



Plate 5.4.3: House in which the former caretaker of the property lived, now occupied by his family

5.4.4 Land-use and Zoning

The main land use is residential. The proposed site, is adjacent to houses from the existing subdivision, and is occupied by the old caretaker's house (Plate 5.4.3), a sewage pond, a National Water Commission (NWC) pumping station, fire hydrants, a Survey Department Trigonometric Station and an existing sewage treatment plant that was never commissioned. The remaining land area consists of abandoned pasture, overgrown trees and shrubs, and limestone forest to the north.



Plate 5.4.4: Trees and shrubs to the south of the property.

There is very little evidence of agricultural use on the existing property. However, the back yard of the former caretaker's house on the property has a small area for the cultivation of domestic crops.

With the proposed development the property will be transformed into a residential gated community providing commercial and social services to the existing Rhyne Park houses and the neighbouring communities. It will include 750 lots with houses and 136 service lots; which will be sold for the building of houses. A community recreational centre, commercial centre, basic school, sewage treatment plant and parks will be included in the layout of the property. The location of the new sewage treatment plant was approved by the relevant department at the National Environment and Planning Agency (NEPA), which stipulates a 30 metres set back from houses and roads.

5.4.5 Physical Infrastructure

The existing infrastructure on the property, including pipes, roads, electrical poles, fire hydrants and sewage treatment plant were installed to facilitate the subdivision that was

planned and started in 1994. These will all be removed and new infrastructure put in. Only the NWC pump house as shown in Plate 5.4.5 and the Survey Department Trigonometric Station will remain.



Plate 5.4.5: Existing NWC pump house.

5.4.5.1 Water Supply

Water supply to the existing subdivision is metered and supplied by the National Water Commission. It is sourced from the Martha Brae River System and is transmitted through the Success Pumping Station. Residents interviewed reported that water supply service received is good. However, they experience occasional water lock offs.

Table 5.4.5.1: Water Availability Martha Brae Basin MCM/Year.

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

Based on an analysis of the existing water system, there is an estimated current potential flow of 707 US gallons per minute. However, with the completion of Rhyne Park Village, an additional amount of 95 US gallons is required, increasing the maximum peak flow to 802 US gallons per million, which will be needed to sustain the property with regular water supply. The analyses and calculations for Rhyne Park Village are based on a population of 5000 (Westech Limited, 2005b).

In order to supply the increased water demand several modifications of the existing water supply will be required, including the addition of a pump and the installation at the Terminal Reservoir.

5.4.5.2 Sewage Treatment and Disposal

Existing sewage treatment facilities on the site include the use of a raw sewage pond, which receives sewage from the existing subdivision. A sewage treatment plant was built in the 90's and is still present on the site (Plate 5.4.5.2 a), but was never commissioned, as the 58 lots connected were under the capacity required to run the plant.



Plate 5.4.5.2 a: Existing sewage treatment plant that was never commissioned.

The raw sewage pond consists of two submerged chambers made of earthen material and is lined (Desmond Flowers Pers. Com.). Evidence of the lining was seen on the surface, as seen in Plate 5.4.5.2 b, this indicates a possible breach of the lining. Treatment of the sewage is by settling and natural aeration, and the effluent is currently discharged into a stream that ultimately enters the Boyce Gully. In order to facilitate the proposed Rhyne Park Village the pond will require draining, excavation and filling. The area will be incorporated into areas used for housing solutions.



Plate 5.4.5.2 b: Raw sewage pond with lining at the surface

A new sewage plant will be built at the initial stage of the development of the property. The existing subdivision and the new houses will be connected to the new sewage treatment plant.

The new sewage plant will be designed utilizing the Lakeside Electro/ Mechanical Equipment, for an average capacity of 0.346 millions litres of sewage per day. The proposed system will include an anaerobic inlet chamber with two anoxic chambers followed by two aeration basins and two clarifiers. A sludge digester and a bank of drying bed will also be included as part of the system, to allow for easier sludge

management during the operation of the plant (Appropriate Technologies Limited, January 2006). The plant will be designed to produce tertiary level treated effluent that will meet NEPA Irrigation Standards.

5.4.5.3 Solid Waste Management

Regular collection of solid waste from the existing subdivision is done by garbage trucks from Western Parks and Markets (WPM) Waste Management Limited, a subdivision of National Solid Waste Management Authority (NSWMA) in Montego Bay. Garbage is collected mostly on Sundays and is rarely collected in a skip.

The solid waste collected on the property is disposed of at the Retirement Landfill, which is currently being upgraded. The landfill currently receives an average of 300 tonnes of waste on a daily basis, serving the parishes of St. James, Trelawny, Hanover and Westmoreland.

5.4.5.4 Electricity and Telecommunications

The Jamaica Public Service Company (JPSCo.) supplies electricity to the existing subdivision and to the GMBA. The recent upgrade and improvements at the JPSCo. Bogue Plant have greatly enhanced power supply to the GMBA. It is anticipated that power supply will be adequate to meet the needs of the proposed development.

Telecommunications services are provided to the GMBA by all the service providers in Jamaica, and data transfer services are provided by the Montego Bay Digiport facility.

5.4.6 Traffic Pattern, Transportation and Access Roads

The main transportation corridor to the Rose Hall area is the Montego Bay to Ocho Rios main road. This is currently being upgraded as part of segment two of the Northern Coastal Highway Improvement Project (NCHIP). Improvements include development links that bypass the towns of Falmouth, Duncans and Rio Bueno, and will function as an improved transportation corridor. Entrance to the site of the proposed development lies approximately 1.5 miles from the Rose Hall main road, at an intersection opposite the

Wyndham Rose Hall main entrance. Currently the site is accessed via the Rose Hall main road (Plate 5.4.6a) and the existing entrance to the VMBS houses. (Plate 5.4.6a)



Plate 5.4.6 a: Access road to the project site, off the Rose Hall main road (view from the main entrance of Wyndham Rose Hall)



Plate 5.4.6.b: Existing entrance to VMBS houses

Montego Bay is the major transportation node for western Jamaica and the hub for Jamaica's national airline, Air Jamaica, and is the larger of two international airports serving the island. Ground transportation for the commuting non residential population, local residents and tourists is largely by privately owned taxis and mini buses. Larger mini buses and tour buses also transport passengers out of the city.

The airport was recently privatised under a development agreement and an expansion is currently taking place. Development plans are underway for the Montego Bay Freeport, which is a major transshipment container port, with cruise berths. The Freeport is associated with the Montego Bay Freezone, which is also expected to increase business enterprise. Road traffic east of Montego Bay associated with these operations is therefore expected to increase.

There are two existing access roads to the property, one on the western side and the other on the southern side of the property. However, only the southern entrance, which is via the existing VMBS houses, is currently accessible. The western entrance of the property (Plate 5.4.6 c) will be improved with the construction of a new road and a bridge at project inception in order to accommodate the flow of construction traffic initially, and residential traffic ultimately.



Plate 5.4.6 c: Western entrance to the property to be upgraded with a road and a new bridge

A traffic study (Nicholson, 2006 in Appendix XIII) was conducted to determine the impact the development could have on current and future operations of relevant roads in the area. The p.m. peak hour (5:00- 6:00 p.m.) is typically considered to be the critical hour in intersection performance analysis for this type of development and therefore be the period used for calculations. A 10-year growth rate of 3% per year was considered for analysis of the traffic demand on the roads. The Level of Service (LOS) is used to evaluate the conditions of the roads (Appendix XIII). LOS A is considered to be the highest level of service and LOS F to be the lowest.

The development proposed by Gore Developments Ltd. could impact two roads: the Spot Valley road and the Rose Hall main road, and no other roads were assessed.

Box 5.4.6: Current conditions of the Spot Valley Road*(Source: George Nicholson, February 2006)***Conditions of the Spot Valley Rd. are as follows:**

- **Driving surface- 3.5 m per lane**
- **Shoulders- 1m (varies)**
- **Road reservations – indeterminate**
- **Terrain- rolling**
- **20 % passing opportunities**
- **4 % heavy vehicles (buses and trucks)**

The current p.m. peak hour traffic flow on the development site road (Spot Valley Road) is 238 vehicles/hour in both directions; using a 3% growth rate in Year 2015 the traffic flow is expected to be 320 vehicles/hour. The LOS values for the 10-year planning horizon along the Spot Valley road are given in the table below.

Table 5.4.6 a: Level of Service (LOS) capacity of Spot Valley road (p.m. peak hour)

	2005		2015	
	<i>Vehicle/hr</i>	<i>LOS</i>	<i>Vehicle/hr</i>	<i>LOS</i>
No Development	238	B	320	B
Development*	n/a	n/a	400	B
Development +	n/a	n/a	416	C

(George Nicholson, January 2005)

* Assumes no growth in number of vehicles in the development during the study period

+ Assumes 3% growth occurs from year 4

Traffic surveys on the Rose Hall main road showed a current p.m. peak hour traffic flow of 520 vehicles/hour; using a 3% growth rate in Yr.2015 the traffic flow is expected to be 699 vehicles/hour. With development traffic in the design year; worst case loading

projected to add 462 vehicles/hour inclusive of existing traffic, total loading on the Rose Hall road would be 1162 vehicles/hour.

Table 5.4.6 b: Level of Service (LOS) along the Rose Hall main road (p.m. peak hour)

	2005		2015	
	<i>Vehicle/hr</i>	<i>LOS</i>	<i>Vehicle/hr</i>	<i>LOS</i>
No Development	520	B	699	D
Development	N/a		1162	A

(Source: George Nicholson, January 2005)

The National Works Agency (NWA) does not provide a standard per unit traffic demand for housing, but recommends that generally 1.75 parking spaces be provided for each dwelling unit in the development. However, given the type of development projected (low income); a more conservative figure of 0.9 parking space per unit will be used to reflect the expected income levels and to calculate the total vehicle ownership (George Nicholson, 2005).

The daily traffic generated by the development is estimated at 798 vehicles trips per day; peak hour traffic flow for the development would be 80 vehicles in Yr 2005.

5.4.7 Civic Amenities

There are no existing social services and amenities available on the property. However, residents from the existing VMBS subdivision utilize social services from Rose Hall area and the surrounding communities. Social services from the GMBA are also utilized.

A basic school and a commercial area will be built as a part of the new development proposed to take place, these will not only serve the Rhyne Park Village but also neighbouring communities. A community park area will also be constructed, for use by residents of Rhyne Park Village, and the existing VMBS homes.

5.4.8 Educational Facilities

Several educational institutions are located in nearby communities. These include Spot Valley Basic School, Barrett Town All Age School, Success Primary and Spot Valley High School (Plate 5.4.8). The Herbert Morrison Secondary School, the Montego Bay Community College, Cornwall College and Mt. Alvernia High School for girls, are also located in the Parish.



Plate 5.4.8: Spot Valley High School

5.4.9 Health Facilities

General health care facilities are limited in the Rose Hall area and in many cases are offered privately through hotels. A health clinic is located in Barrett Town. However, all major health facilities are located in the city of Montego Bay, including the Cornwall Regional Hospital, health clinics and a number of doctors' offices.

5.4.10 Fire Services

Fire services for the Rose Hall area and surrounding communities are available mainly from the Ironshore Fire station and in some cases the Falmouth Fire station. The Ironshore Fire station is the closest to the project area, and has one fire unit and an

ambulance. Fire hydrants will also be located at appropriate positions on the site. Information on the water supply system is given in Appendix VI.

Total fire flow as recommended by Kuichling for small districts (Westech Ltd. 2005 b), based on a population of 5000 is 1565.2 us gpm. It is the practice to moderate these recommended flows as suggested by the National Board of Fire Underwriters (USA) on the basis that construction in Jamaica has much less fire load as compared with the United States, therefore a local fire load of 50 percent that of the United States is recommended (Westech Ltd, 2005 b).

The terrain will allow the use of four fire streams each discharging 200 gallons per minute for a total flow of 800 us gpm. The worst case scenario for fire flow see four fire hydrants at the most remote points of the distribution system discharging simultaneously without any domestic demand. (Westech Limited, 2005 b).

5.4.11 Recreation

No formal recreational facilities are currently on the property, but a community football field has been established (Plate 5.4.11). This football field will have to be removed but the Rhyne Park Village will provide green space and recreational areas that will add to the aesthetics and recreational facilities of the property. Over 20 acres has been allocated for green space (both passive and active). This acreage meets the requirements of the Town Planning Department for the number of residential lots. The active green space includes a large central community park with a playground, jogging trail a football field and netball court.



Plate 5.4.11: Existing Football Field

Recreational facilities provided by GMBA can also supplement the recreational facilities on site. These include beaches, clubs, parks, and amusement centers.

5.4.12 Archaeological and Cultural Heritage

The property is on what was part to the Rose Hall lands and as such is on lands that are of significant archaeological and cultural importance. In the colonial days the land was under sugar cane cultivation. It should be noted that the property was previously cleared and subdivision infrastructure put in (roads, pipes, fire hydrants) in the early 1990's, and so the current development is not likely to result in unearthing of untouched artefacts. However, considering the archaeological and cultural heritage of the area, the Jamaica National Heritage Trust should be advised of the proposed development, and allowed the opportunity to conduct a Watching Brief, if required. The site is spatially a part of Rose

Hall, and is close to the legendary Rose Hall Great House of Annie Palmer, which is a JNHT listed site.

The JNHT was contacted by the EIA team (Appendix IV) in order to determine what information about the project site existed on their database.

The coastal plain area lying between Barrett Town and Flankers (traditionally and collectively lumped as Rose Hall) constituted an important settlement area for the Tainos. Little River, which enters the sea just beside Wyndham Rose Hall, has given its name to one of the three major Taino complexes identified in Jamaica. Furthermore several 'guts' that dissect the area on a south-north axis, may have once been perennial rivers and the presence of these fresh water sources would have greatly facilitated settlement.

Dianne Golding-Frankson, an expert on the Tainos, indicated in personal communication that the historian Frank Cundall's maps confirm that Rhyne Park was the area formally called Spotty Hill, which was located next to Spotty Valley which housed a taino petroglyphic cave. The adjoining hill was a midden / village site, (Golding- Frankson, Pers. Com., February 2006).

Community oral tradition, probed during community based interviewing for this project and for a recent Strategic Environmental Assessment for Rose Hall (May, 2004) confirmed the potential presence of this Taino cave and settlement area.

Communication with Jamaica National Heritage Trust, confirmed that their Sites and Monuments Record shows no monuments or listed sites on the property, but indicates that there are historic sites in the immediate vicinity of Rhyne Park, including plantation houses, burial grounds and enslaved villages.

5.4.13 Developments Underway

There are several major developments underway for the north coast from Montego Bay to Ocho Rios. The North Coast Highway Improvement Project (NCHiP) includes as Segment II upgrading of the main artery between Montego Bay and Ocho Rios. NCHiP is scheduled to begin work in the Rose Hall area in late 2006. With completion, it is expected that the highway will reduce the traveling time between the major town centres. This will in essence promote the growth of tourism and other business ventures along the corridor.

Other major developments include the Iberostar Rose Hall Resort and Spa, a three phase, three hundred room facility; the Palmyra Resorts and Spa, a condominium complex with a total of 1616 rooms; Harmony Cove a major hotel resort including hotels, villas, shopping village, condominiums and a marina and the Bahia Principe Hotel at Pear Tree Bottom. These developments are currently under construction and will play a major role in boosting the economic growth of the corridor and will enhance the existing tourism products within and the wider Jamaica.

5.4.14 Public Perception of the Project

Residents interviewed from the existing subdivision and neighbouring communities, were aware of the project and reported that Rhyne Park Village housing development is well needed in the community to provide housing solutions for the area.

In an interview with a gentleman from the existing subdivision, he commented that he sees the expansion to be well needed to provide housing, however he liked the fact that the existing VMBS housing complex is small and peaceful and is concerned as to whether the complex will remain peaceful after the expansion.

The provision of housing solutions is seen as a means to solve the problems associated with the emergence of informal settlements and crime that often accompany these. Residents reported that more planned residential housing developments are badly needed

in the area. A police officer at the Barrett Town Police Station reported '*I welcome these developments....; they are really needed in the area*' (Mr. Cummings Pers. Com).

Residents interviewed see the housing developments not only as a means of providing housing but also for providing employment opportunities, especially in the area of construction. A mechanic interviewed in Barrett Town who also works on construction site, reported '*Yes man, the development is a good thing..., I want to get a job on the site*'

6.0 Issues Identified, Potential Impacts and Mitigation Measures

6.1 Issues Identified

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:

Air Quality:	Construction phase dust
Water Quality:	Draining of sewage pond, Disposal of effluent, Disposal of sludge, Contamination of surface water
Geology:	Erodibility, Soil stability
Hydrology:	Sewage Pond Removal; Potential for offsite flooding; Capacity of detention ponds
Ecology:	Habitat loss and modification; Dry limestone forest
Solid Waste Management:	Removal of vegetative matter; Rocks and rubble; Existing infrastructure; Approved disposal site; Disposal of sludge
Liquid Waste Management:	Approval of STP; Connection of existing VMBS houses; Draining of existing sewage pond
Archaeological and Cultural Heritage:	Potential for Taino artifacts; Potential for Colonial artifacts

6.2 Potential Impacts and Mitigation Measures

6.2.1 Increased Turbidity & Reduced Drainage Capacity

Potential Impacts

Grading, earthworks and removal of vegetation will expose the slopes to soil erosion from impacting raindrops. This can lead to the development of first order streams or rills that can transport topsoil and erode the limestone marls. During construction improperly stockpiled earth materials can also be transmitted to the surface water drainage system,

thus impacting on turbidity, and drainage capacity. The use of heavy equipment on slopes and unpaved areas can also lead to a decline in soil stability. This will by extension impact on the marine environment. This is expected to be a major impact if not properly mitigated and should be short term during the construction phase.

Mitigation Measures

- Slope clearance should be phased with construction activities and bare soils should be re-vegetated as quickly as possible.
- Replanting the area with fast-growing trees that are already part of the ecology should be undertaken.
- The detention ponds should be used as silt traps in the construction phase.
- Stockpiled earth material need to be secured and covered against inadvertent removal by stormwater.
- Internal roads should be paved or consolidated and haulage trucks should carry loads not exceeding axel limits.
- All existing drainage lines should be kept open
- Siltation control devices should be deployed during the construction phase to minimize sediment loading t the water courses and the coastal waters.

6.2.2 Dust and Noise

Potential Impacts

Noise and dust nuisance related to construction will affect communities within 160 m. In particular the existing housing scheme on the southeastern side of the proposed development may be negatively impacted once the construction begins in zones 1 and 3. The 160 m zone is based on the physical property of sound whose energy is inversely proportional to the square of the distance. At a distance of approximately 160 m and starting from a noise level of 95 dB the sound level would have been reduced to 68 dB. The recommended WHO standard is 70 dB for daylight hours. This is expected to be a short term, reversible, minor impact.

Mitigation Measures

- Heavy equipment should enter through the designated main entrance at the western end of the development side and not through the existing VMBS housing subdivision.
- Vehicles should be properly maintained and the exhaust systems should be muffled as required.
- The movement of heavy equipment should be restricted to daytime hours or hours agreed to by the community.

6.2.3 Air Quality

Potential Impacts

During the construction phase air quality is expected to decline as a result of an increase in levels of fugitive dust from cleared land, stockpiled earth materials, dusty roads and gaseous emissions from vehicular exhaust. Respirable particulates are a public health hazard and may otherwise create considerable nuisances to the public.

This is expected to be a short-term, reversible impact. It may be considered a major impact for the existing VMBS houses, which are in close proximity to the site, but a minor impact for other communities such as Barrett Town. During the construction the residents of the existing VMBS development will likely experience the greatest air quality impacts. As a result of their location to the proposed development, fugitive dust may be blown directly across the construction site to these homes. The residents in the section of Barrett Town bordering the project area are not likely to have significant fugitive dust issues as the escarpment to the north of the project site serves as a barrier as well as the trees in the proposed 'green area' which will act as filters for the dust.

Mitigation Measures

- The regular maintenance of vehicles is essential to reduce gaseous emissions.

- Wetting of stockpiles and haulage roads should be conducted on an appropriate schedule and all trucks carrying construction material should be covered. A rigorous wetting programme should be implemented to reduce fugitive dust levels once clearing of vegetation begins.
- Fencing the construction site to a height that will reduce particulate levels near the existing homes.
- Retention of as many trees for as long as possible near the existing homes will enhance the screening of fugitive dust.
- Covering of all stockpiles of earth materials, especially fines and covering of all haulage vehicles carrying fines and cement, will be essential.
- A monitoring programme for dust is recommended.
- Adequate communication with residents in the VMBS scheme should be encouraged.
- Dust masks should be provided for workers.

6.2.4 Water Quality

Potential Impacts

The increased use of on site sewage disposal systems may be accompanied by an increase in potential pollution to ground and surface waters by these systems. Public concerns over health and potential degradation of water quality dictate that these systems are properly managed so they contribute as little as possible to these concerns. Management of the proposed sewage treatment system is important to ensure that there is no further deterioration in the surface water systems in the area. During construction, oil and grease and hazardous material should be managed in properly designated areas, and disposed of appropriately off-site.

In the operation phase the water quality of receiving water bodies is expected to improve due to the use of a Sewage Treatment Plant and cessation of the collection of raw sewage in the pond and eventual discharge into the Boyce Gully. The central sewage treatment facility will be constructed in Zone 8. The STP will be constructed with a biological

nitrogen and phosphorus removal step within closed-loop reactors. The plant is designed by Lakeside Electro/Mechanical Equipment and has eight basic components:

- Grit/trash chamber
- Two anoxic chambers
- Two Spiraflo clarifiers
- Digester
- Anaerobic chamber
- Two closed loop reactors (oxidation ditches)
- Chlorine contact chamber
- Two drying beds

The plant is designed to receive an average sewage inflow of 1,309 m³/d and to meet the NRCA Sewage Effluent standard. This would therefore be along term, major positive impact of the development.

During the operation phase stormwater run-off can carry large sediment loads which increase turbidity in the coastal waters. This would be a long-term, major irreversible impact if not mitigated.

Mitigation Measures

- The sludge and liquid effluent in the existing sewage pond must be disposed of in an appropriate manner.
- It is the recommendation of the environmental impact assessment that the contents of the pond are transported to a municipal treatment facility. The remaining sludge can be dried or stabilized with lime (calcium oxide) and used as soil conditioners. Sewage sludge has beneficial plant nutrients and soil conditioning properties; it may however contain pathogenic bacteria and other disease causing microorganisms.
- Disposal of untreated sewage sludge can present a health risk to humans through direct or indirect contact. The cost for draining the sewage pod has been determined as \$20,000 per truckload.
- The degree of purification and filtration of wastewater by soil is primarily dependent upon the hydraulic characteristics of the soil. In general, the slower the wastewater moves through the soil the more likely soil-wastewater interactions will occur leading to increased filtration and purification.

- During the operation phase the detention ponds will assist in slowing the flow velocity and allowing for heavier particles to settle prior to a discharge into the environment thus reducing turbidity levels. Open areas with hard un-vegetated surfaces should be landscaped.
- Adequate siltation control devices should be deployed where earth movement occurs close to waterways.
- Establishment of a new STP must be after receipt of a permit from NEPA for construction of same, and a license for the discharge of effluent.

6.2.5 Flood Hazard (on site)

Potential Impacts

The Westech Report (Westech Ltd., 2005a) indicates that the pre- and post-development peak flows at the site will increase significantly which is summarized in Table 6.2.5.

Table 6.2.5: Pre and Post Development Peak Flows per Tributary Zone

Zone	Pre Dev't m ³ /s	Post Dev't m ³ /s	Difference m ³ /s	Final Receptor
1	2.5	5.06	+2.56	Boyce Gully
2	0.96	1.23	+0.27	Boyce Gully
3	1.16	3.49	+2.33	Boyce Gully
4	0.68	2.07	+1.39	Spot Valley R.
5	0.56	1.09	+0.53	Boyce Gully
6	0.93	3.42	+2.49	Boyce Gully
7	2.06	5.15	+3.09	Spot Valley R.
8	0.6	0.7	+0.1	Boyce Gully
Total	9.45	22.21	+12.76 (+135 %)	-----

Comment [MSOffice2]: check source of this table as westech indicated – “Detention ponds will be sized so as to ensure that the total flow into the Boyce and eastern Gullies are equal to or less than the pre-development scenario. This may mean that conservative, disproportion and detention is enforce in areas favourable to pond siting while other areas would see unconservative disproportionate detention because of limitations to pond siting imposed by the topography, or even no detention at all.

These changes are mainly due to compaction and the removal of permeable areas by constructing roads, driveways and housing units. The changes in the runoff coefficient are detailed in the Westech Ltd. report to be found in the Appendix V.

Mitigation Measures

- Site grading and leveling with utilizing the road network as stormwater drains and dedicated drains within the scheme will safely convey stormwater to the designated storage areas or receiving water bodies.
- The detention ponds that have been designed will facilitate collection and containment of stormwater runoff, so that flooding does not occur on the site. Flow from the detention ponds will be channeled into the Boyce Gully. The engineering design follows the NWA design criteria for drainage structures. The design is based on a 50 year return period. For any event above the 50 year return period, overflow will enter the Boyce Gully.
- With the detention ponds in place, the pre- and post- development flows will not be significantly different.
- Techniques to improve infiltration such as tiled parking lots or grass surface instead of concrete should be encouraged.
- All existing drainage lines must be kept open.
- During construction vegetation and other construction debris should be stored in designated areas away from drainage channels.

6.2.6 Flood Hazard (Off Site)

Potential Impacts

The increased peak flows will impact on the receiving channels below the property and on the culverts that underpass the North Coast Highway. The analysis of the existing environment and engineering reports indicated that with return periods of 50 years, the capacity of the existing two box culverts seem to be inadequate for conveying peak flows for even the pre-development scenario and this will remain for the post development scenario.

Mitigation Measures

Three detention ponds will be constructed at strategic locations as shown in Figure 6.2.6.

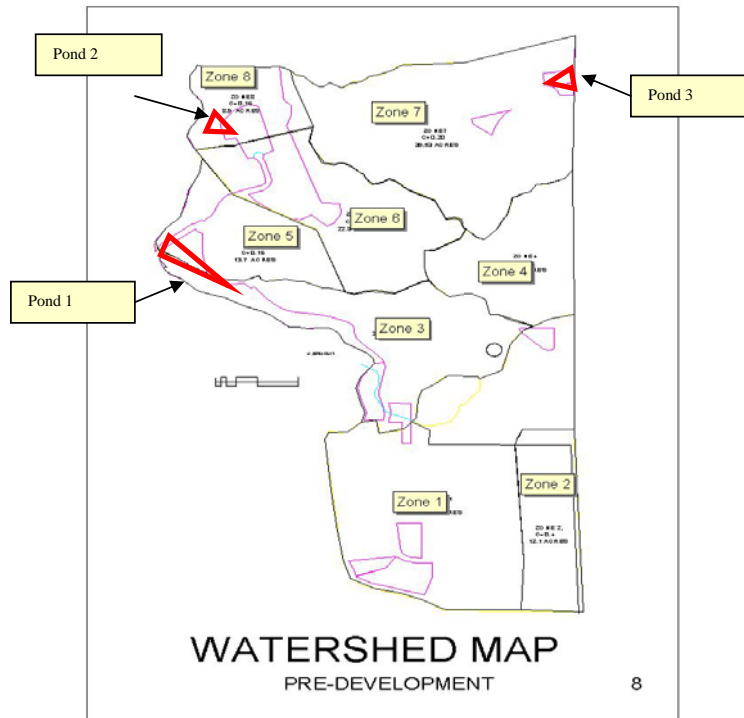


Figure 6.2.6: Location of Detention Ponds

- The detention ponds have been sized to ensure that the total flow into the Boyce Gully and the eastern gully are equal to or less than the pre-development scenario. Peak flow associated with return periods greater than 50 year will overflow the crest of the detention ponds and protective aprons will be installed to prevent scouring below the dam.
- The Westech report indicates that peak flows associated with return periods greater than 50 year will overflow the crest of the dams and flow into the Boyce Gully.
- The ponds are designed to mitigate the effect of the increased runoff as a result of the proposed subdivision only. They do not address the possibility that the existing hydraulic structures on the Rose Hall main road may already be adequate.

- The capacity of the existing box culverts needs to be increased. The capacity can be increased by enabling the culverts to flow under higher heads. This can be achieved by the addition of wing walls and the raising of existing head walls. This however, is not the responsibility of the developer but is the responsibility of the relevant government agencies, as these culverts are already under-designed.
- Additionally, the proposed road works under the Northern Coastal Highway Improvement Project (NCHiP) should result in an increased capacity of relevant hydraulic structures.

6.2.7 Recharge Areas

Potential Impacts

The change in land use associated with a higher degree of impermeability reduces the volume of rainwater percolating into the underground and contributing to recharge. The rock formation underlying the area is considered an aquiclude due to its low permeability and as such impact is not considered significant.

Mitigation Measures

- Some leakage will occur through the base of the detention ponds, otherwise no further mitigation is required.

6.2.8 Slope Stability

Potential Impacts

The steep slopes particularly within zones 5, 6 and 8 are vulnerable to erosion. Soils overlaying Montpelier are generally thin and as such the potential for soil erosion is low. Road construction particularly near slopes has a high potential for slumping in soft marls.

Mitigation Measures

- It is proposed to retain these areas as nature reserve and green belt.
- Where houses are constructed on steeper slopes appropriate consolidation activities in pre-construction and during construction stages of the houses are followed.

- Recommendations from the Mines and Geology Division are followed.

6.3 Biological Impacts

Potential Impacts

The clearing of vegetation will result in the modification or removal of existing habitats for birds. However, there are no rare, threatened or endangered bird species reported from the site. The species reported from the abandoned pasture areas and scrubland are mostly ubiquitous species that may easily adapt to a modified environment or re-locate to the verges of the remaining vegetated areas. More selective species and some migratory species may be dislocated. Woodland species may relocate to the undisturbed areas that will remain as green areas, even during the construction phase. The loss of the existing habitat will be an irreversible impact, for the areas affected.

Impacts on water quality that may ultimately affect the marine environment have been described in the water quality section.

Mitigation Measures

- Landscaping in the development should occur to replace vegetation lost, and this could encourage the re-establishment of dislocated bird species. This is especially important for migratory species that encounter the north coast first on their southward journey and require a suitable habitat.
- The limestone woodland and other areas to be kept as green spaces or buffers should be maintained in their current state during the construction period.
- These areas should not be used for storing of equipment, side-tipping of earth materials, handling of hazardous materials or disposal of solid or liquid waste.
- The mitigation measures as presented to maintain the integrity of the water quality leaving the site, should assist in improving the coastal water quality in the long term.

6.4 Socio-economic Aspects

6.4.1 Traffic, Transportation and Access Roads-Potential Impacts

The development proposed by Gore Developments Ltd. along the Spot Valley Road is not expected to negatively impact on the current and future operation of the corridor. Considering service volumes along the Rose Hall main road, the highway will operate at LOS B (LOS A after upgrading). The level of service of the Spot Valley road due to the development in Yr 2015 will be LOS C. With the policy of maintaining minor roads at LOS C or better, the development does not detrimentally affect the level of service of the corridor.

During the construction phase slow moving vehicles cause congestion on the North Coast Highway and the road network can be subjected to additional wear and tear. Congestion is expected to be a medium term, reversible impact that may be major during peak hours. Road wear and tear may be a long term impact. During the operation phase increased traffic will be observed as a result of the housing subdivision. This is expected to be along term irreversible impact, but is not expected to be major according to the Traffic Impact Assessment (Appendix XIII).

Motorists that use the Spot Valley Road may experience some delays during the morning peak as they attempt to join the flow of traffic on the major road. This is to be expected where a minor road meets a highway. For the evening peak, sufficient lane capacity and gaps exist so that turns onto the Spot Valley Road should not present undue problems.

Mitigation Measures

- Scheduling of construction work can minimize traffic flow disturbances. The North Coast Highway is heavily travelled and other construction activities are ongoing (North Coast Highway Improvement and other development).
- There should be some discussion with the NWA to determine the construction schedule.

- Adequately trained flag persons and road signs are required where heavy traffic crosses the highway.
- Where appropriate road closures, detours and obstructions should be made public, in advance, through the print and electronic media.
- The construction schedule should be made available to agencies such as the National Works Agency and other stakeholders such as the Northern Coastal Highway Improvement Project, Community Groups and hotels.
- Additionally, given the magnitude of the development, for safety purposes it is recommended that the develop installing **Intersection Ahead** signs along the Spot Valley Road, indicating the presence of the entrance to the development.
- Haulage vehicles should be appropriately covered and adhere to axel limits

6.4.2 Employment

Potential Impacts

Employment opportunities will arise during both the site preparation and construction phase and will be limited to mostly unskilled labour. This is expected to be a positive, short-term, reversible impact. Vendors will be attracted to setup road-side shops and cook shops, which may be a negative, short-term impact, if not properly managed. The sourcing of aggregate will open linkages with local suppliers.

Mitigation Measures

- An area should be designated for vending activities and properly equipped with solid waste receptacles, portable chemical toilets and running water. This will encourage proper sanitation and reduce negative public health impacts. Workers need to be instructed on traffic management, waste (liquid and solid) disposal practices, vehicle maintenance and oil spill control.
- Security is critical and arrangements with the local law enforcement arm or any other security provider should be made.
- Employment opportunities should be advertised through the Parish Council, as appropriate.

6.4.3 Solid and Liquid Waste Management

Potential Impacts

Construction debris, cleared vegetation and solid waste will be generated during the construction phase. Sanitary facilities are to be provided by chemical portable toilets, serviced by an approved contractor.

Mitigation Measures

- Waste separation and adequate storage receptacles should be provided.
- Arrangement should be made with local approved waste haulers and the NSWMA for disposal at an approved landfill site for St. James.
- Hazardous waste should be separated and stored in clearly designated areas. Advice for labeling and packaging is to be sought from the NSWMA.
- Solid waste receptacles should be provided for workers on site.
- Portable chemical toilets should be provided by the developer and should be from an approved contractor. Portable toilets should be maintained and emptied by a certified contractor.
- Draining and removal of liquid and sludge from the sewage pond should be as detailed in above (Section 6.1.4). Arrangements should be made with the NWC Bogue Treatment Plant for the disposal of the sewage effluent.

6.4.4 Potable Water Demand

Potential Impacts

The development will require approximately 1,250 m³/d (330,000 US gals) based on a per capita requirement of 227 l/d and losses of 10 %. A total flow of 3 m³/min to satisfy the fire fighting demand was calculated. A storage capacity needs to be provided for at least 1.5 days resulting in a required storage capacity of 1,880 m³. The capacity of the existing Mt. Zion spring is inadequate to satisfy the existing demand.

Mitigation Measures

- The National Water Commission supply network will meet the required demand by taking water from the existing 32” main pipeline running along the North Coast Highway as per agreement.

6.4.5 Archaeological and Cultural Heritage

Potential Impacts

During site preparation and construction earth works and excavation will be required.

Mitigation Measures

- The JNHT should be advised of the project and construction schedule and allowed to perform a Watching Brief if required.
- Any location where artifacts are found is to be clearly demarcated and protected against public access and interference until the JNHT has given clearance.

6.4.6 Public Health and Safety

Public health and safety must be maintained at all times, and this includes the general public and workers on the project site.

- To minimize the risk to the public during construction, activities that will directly affect the movement of traffic and pedestrians should be properly scheduled.
- Standard construction techniques for sign-posting and flagging should be adhered to.
- Dust control by wetting is essential.
- Unnecessary idling of vehicles should be avoided.
- All hazardous material should be stored in properly labeled and designated areas.
- All workers should be equipped with hard hats, construction vests, work boots, goggles, ear muffs and dust masks, as appropriate for the tasks at hand.

7.0 Potential Impacts and Mitigation Measures

7.1 Positive Impacts

Several positive impacts are expected from the development of Rhyne Park Village, as proposed.

7.2 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. Additionally, opportunities will be created for the supply of various types of construction materials.

7.3 Provision of Housing in the Operation Phase

In the operation phase 900 housing solutions will be provided in the Rhyne Park Village. Public perception has indicated a need for the housing and anticipation for this new development.

7.4 Draining and Removal of Existing Sewage Treatment Pond

The existing sewage pond is a public health hazard as it is an open system, possibly with a breached lining, and discharges into a stream, which ultimately enters the Boyce Gully and enters the coastal waters. This pond will have to be drained, excavated and filled to facilitate the housing subdivision. The existing houses that are currently emptying sewage into this pond will be connected to the new sewage treatment plant.

7.5 Provision of STP for Existing VMBS Houses

The provision of a sewage treatment plant for the existing houses is a positive impact. These homes anticipated connection to the sewage treatment plant that was created for the original subdivision. With only 58 houses, the flow would have been under design capacity and not feasible.

7.6 Eventual Restoration of Surface Water Quality

The proper treatment of sewage and disposal of treated effluent that meets NEPA standards will result in improved water quality in the streams, the Boyce Gully and ultimately the costal waters, in the vicinity of the Boyce Gully, in the long term.

8.0 Consideration of Alternatives

8.1 Alternative Sites

No other sites were considered for this development.

8.2 Sewage Treatment Plant

Several options were considered for the treatment of sewage for the Rhyne Park development.

- a. The first sewage treatment option considered was connection to the centralized Sewage Treatment Plant (STP) to be constructed by Rose Hall Developments Ltd. Discussions were held between Rose Development Ltd. and Gore Developments Ltd. but no mutually beneficial arrangement was forthcoming.
- b. The second treatment option considered was the use of the existing STP that was constructed in the 1990's but never commissioned. Communication between Gore Developments Ltd. and the National Environment and Planning Agency regarding the use of the existing STP has been extensive and some of the communication is recorded in Appendix VIII. The location of the STP close to the Boyce Gully was considered by NEPA to be a significant negative aspect. Additionally, the proximity of the STP to the proposed rehabilitated main entrance did not meet the minimum setback requirements of 30m from a public road.
- c. The third option considered was connection to the STP to be constructed by West Indies Home Contractors Ltd. (WIHCON) at the new Spot Valley Housing Development. There were extensive discussions between Gore Developments Ltd. and WIHCON. Connection to the WIHCON STP would have required an expansion of that facility to meet the increased flows that would be generated by the Rhyne Park Village. The approvals given to WIHCON were to facilitate their own development and

associated facilities and connection by another major development would not be within the conditions of approval.

- d. The fourth option considered was the construction of an entirely new STP to support the Rhyne Park Village. The design for this facility is given in Appendix III. Effluent discharge parameters will meet NEPA guidelines. This plant is to be located in the northwest corner of the property. The STP will be constructed first, to facilitate immediate connection of the existing VMBS houses, so that the existing sewage pond can be drained and the site rehabilitated to allow the development to proceed. This fourth option is the preferred option of the developer.

8.3 Housing Solutions & Green Space

The number of housing solutions and allocation of green space and recreational areas, was determined firstly by the Town Planning requirements and secondly by effective use of space and the finalization of the location of the Sewage Treatment Plant. The final number of solutions and acreage of green spaces meets the national requirements.

8.4 The No Action Alternative

The No Action Alternative would see the property at Rhyne Park remaining in the existing condition, which is a mixture of secondary growth and unimproved pastureland adjacent to the exiting VMBS houses. This would mean a continuation of the disposal of raw sewage into a pond that has clearly not been maintained, as evidenced by the high levels of effluent (above the previously designed berm), and possible breaches in the lining (as evidenced by the bubbling of the lining and high moisture content in the surrounding earth. Additionally, the No Action Alternative would result in the continued release of raw sewage effluent into the streams and eventually into the Boyce Gully and to the coastal waters. Although this option is certainly feasible, and would result in the continuation of a situation that has existed for some thirteen years.

The implementation of the No Action Alternative would not result in the following positive impacts:

1. Construction and commissioning of a STP to treat the effluent being currently discharged from the existing 58 VMBS houses.
2. Removal of the pond, which is a health risk as it is open and accessible. Draining, excavation and filling would facilitate removal of the pond.
3. Cessation of the release of untreated sewage effluent into the stream that leads to the Boyce Gully.
4. Provision of over 800 housing solutions to meet the needs of the ever growing staff that serve the tourist sector in this region
5. Partial fulfillment of the mandate of the Rose Hall Master Plan as regards middle income housing for the area
6. Provision of employment in the short term for skilled and unskilled workers.

9.0 Outline Monitoring Programme

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

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

The Monitoring Plan should include the following components:

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

The duration of the monitoring programme should be for the entire construction period, with monthly reporting.

The Monitoring Programme cannot be prepared in detail before the permit is received from NEPA as Terms and Conditions of the permit must be taken into consideration, and included in the monitoring programme as appropriate.
