and becoming employed in this development. A point of concern with the project was that there will be an inflow of outsiders from different areas that will benefit from the project over the local residents.

#### 2.3.6 Falmouth

Falmouth is the parish capital, and as it's administrative and commercial center it will probably be the community most positively involved with the shaping and promotion of the Park.

#### (1) Demographics

The population of Falmouth was 8,188 at the time of the 2001 Census. Between 1991 and 2001 its population had grown by only 1.85 %. This compares with a 51 % change in the population of Ocho Rios over the same period and a 13% change in the population of Montego Bay. Growth in population, even allowing for the redefinition of some boundaries, must be viewed as relatively slow, when compared with Jamaica's overall rate of growth of 5%. It is likely that population growth will increase more rapidly as tourism development in the parish takes place, as has been the pattern elsewhere. Between 1991 and 2001 there has been a net loss of about 7,100 persons from the parish mainly to KMA, St. Catherine and St. James. This movement may also be slowed.

In two respects the demographic profile of Trelawny, underscores the uncertainty of Project employment benefits to the communities. Fifty one percent (51%) of the age 15 and over population is reported as having been exposed to some secondary level of education, the second lowest percentage among all parishes. Although overall demographic characteristics are unlikely to have a direct impact on any individual project, they do reinforce the data collected in the communities that point to high unemployment among youth, low levels of economic activity and low job skills. The
demographic data underscores the challenging social environment in which the Project will operate.



### Figure 2.41: The Falmouth Community

## (2) Land Use and Livelihoods

Land use in Falmouth is shared between commercial and residential activity. It is an important market center for produce distributed throughout the parish, and as earlier mentioned is the administrative capital of the parish. Employment covers the full spectrum of large town occupations. Tourism though present, is not the main source of its revenues, since most tourist traffic transits the town on the way to Ocho Rios or Montego Bay. With the completion of the Highway, which by-passes the town, this trend is likely to be intensified. The project is likely to draw on the pool of construction, domestic, administrative, technical and managerial resources that are associated with any large town of this size, if not for its full needs, certainly for some proportion of it.

The community of Falmouth being the parish capital and the heart beat of the parish sees it as a major asset to the parish. Such facility is seen as one that will help to reduce idle hands and reduce the possibilities of crime. The residents welcome the development and emphasize the need for a well coordinated development. Concerns are that there need to be some level of public awareness that will help the residents to appreciate the future and value of the future of their community, parish and long term country's standard of living.

#### 2.3.7 Public Health and Safety:

Garbage collection in all of the communities is undertaken regularly by National Solid Waste Management Authority. Hague Settlement reported that irregular scheduling led to frequent burning by residents. Sanitary conveniences are mainly a combination of pit latrines and flush toilets although none of the residents in the communities felt that human waste was entering the lagoon or sea via gullies or waterways. In Coopers Pen, for example, the juxtaposition of the squatter community which slopes towards the sea, and the degraded algae covered fringing reef as reported by the fishermen, suggests the impacts of nutrient loading of that bay.

In Rock where 100% of toilet facilities run to pits, the degraded wetlands bordering the area which might otherwise have offered some filtration, suggests that this may be all source of nutrient loading into the lagoon. There is only one sewage treatment plant in Falmouth, which was built to serve Falmouth Gardens (a housing scheme of about 150 units) but to which the hospital and food market have also been connected. The remainder of the town uses flush toilets. Again, because Falmouth itself is at sea level (some anecdotal reports place it below sea level), sewering the town is an urgent public health priority.

The nearest health facilities available to the communities are in Falmouth, where a Type C Hospital is located. Falmouth also has a Type 4 Health Clinic, which is considered adequate for serving the needs in this area. Falmouth has the only fire station in the parish but this station has only one unit. Fire services must be considered totally inadequate in the event of there being a significant occurrence, not to mention a multiple event. Considering Falmouth's heritage assets, this situation is deplorable. However, because of pending tourism and sports developments in the parish, plans are underway for a new

station in Falmouth. With respect to both police and postal services for the communities, these are centered in Falmouth. A potential health problem for the Project, or at least one that will pose a nuisance, is the mosquito population in the wetlands.

#### 2.3.8 Water Consumption

The communities are supplied water by NWC and in each community; the service is regarded as adequate. Most dwellings are reported to be metered. Trelawny is regarded as having more than adequate water resources. These resources exists in the Martha Brae River Basin, from which the parish satisfies its needs but also exports water.

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

In recognition of the tourism development that has taken place and is planned for the planned for the Parish. Treatment Plant # 1 at Martha Brae is to be refurbished to restore it to its designed capacity of 6M gallons per day, up from the roughly 4M gallons that it can treat currently. Upon completion, it is expected that the 3M gallons currently exported to St. James will continue, and the remaining 3M gallons will serve increased demand eastwards to Braco. Treatment Plant #2 is located just outside of Falmouth. Currently most of its water is exported to St. James.

#### 2.3.9 Electricity:

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

## 2.3.10 Telephone:

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

# **LEGISLATION**

Martha Brae Theme Park /EIA/Nov.2006

## **3.0 LEGISLATION:**

#### **3.1 Environmental Protection and Permitting**

#### 3.1.1 Natural Resources Conservation Authority (NRCA) Act

The NRCA Act is Jamaica's umbrella environmental law. The purpose of the Act is to provide for the management, conservation and protection of the natural resources of Jamaica.

The Act has established the Natural Resources Conservation Authority (NRCA), which has a number of powers including, inter alia:-

- \* Issuing of permits to persons responsible for undertaking any construction, enterprise or development of a prescribed category in a prescribed area
- \* Issuing licences for the discharge of trade or sewage effluent
- Requesting an Environmental Impact Assessment (EIA) from an applicant for a permit or the person responsible for undertaking any construction, enterprise or development
- \* Revocation or suspension of permits
- \* The Act also gave power of enforcement of the following environmental laws to the NRCA.

#### 3.1.2 Environmental Review and Permitting Process (1997)

The Environmental Permit and License System (P&L), introduced in 1997, is a mechanism to ensure that all developments in Jamaica meet required standards in order to minimize negative environmental impacts. The P&L System is administered by the National Environment and Planning Agency (NEPA), through the Applications Section (formerly the Permit and License Secretariat). Permits are required by persons undertaking new development which fall within a prescribed category. Under the NRCA

Act of 1991, the NRCA is authorized to issue, suspend and revoke permits and licences if facilities are not in compliance with the environmental standards and conditions of approval stipulated. An applicant for a Permit or License must complete an application form as well as a Project Information Form (PIF) for submission to the NRCA/NEPA.

The main objectives of the Permit and License System are to:

- \* To ensure compliance with sections 9 & 12 of the NRCA Act, which gives the NRCA the right to issue permits for new developments and request EIA studies as required.
- \* To ensure the environmental issues are considered at the planning stage.
- \* Monitor waste discharge to the environment
- \* To ensure compliance with existing standards
- \* To ensure that production of goods and services are done in an environmentally friendly way, and;
- \* To bring existing facilities into compliance with existing standards.

#### 3.1.3 Watershed Protection Act (1963)

The Watersheds Protection Act of 1963 provides for the designation of watersheds for conservation purposes to reduce soil erosion, ensure regular flow in rivers and streams, and to maintain optimum levels of groundwater. This Act has been incorporated into the NRCA Act of 1991. More recently, the Natural Resources Conservation Authority in collaboration with the Ministry of Lands and the Environment (previously the Ministry of Environment and Housing) has produced a Watershed Policy for Jamaica (NRCA/MOEH, 1999) to assist in the management of Jamaica's watersheds. Management of the watersheds is done under Watershed Management Units. There are a total of 26 Watershed Management Units for the island.

Likely Related Issues: Stream Bed modification, Minor River Training Works, Bank Protection works Encroachment on the river banks

### 3.1.4 Flood Water Control Act:

The Act designates specific persons who are given the responsibility to enter land I floodwater control area to:

- Survey, measure, alter or regulate watercourses, maintain or build tools required to undertake flood control works.
- Clean watercourse or banks of such and deposit where required.
- Construct, improve, repair or maintain flood water control works.

Likely Related Issues

River training works, Stream bed modification, Modifying water courses

### 3.1.5 The Endangered Species Act (1999)

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

Likely Related Issues: Fauna disturbance and removal, effects on habitat, barriers to movement, aquatic fauna, wildlife corridors and protection of sensitive areas

## 3.1.6 Water Resources Act (1995)

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

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

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

With regard to underground water, <u>Section 37</u> states that it is unlawful to allow this water to go to waste. However, if the underground water "interferes or threatens to interfere with the execution or operation of any underground works", it will not be unlawful to allow the water to go to waste in order to carry out the required works provided that there is no other reasonable method of disposing of the water. The Authority also has the power to determine the safe yield of aquifers (<u>Section 38</u>).

#### Likely Issues:

Water abstraction, construction works around or adjacent to water resources.

#### 3.1.7 Country Fires Act (1942)

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

Offences against this Act include:

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

Likely Issues: Burning of trash and other debris, Fire Management

## 3.1.8 Quarries Control Act (1983)

The Quarries Control Act of 1983 established the Quarries Advisory Committee, which advises the Minister on general policy relating to quarries as well as on applications for licenses. The Act provides for the establishment of quarry zones, and controls licensing and operations of all quarries. The Minister may on the recommendation of the Quarries Advisory Committee declare as a specified area any area, in which quarry zones are to be established and establish quarry zones within any such specified area. **Section 5** of the Act states that; a licence is required for establishing or operating a quarry though this requirement may be waived by the Minister, if the mineral to be extracted is less than 100 cubic meters. Application procedures are outlined in **Section 8**. The prescribed form is to be filed with the Minister along with the prescribed fee and relevant particulars. The applicant is also required to place a notice in a prominent place at the proposed site for a period of at least 21 days starting from the date on which it was filed.

*Likely Issues: Sourcing of construction material, mining materials from river bed, etc* 

#### 3.1.9 Air Quality Standards

The Federal Clean Air Acts, which came into force in the United States in 1990 established air quality standards for six pollutants: ozone ( $O_3$ ), carbon monoxide (CO), sulfur dioxide ( $SO_2$ ), nitrogen dioxide ( $NO_2$ ), respirable particulate matter ( $PM_{10}$ ) and lead (Pb). An allowable level for each of these pollutants has been set by the United States Environmental Protection Agency (US EPA) whose objective is to protect the public from exposure to dangerous levels. National standards, known as the National Ambient Air Quality Standards (NAAQS), were established and they were categorized into two groups. In one group, there are the primary standards, designed to protect the environment and limit property damage.

### Likely Issues:

Dust management, storing and stockpiling of construction material, burning of trash, exhaust fumes from equipment, emission of the atmosphere, land clearing

## 3,1,10 Noise Standards

Jamaica has a national noise guideline for environmental noise, which is similar to the World Health Organization guidelines, which is often used for benchmarking purposes.

*Likely Issues: Vehicular movement, pile driving, noise & vibrations* 

## 3.1.11 Water Quality Regulation NRCA Act (1990)

The NRCA has primary responsibility for control of pollution in Jamaica's environment, including pollution of water. National Standards exist for industrial and sewage discharge into rivers and streams. WHO Standards for drinking water are used and these are regulated by the National Water Commission. There are national standards for ambient water quality of riverine systems.

*Likely Issues: Erosion and sediment control, flood control, land clearing activities, earthworks* 

#### 3.1.12 The National Solid Waste Management Authority Act (2001)

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

#### Likely Issues:

Solid waste management and disposal, construction camps, equipment storage etc.

#### 3.1.13 Jamaica National Heritage Trust Act (1985)

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

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

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

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

Likely Issues: Cultural heritage, structures, siting of construction

## 3.1.15 Mining Act (1947)

It is the responsibility of the Commissioner of Mines to exercise general supervision over all prospecting and mining operations in the Island. **Section 8** of the Act identifies lands excluded from prospecting or mining. These include:

Land to be used for any public purpose (other than mining), for a burial ground or within 100 yards of such places;

- \* Any area located within any town or village;
- \* Land reserved for the purpose of a railway or situated within 100 yards of any railway (unless the railway is constructed by the mining lessee for use during operations);
- \* Any area, which is the site or is within 100 yards of any building, works, reservoir or dam or occupied by the Government or a public authority;
- \* Any street road or highway or any land within 50 yards of the center line of a street, road or highway other than one constructed on the mining lease by the mining lessee;
- \* Land within 100 yards of any building
- \* Prospecting may proceed in these areas only with the consent of the Commissioner, or in the case of a building, the consent of its occupier.

According to **Section 9** of the Act, the Minister may at any time, declare an area closed to prospecting and mining. This excludes any lands to which a lessee has rights under a licence or mining lease.

*Likely Issues: Sourcing of material for construction and backfilling* 

## 3.1.16 Biodiversity Convention

The objectives of the Convention on Biological Diversity are "the conservation of biological diversity, sustainable use of its components and the fair equitable sharing of the benefits arising out of the utilization of genetic resources". The Convention acknowledges that the "conservation of biological diversity is a common concern of humankind and an integral part of the development process". In order to achieve its goals, the signatories are required to:

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

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

## 3.1.17: The Public Health Act (1974)

This act falls under the ambit of the Ministry of Health (MOH) and governs all matters concerning the handling of food material. In addition, provisions are also made under this act for activities of the Environmental Health Unit (EHU), a division of the MOH. The primary function of this unit is the approval of waste water treatment systems, monitoring of waster water quality using standards published by NEPA.

Likely Issues: Design of sewage treatment system, Operation of waste water systems, discharge of effluent etc.

#### 3.1.18: Water Quality NRCA Act (1990)

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

Effluent Standards - Existing Plants								
Parameter	Effluent Standard							
BOD5	20 mg/l							
TSS	30 mg/l							
Nitrates (as Nitrogen)	30 mg/							
Phosphates	10 mg/l							
COD	100 mg/l							
pH	6-9							
Faecal Coliform	1000 MPN/100ml							
Residual Chlorine	1.5 mg/l							
Proposed Sewage Effluent Standa	rds – New Plants							
BOD5	20 mg/l							
TSS	20 mg/l							
Total Nitrogen	10 mg/l							
Phosphates	4 mg/l							
COD	100 mg/l							
рН	6-9							
Faecal Coliform	1000 MPN/100ml							

Effluent Standards - Existing Plants								
Parameter	Effluent Standard							
Residual Chlorine	1.5 mg/l							
Natural Resources Conservation Authority (NRCA) Interim Sewage Effluent Irrigation Standards								
Parameter	Standard Limit							
Oil & Grease	10 mg/L							
Total Suspended Solids (TSS)	15 mg/L							
Residual Chlorine	0.5 mg/L							
Biochemical Oxygen Demand (BOD)	15 mg/L							
Chemical Oxygen Demand (COD)	<100 mg/L							
Faecal Coliform	12 MPN/100mL							

#### **3.1.19 Trelawny Parish Council**

The Trelawny Parish Council has portfolio responsibility for the provision of public services such as public health, fire protection, street cleaning and maintenance of recreational areas such as parks and play fields. The parish council's portfolio of solid waste collection and management of public markets was taken over by Western Parks and Markets. The government has however; more recently established the National Solid Waste Agency, which will be given overall responsibility of managing national solid waste. It must be noted that one of the Parish Council's key responsibility is development control. This very important function serves to not just guide development but to shape and influence the pattern of development in any parish and or region. As a direct result development proposals have to be sent to the local parish council for development approval.

# **POTENTIAL IMPACTS**

### 4.0 **POTENTIAL IMPACTS:**

The development has the potential to create a wide range of impacts if it is implemented. The impacts can either be positive or negative, depending on the receptors involved and the parameters such as magnitude and duration. This project will no doubt have significant positive impacts on a number of areas such as, employment, foreign exchange earnings as well as providing opportunities for economic growth and community enhancement. The environmental impact matrix shown on Table 5 and the Impact analysis shown in Table 6, and outlines some of the potential impacts during the Construction and Operation phases of the project.

Several issues have been identified for the proposed development that must be taken into consideration at the design, construction and operation phases. These issues have been explored in light of the potential impacts of the project on the existing environment, as well as the environmental attributes and how they may affect the project. The main issues that have been identified are:

#	ISSUES	IMPACT
1	Drainage/Flooding	Pre and Post stormwater runoff
2	Liquid Waste Management	Approval and licencing of Sewage Treatment Facility
3	Air Quality	Construction phase dust
4	Water Quality	Surface and ground water
5	Water Quantity	Sustainable yield and long term availability of ground water resources
6	Geology	Erodibility, Soil stability
7	Hazardous Materials	Handling and storage
8	Hazard Vulnerability	Hurricanes, seismic activity, flooding
9	Ecology	Vegetation and Habitat loss
10	Demographics	Character of communities

Table 4.1 Potential Issues and Impact

#	ISSUES	IMPACT
11	Traffic	Egress and Ingress, North Coast Highway
12	Public Health and Safety	Cane field fires, agricultural pesticide use and water quality
13	Solid Waste Management	Removal of vegetative matter, removal of domestic waste and construction waste to an approved disposal site;

## Table 4.2: OVERALL ENVIRONMENTAL IMPACT IDENTIFICATION MATRIX

									Env	riror	nm	enta	al Fa	acto	rs										Eval	
ACTIVITIES AND	Air Water		l	anc	ł	Flo Fa	ora a auna	& a		Hu	mar	า Us	e		Quality of Life						Env. Risk					
ASSOCIATED POTENTIAL IMPACTS																										
<u>Key to Signs</u>																										
<ul> <li>x = Minor Negative Impact</li> <li>X = Major Negative impact</li> <li>o = Minor positive impact</li> <li>O = Major Positive Impact</li> <li>* Degree of environmental Risk in outcome</li> </ul>	Dust Level	Other Pollutant (C0 <sub>2</sub> , C0)	Surface Water Flows	Surface Water Quality	Ground Water Quality	Erosion & Siltation	Drainage Pattern	Slope Stability	Sensitive Habitat	Terrestrial Flora & Fauna	Aquatic Flora & Fauna	Infrastructure Service	Other Public Facilities	Agriculture & Forestry	Aquaculture & Fisheries	Recreation	Industry & Commerce	Social Stability/Cohesion	Public Safety	Environmental Health	Noise & Vibration	Cultural Heritage	Landscape Ouality	Non – significant	Minor	Significant
SITE PREPARATION & CONSTRUCTION																										
Vegetation Clearance	x			x			x			x	x										x				x	
Access Roads	х		х			х				х															x	
Equipment Operation		x																			x				x	
Traffic Flow alteration																			x		x				x	
Employment																	0	0						х		
Air Quality (Dust)	х																								x	
General Construction Works	x					x				x		0	0												x	
Material Sourcing																	0							x		
Material Transportation																	0							x		
Material Storage & Equipment																			x					x		
Spills			х	Х	X	х			х										х	х			х		x	
Water Demand																	0							x		
Waste water generation &				х	x														x					x		

	Environmental Factors									Eval																
ACTIVITIES AND		Air Water		I	_and	ł	Flo Fa	ora 8 auna	<b>&amp;</b> 1		Hu	mai	า Us	e		Quality of Life						Env. Risk		t		
ASSOCIATED POTENTIAL IMPACTS																										
<u>Key to Signs</u>																										
<ul> <li>x = Minor Negative Impact</li> <li>X = Major Negative impact</li> <li>o = Minor positive impact</li> <li>O = Major Positive Impact</li> <li>* Degree of environmental Risk in outcome</li> </ul>	Dust Level	Other Pollutant (C0 <sub>2</sub> , C0)	Surface Water Flows	Surface Water Quality	Ground Water Quality	Erosion & Siltation	Drainage Pattern	Slope Stability	Sensitive Habitat	Terrestrial Flora & Fauna	Aquatic Flora & Fauna	Infrastructure Service	Other Public Facilities	Agriculture & Forestry	Aquaculture & Fisheries	Recreation	Industry & Commerce	Social Stability/Cohesion	Public Safety	Environmental Health	Noise & Vibration	Cultural Heritage	I andscane Ouality	Non – significant	Minor	Significant
Disposal																										
Solid waste generation & Handling			x	х								x					0								x	
Landscaping	0	0	0	0	0	0	0									0	0	0	0	0	0	0	0			
Emergency Response												x												x		
Health & Safety												х												x		
Community Benefits																	0							x		
OPERATION																										
Natural Hazards												х	х			x			х						x	
Maintenance																			0	0	х			х		
Drainage			0	X							_													X		
Recreation											_						0	0				0		X		$\left  - \right $
Labour Demand	0	0	0	0	0	0	0	0			-						0	0							$\vdash$	
Employment								0								0	0		0	0						

Table 5: Potential Impacts and Mitigation Measures

#### **ACTIVITIES**

IMPACTS

#### **Site Preparation and Construction**

Land Soil erosion and siltation of watercourses could have a negative impact on the flow regime and Clearance and Vegetation water quality within the Martha Brae River Removal adjacent to the Theme Park construction site. This could lead to minor negative impacts such quality declined water and as water transparency, along with severe negative impacts such as flow impairment and localized upstream or downstream flooding (arising from the overtopping of the river banks). It is imperative, therefore, that proper sediment management practices are implemented during site clearance, site preparation and the construction phase of the project.

Under no circumstance will top soil, sand, marl, silt, cut vegetation be allowed to collect within the river to the extent that they impair surface water flow and provide the opportunity for overtopping and flooding. Silt screens will be used to control the movement on most of the work sites.

**MITIGATION** 

- Fine grained materials (sand, marl, etc.) will be stockpiled away from drainage channels and low berms will be placed around them or they will be covered with tarpaulin to prevent them from being eroded and washed away.
- Vegetation clearance, particularly on sections with grass, will be phased and cleared only as the need arises. This will help reduce the risk of soil erosion. Exposed areas will be revegetated and grassed as soon as possible after construction to reduce soil erosion and sediment runoff into the rivers and

ACTIVITIES	IMPACTS	MITIGATION
		<ul> <li>gullies. Installation of silt fences will required as part of the contract implementation.</li> <li>By design many mature trees on the site will be left intact, and by extension endemic terrestrial fauna. Species introduction should occur naturally and in other cases introduced carefully.</li> </ul>
Employment	Direct employment of tradesmen and laborers during the construction phase will no doubt be significant to the neighboring communities. The development will also spawn indirect employment throughout the surrounding areas and represents a positive direct and long-term benefit.	No mitigation is required.
Noise Pollution	Site clearance and construction of the proposed development necessitates the use of heavy equipment. These equipment include Front End loaders, backhoes, jackhammers etc.	<ol> <li>The use equipment that has low noise emissions as stated by the manufacturers is recommended.</li> <li>Use equipment that is properly fitted with noise reduction devices such as mufflers.</li> <li>Operate noise-generating equipment during regular working</li> </ol>

ACTIVITIES	IMPACTS	MITIGATION
		hours (e.g. 7 $am - 7 pm$ ) to reduce the potential of creating a
		noise nuisance during the night.
		4. Construction workers operating equipment that generates
		noise should be equipped with noise protection. It is
		recommended that workers operating equipment generating noise
		of $\geq 80$ dBA (decibels) continuously for 8 hours or more should
		use ear muffs. Workers experiencing prolonged noise levels 70 -
		80 dBA should wear earplugs.
Air Quality	Site preparation and construction has the	1. Access roads should be dampened every 4-6 hours or within
	potential to have a two-folded direct negative	reason to prevent a dust nuisance and on hotter days, this
	impact on air quality. The first impact is air	frequency should be increased.
	pollution generated from the construction	
	equipment and transportation. The second is	2. Minimize cleared areas to those that are needed to be used.
	from fugitive dust from cleared areas and raw	3. Cover or wet construction materials such as marl to prevent a
	materials stored on site. Fugitive dust has the	dust nuisance.
	potential to affect the health of construction	4. Where unavoidable, construction workers working in dusty
	workers, the resident population and the	areas should be provided and fitted with respirators.
	vegetation.	
Solid Waste	During this construction phase of the proposed	1. Skips and bins should be strategically placed within the

ACTIVITIES	IMPACTS	MITIGATION
Generation	project, solid waste generation may occur	campsite and construction site.
and Handling	mainly from two points:	2. The skips and bins at the construction campsite should be
		adequately designed and covered to prevent access by vermin and
	1. From the construction campsite.	minimize odor.
	2. From construction activities such as site	3. The skips and bins at the construction site should be
	clearance and excavation.	adequately covered to prevent a dust nuisance.
		4. The skips and bins at both the construction campsite and
		construction site should be emptied regularly to prevent
		overfilling.
		5. Disposal of the contents of the skips and bins should be done at
		an approved disposal site and by experienced persons/ private
		contractor.
		6. Minimize and reduce the quantities of solid waste during site
		preparation and construction. Where possible, branches and
		leaves should be put through a wood chipper to make soil cover
		for landscaping purposes.
Waste Water	With every construction site and campsite, there	1. Provide portable sanitary conveniences for the construction
Generation	is the need to provide construction workers with	workers for control of sewage waste. A ratio of approximately 25
and Disposal	showers and sanitary conveniences. The	workers per chemical toilet should be used.

ACTIVITIES	IMPACTS	MITIGATION
	disposal of the wastewater generated at the	
	construction campsite has the potential to have a	2. Provision should be made for proper sanitary conveniences
	minor negative impact on groundwater.	and showers or wash down areas for workers.
Storage of	Raw materials, for example sand and marl, used	1. Raw materials that generate dust should be covered or wet
Materials and	in the construction of the proposed development	frequently to prevent them from becoming air or waterborne.
Equipment	will be stored onsite. There will be a potential	2. Raw material should be placed on hardstands surrounded by
	for them to become air or waterborne. Stored	berms.
	fuels and the repair of construction equipment	3. Equipment should be stored on impermeable hard stands
	has the potential to leak hydraulic fuels, oils etc.	surrounded by berms to contain any accidental surface runoff.
		4. Bulk storage of fuels and oils should be in clearly marked
		containers (tanks/drums etc.) indicating the type and quantity
		being stored. In addition, these containers should be surrounded
		by berms to contain the volume being stored in case of accidental
		spillage.
Transportation	The transportation and use of heavy equipment	1. Adequate and appropriate road signs should be erected to
of Raw	and trucks is required during construction.	warn road users of the construction activities. For example
Materials,	Trucks will transport raw materials and heavy	reduced speed near the construction site.
equipment and	equipment. This has the potential to directly	2. Raw materials such as marl and sand should be adequately
Spoils	impact traffic flow along local roads and	covered within the trucks to prevent any escaping into the air and

ACTIVITIES	IMPACTS	MITIGATION
	especially at the entrance to the construction	along the roadway.
	site.	3. The trucks should be parked on the proposed site until they are
		off loaded.
		4. Heavy equipment should be transported early morning (12 am
		-5 am) with proper pilotage.
		5. The use of flagmen should be employed to regulate traffic flow
		when work is adjacent to or along heavy trafficked routes.
Emergency	Construction of the proposed theme park has the	1. A lead person should be identified and appointed to be
Response	potential for accidental injury. These maybe	responsible for emergencies occurring on the site. This person
	either minor or major accidents.	should be clearly identified to he construction workers.
		2. The Construction Management Team should have onsite first
		aid kits and arrange for a local nurse and/or doctor to be on call
		for the construction site.
		3. Make prior arrangements with local health care facilities such
		as health centers or the hospitals to accommodate any
		eventualities.
		4. Material Safety Data Sheets (MSDS) should be stored onsite.
Workers	Construction of this kind often entails workers	The provision of lifelines, personal safety nets or safety lanyards
Safety	being suspended in the construction process.	and scaffolding for the construction workers is recommended.

ACTIVITIES	IMPACTS	MITIGATION
	This has the potential for an increase in	
	construction accidents.	
Traffic	The construction of the theme park will	1. Place adequate and appropriate construction warning signs.
Management	necessitate the access and egress of construction	2. Provide flaggers in instances where there will be interferences
	traffic along the North Coast Highway. This	with regular traffic flow.
	will have some negative impact on safety of	
	regular traffic and may cause some amount of	
	delay.	
Community	Other than providing direct and indirect	No mitigation required, but constant dialogue to maintain good
Benefits	employment benefits outlined above, there will	community relations is recommended.
	be improvement in the infrastructure and	
	recreational offering of the community.	
<b>OPERATIONS</b>		
Natural	Natural hazards such as flooding, hurricane and	<b>1.</b> Ensure that the new structures can withstand hurricane and
Hazards	earthquake has the potential to impact	earthquake impacts.
	negatively on the structural integrity of the	2. Ensure that the new structures are designed to withstand a 50
	theme park facilities.	-100 year flood event.
		3. Inspections should be conducted at appropriate intervals by

ACTIVITIES	IMPACTS	MITIGATION
		qualified personnel to ensure integrity of structures.
		4. Develop an emergency response plan for the theme park.
Maintenance	Routine maintenance of the rides required to	1. The use of lead based paints should be prohibited. If this is
	ensure the integrity. This may entail sand	unavoidable care should be taken to prevent inhalation by the
	blasting, scraping, painting routinely.	persons applying the paint and to minimize the potential for the
		paint to enter the ecosystem.
		2. When sand blasting and scraping, collection mechanisms
		should be placed strategically to prevent the particulates from
		entering the waterways or getting airborne
		3. The load capacity of the rides should be calculated and signs
		placed instructing that these should not be exceeded at all.
Drainage ,	As is the case under the site preparation and	Engineering works will seek to keep to a minimum changes in
Flooding,	construction phases of the project, siltation of	surface flows of existing waterways. These designs will ensure
Sub-surface	watercourses could have a negative impact on	that post-project drainage systems can accommodate any
and Overland	the flow regime within the river/gully associated	increases in volumes of d surface water and without increasing
Drainage	with the in question.	risk of flooding.

#### **CUMULATIVE IMPACTS:**

#### **Change of Land Use**

Most of the area was originally under agriculture but based on the TPD plan (1997) Development Plan a large section is slated for residential and urban use. This development will be a part of this change in land use. This is not expected to be a negative impact as many of these lands have not been actively under agriculture and the need for attraction and economic activity in the area is large.

### Traffic

Traffic congestion on the Falmouth Bypass road is expected to increase significantly with in the vicinity of the site during construction and operation, as the vehicles from these houses will utilize this road. Properly engineered access and egress for the development should prevent congestion at the entrance/exit.

# **ALTERNATIVES**

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### 5.0 ANALYSIS OF ALTERNATIVES

The analysis of alternatives in Environmental Assessments considers practicable strategies that will promote the elimination of negative environmental impacts identified. This section is a requirement of the National Environment and Planning Agency (NEPA), and is critical in consideration of the ideal development with minimal environmental disturbance.

This report has identified the major environmental impacts, noted in section 4 and detailed the environmental management guidelines in section 5.

The following alternatives have been identified. They are discussed in further detail below:

- \* The "No-Action" Alternative
- \* The proposed Development as described in the report

#### 5.1 The "No-Action" Alternative

The "no action" alternative is required to ensure the consideration of the original environment without any development. This is necessary for the decision-makers in considering all possibilities.



The site in its present state is underutilized and is subjected to various abuses. The development will have a minimal effect on the physical environment. However, given the poor state of some sections of the site, solid waste issues, harvesting of mangroves and possible illegal settlement, there would be no positive change to the social and economic livelihood of the communities identified.

The site in its current state is subject to illegal dumping of solid waste, an action that will no doubt continue if there is no change in use or control.



Harvesting of Mangroves at the site has been taking place for a long time and with little of no control, the activity is likely to continue.



## 5.2 The Proposed Development as Described In the Report

The impacts and mitigation measures for this alternative has been discussed in section 5 of this report. This alternative will have minimal impact on the physical environment and

has considered the necessary measures to almost eliminate the identified issues of public health, safety and transportation (as outlined in section 5).

#### **5.3 Overview of Alternative Analysis**

Based on the above, the second alternative is the most preferred, given the importance of the new economic initiatives to the economic well being of the Falmouth and the country at large.

# **OUTLINE MONITORING PLAN**

#### 6.0 Outline Monitoring Plan

If a permit is granted for the proposed project, and before site preparation and construction activities begin, the developer should submit a Monitoring Programme to NEPA for approval, if required to do so. The aim of the Monitoring Programme is to ensure:

- 1. Compliance with relevant legislation
- 2. Implementation of the mitigation measures
- 3. Long-term minimization of negative environmental impacts.
- 4. Conformance with Specific conditions of the Environmental Permit

The Monitoring Program should include:

- 1. A Construction Plan and Schedule with a description of any proposed phasing of activities,
- 2. Recommended Mitigation Measures and proposed methods of compliance.

The Monitoring Programme should also include:

- 1. An Inspection Protocol;
- 2. Planned Supervision of Site Preparation and Construction Activities and implementation of Post Construction Monitoring.

During construction reports should be submitted to NEPA as well as a final summary report of the effectiveness of the mitigation measures. Parameters to be included in the Monitoring Programme should include, but not be limited to:

1. Air Quality

- 2. Water Quality,
- 3. Noise,
- 4. Solid Waste Management,
- 5. Conservation measures.

A detailed plan for the monitoring of the project is outlined in appendix
## **REFERENCES:**

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