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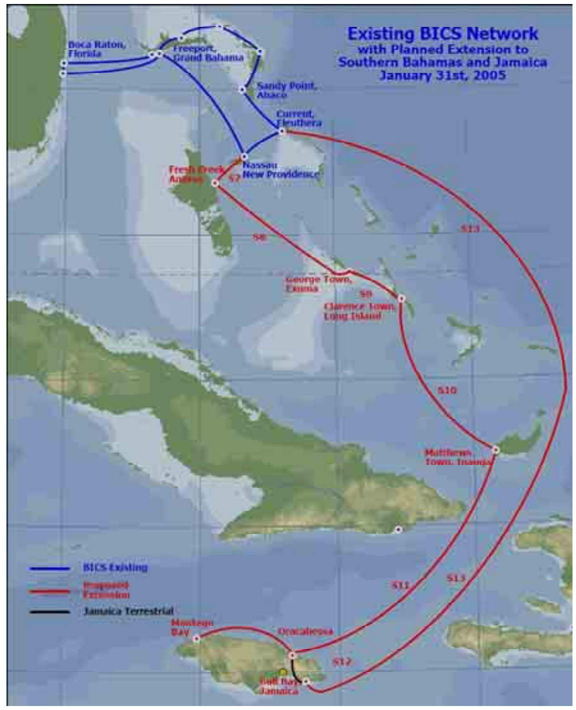

Environmental Impact Assessment for Establishment of a Fibre Optic Cable Network from the Bahamas to Jamaica

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EXECUTIVE SUMMARY

Executive Summary

Fibralink Jamaica is planning to expand their existing submarine fibre-optic network connection in the Bahamas to Jamaica.

This will provide a high-capacity fiber-optic connection between the United States (US) and Jamaica. The project will see an efficient communications system being put in place that improves on quality and reliability. The project is designed to minimize network contingencies such as potential data transmission disruptions due to network cuts and outages, and natural disasters such as hurricanes, as witnessed during Hurricane Ivan in September 2004.

The project will provide the first direct connection between the Bahamas and Jamaica, and supply the increasing demand for global voice and data transmission capability. The proposed fiber-optic project will add additional data transmission capability, increased suppliers and reduced costs, and supply the increasing demand for electronic communications (phone, facsimile, email, Internet).

The purpose of project is to employ marine cable installation technology to install a submarine fiber-optic cable between Jamaica and the Bahamas. The specific landing sites in Jamaica for the proposed project are as follows:

- Montego Bay, St. James
- Tower Isle, St. Mary
- Bull Bay, St. Thomas

The project will use state-of-the-art cable installation technology to provide for the maximum possible integrity and safety of the installed cable. The proposed work covered in this EIA involves:

- Explanations of the technology, routing and process of deployment of the cable
- The environmental setting and baseline for the proposed submarine cable expansion included studies, analyses and assessments on:
  - geomorphology
  - geology
  - water resources
  - terrestrial and marine ecology

- land use and aesthetics
- socio-economics
- community consultations
- archaeological and historical heritage resources
- air quality
- weather, noise, etc.

• Cable type, cable laying methods
• Solid and hazardous waste management practice.
• Routing of cables and associated risks of proposed actions
• Analysis of Alternatives
• Impact identification
• Impact mitigation
• Structural integrity testing of cable.

The potential negative environmental impacts of this study have been thoroughly addressed and our findings indicate that those potential impact identified maybe considered negligible and of short duration. These potentially negative impacts have been identified mainly during the construction phase of the project and with good project management can be sufficiently mitigated..

No new or unfamiliar major negative impacts or risks were identified. Additionally, several potentially beneficial impacts have been identified that can be realized from the implementation of this project.

The potential impacts identified for the pre-construction, construction and operating phases of the proposed project include:

Negative

• Minimal suspended solids during cable laying
• Minimal noise and vibration during construction
• Minimal aesthetics and transient change of land and marine use

Positive

• Improved broadband access by commissioning new connections
• Potential vast increase in investment revenue and job creation due to improvements in the telecommunications industry from this project.

- No loss of biodiversity
- No loss of archaeological and historical heritage resources.

Any negative impacts identified will be effectively mitigated using traditional and state of the art methods, as necessary.

Several government agencies were contacted as well as various public interests throughout the EIA process. This was done to present all parties with information on the project determined areas of potential conflict and to encourage open dialogue on this very important development project. Further, Fibralink has promised to provide the appropriate authorities with As-Laid positions and charts for notification to the appropriate mapping agencies in the island.

An environmental management plan will be incorporated as well as a monitoring protocol for all aspects from startup to operation.

Conclusion

The proposed expansion of the broadband network for Jamaica is planned to take place against a background of improvements in the quality of broadband connection, increases in connectivity in meeting the demand, decreases in cost for access to all, and the lessening of disruption due to accidents or natural disasters.

The potential impacts identified if realized will be mitigated using proven technologies. No new or unfamiliar environmental impacts or risks have been identified with the proposed project.

The proposed project represents a large investment in Jamaica and bears the potential for enormous macro and micro economic growth and development as well as social benefits to Jamaica.

PROJECT DESCRIPTION

1 Project Description

1.1 Introduction

The installation of Fiber optics is the preferred method of carrying voice, video, and data communications. Its superior information-carrying capacity enables the use of applications that require large amounts of bandwidth.

Fiber-optic cable allows for optimization of transmission equipment because it lacks the delay found in satellite connections. Further, unlike satellite communications, fiber-optic cables are insensitive to electromagnetic and/or atmospheric interference and offer a secure link because of their relative immunity to eavesdropping.

1.2 Background

FibraLink Jamaica Limited (FibraLink) is a recently incorporated Jamaican company established with the expressed purpose of building, owning and operating a sub-marine fiber-optic network to provide broadband communication linkages for Jamaica to the rest of the world via the Bahamas and the United States of America.

Following on the significant loss of broadband service to the island during Hurricane Ivan in September of 2004, the need for additional and redundant fiber optic linkages to the island was realized.

Pursuant to Section 13 and Section 78 of the Telecommunications Act, 2000, a license for the construction and operation of a Submarine Fiber Optic Cable Network was granted to FibraLink on December 20, 2004 by the Minister of Commerce, Science and Technology, the Honorable Phillip Paulwell (a copy of the signature pages are enclosed as Appendix II). This license stipulates that:

"The Ready for Service Date shall be no later than the 31st day of October 2005." This means that all environmental, building and other associated permits and licenses must be granted in a timeframe that allows for the mobilization of equipment and completion of all works prior to that date.

In granting a license to FibraLink Jamaica, the Office of Utility Regulations (OUR) required that all single points of failure be eliminated from the network. The OUR's suggested alternative was to have a minimum of two landings in Jamaica – one at Bull Bay, as originally proposed, and at least one located on the northern coast. FibraLink maintains the proposed Bull Bay landing site and has identified two (2) potential north coast landing sites, one just east of Ocho Rios in Tower Isle, St. Mary and the other just west of Montego Bay in the vicinity of the Great River. Existing Jamaica Public Service Company (JPSCo) high tension lines and/or below ground trenching will be utilized to make terrestrial connections from the various landing sites. Figure 1-1 below shows the proposed routing and terrestrial connections of the proposed network.

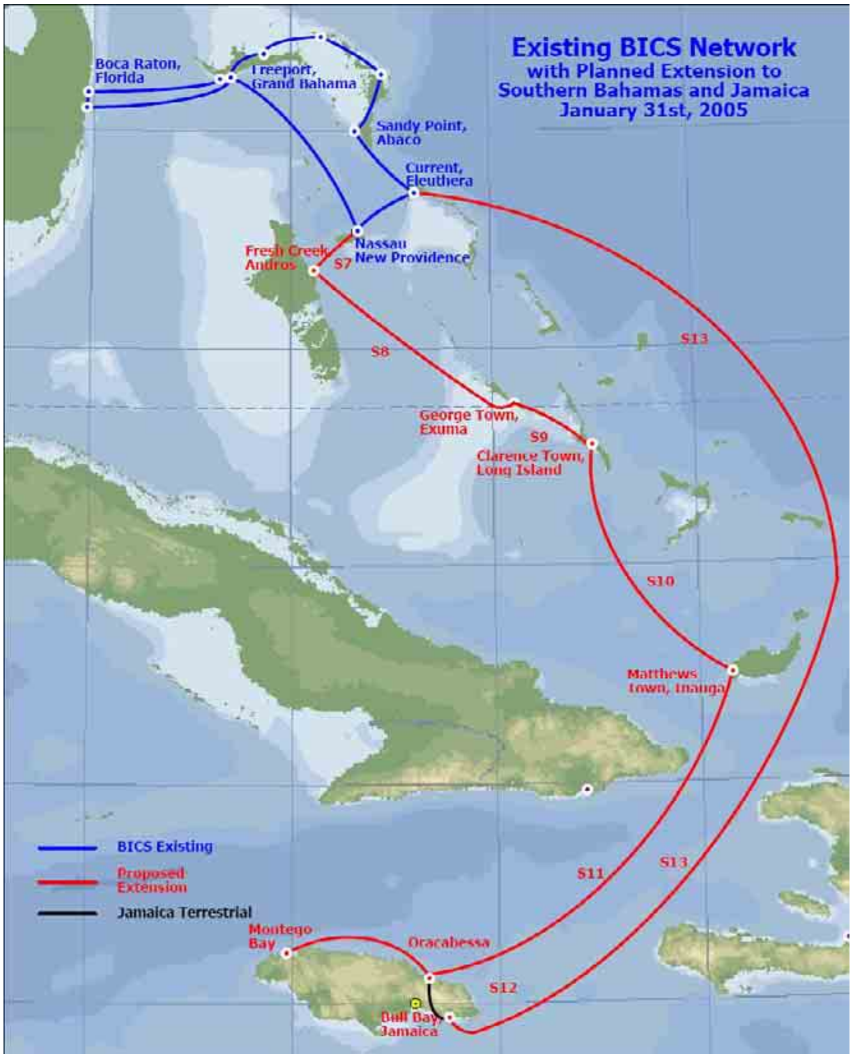


FIGURE 1-1: PROPOSED ROUTING AND TERRESTRIAL CONNECTIONS

1.2.1 Regional Cable History

Many submarine cables are installed throughout the Caribbean Region including the Bahamas and Jamaica. The following is a list of known active and inactive cables that may be crossed during this project. There is also the potential for a number of either scientific or military sub-marine cables throughout the area. It is not envisioned that these cables will interfere in any way with the proposed FibraLink cable between Bahamas and Jamaica.

TABLE 1-1: POTENTIAL CABLE CROSSINGS

System Name	Details
TCS-1	In Service: 1990 San Juan, Puerto Rico -- Barnquilla, Columbia -- Santo Domingo, Dominican Republic -- Kingston, Jamaica - 2,593km at 140 Mb/s KHz Maintenance Authorities: AT & T, MCI, Sprint
ECFS	In-Service: Sept 1995 Maintenance Authorities: TSTT
ARCOS-1 (AMERICAS REGION CARIBBEAN RING SYSTEM)	Phase 1: In-Service: September 2001 Hollywood, USA; Nassau, Bahamas; Cat Island, Bahamas; Crooked Island, Bahamas; Puerto Plata, Dominican Republic; Punta Cana, Dominican Republic; San Juan, Puerto Rico.
Florida-Jamaica	Out-of-service: retired 1992, 1963: 29 years of Service Florida City, Florida, U.S.A. -- Kingston, Jamaica - 1,545km at 384 + 384 KHz Maintenance Authorities: AT & T, Jamaican International Telecommunications Ltd.
Canal Zone-Jamaica	Out-of-service: Retired 1998, 1963: 34 years of service Kingston, Jamaica - Fort Sherman, Panama - 1,150km at 384 + 384 KHz Maintenance Authorities: AT&T, ITT Central American Cables & Radio

1.3 The Proposal

FibraLink proposes to construct and operate a 2,800 km fiber-optic sub-marine cable network linking Jamaica via various Bahamian Islands to the United States of America and ultimately the world.

1.3.1 The Cable

With now over 20 submarine communication cables in the Bahamas and Caribbean waters, there has been no reported negative impact on the environment. The routing of each of the new cables has been based on avoiding any sensitive area such as coral reef and fish nurseries and proven techniques used during the recent construction of the original segments between the United States of America and the Bahamas will be used for the Jamaican portion of the installation. The small size of the cable (see cable specification figures below), the narrow path of the cable and the shortness of the construction phase are the major factors limiting the potential for impacts.

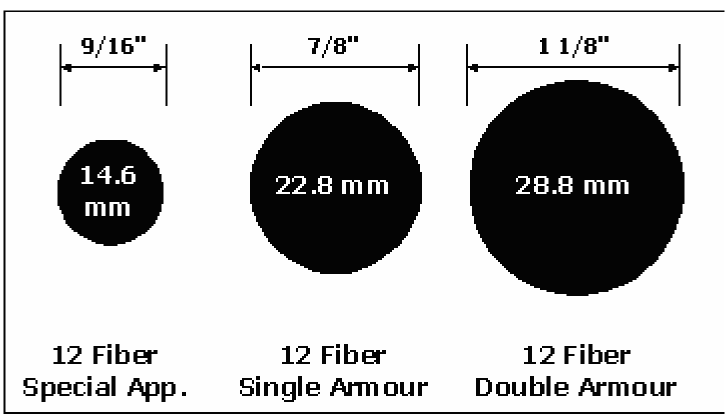


Figure 1-2: Cable Cross-Section

All non-repeatered armoured fiber optic submarine cables are basically constructed in a similar manner. Figure 1-3 below shows the typical components of such cables.

It is planned that most of the new cable links of BICS extension will be repeaterless. Repeatered fiber optic submarine cables on the other hand carry a constant dc current of 1 Amps to feed power to the underwater repeaters. There is no external electric field associated with the power on the inner conductor. The ratio of the conductivity of the polyethylene insulation to that of seawater means that the electric field remains only within the cable insulation. However, the dc current in the inner conductor does set up a stationary magnetic field in the form of concentric rings emanating from the cable. For a cable carrying 1 amps this means that the magnetic flux density due to the cable at a distance 1 metre away is 0.2 micro Tesla. This is two orders of magnitude lower than the vertical component of the earth's magnetic field on the West Coast of the United States, which is about 43 micro Tesla.

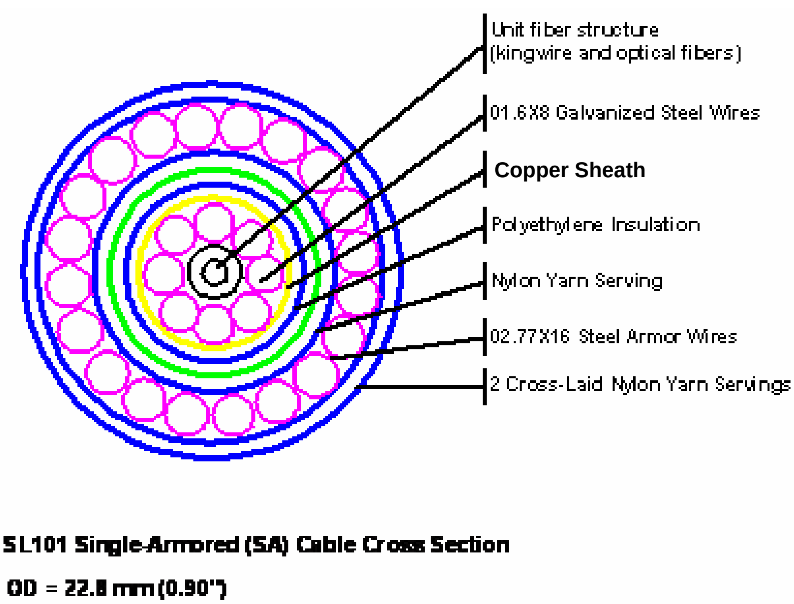
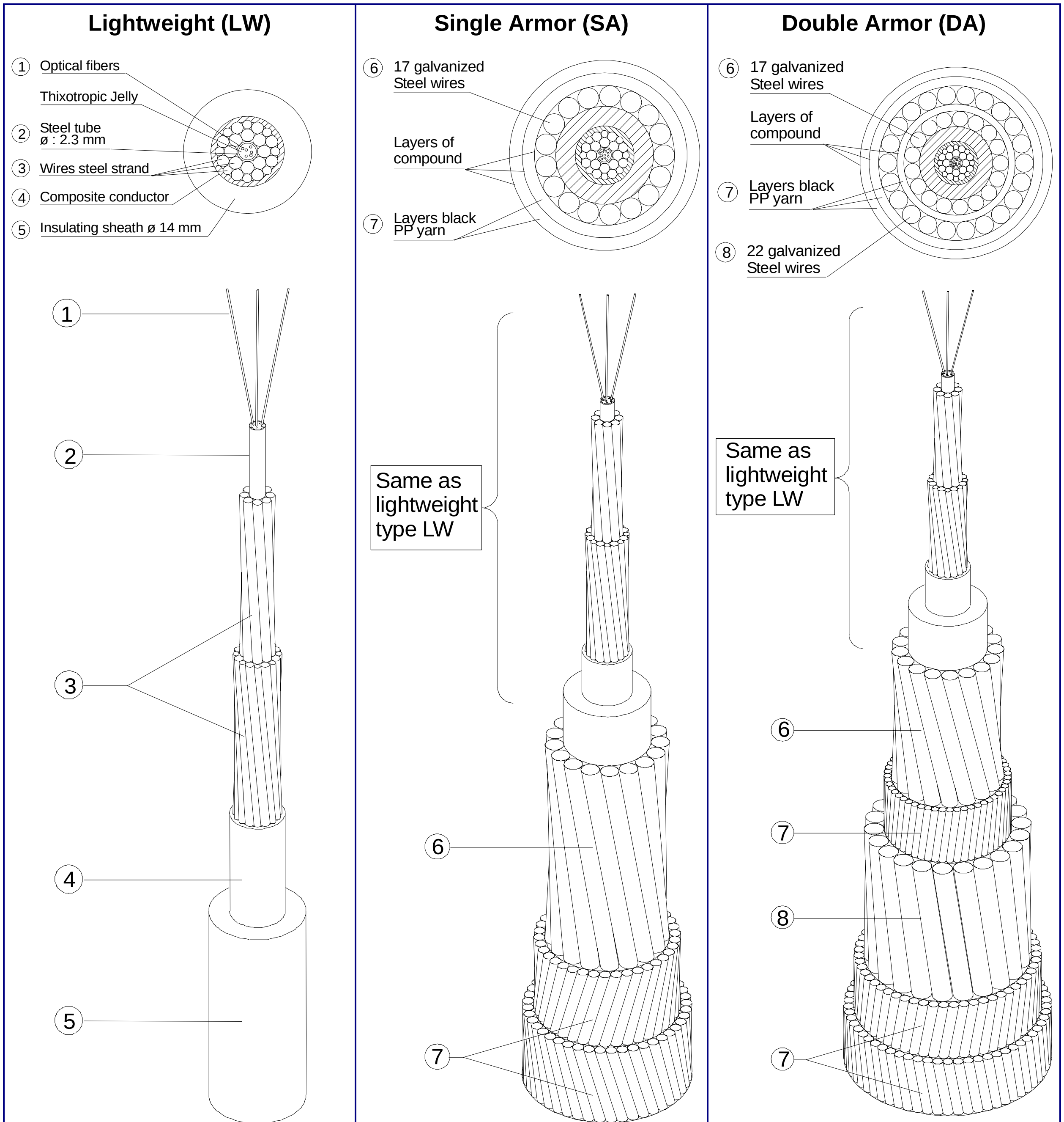


FIGURE 1-3: TYPICAL CROSS-SECTION OF A SINGLE ARMOURED SUB-MARINE FIBER OPTIC CABLE (NOT TO SCALE)



Characteristics	Unit	LW	SA	DA
Outer diameter	mm	14	26	35
Weight in air	kg/m	0.44	1.6	3.5
Weight in water	kg/m	0.28	1.0	2.4

To ensure longevity of the cable and to minimize the potential for breaks, it is important that the cable is laid in areas of soft sand bottom, away from coral and other hard marine structures and anchorages. Where necessary, the cable will be protected through the use of a boltless articulated pipe. The incorporation of the articulated pipe will also provide a self burial method, thus avoiding excessive disruption to the ocean floor.

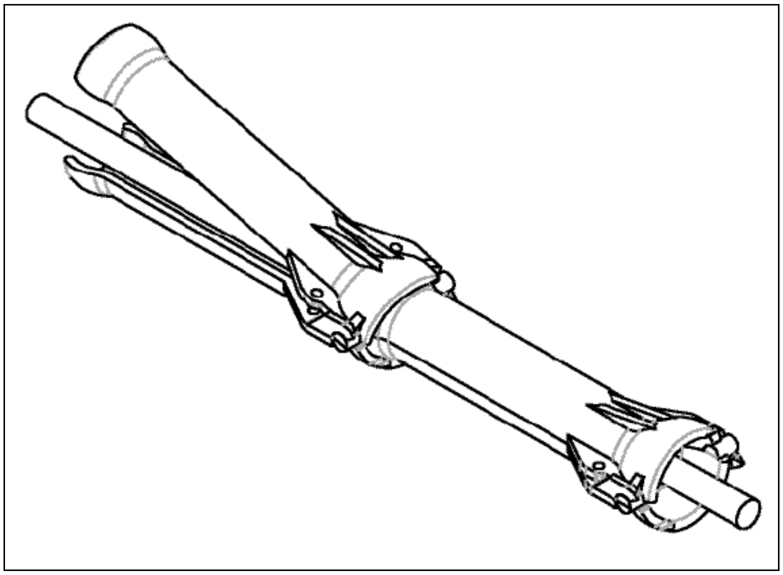


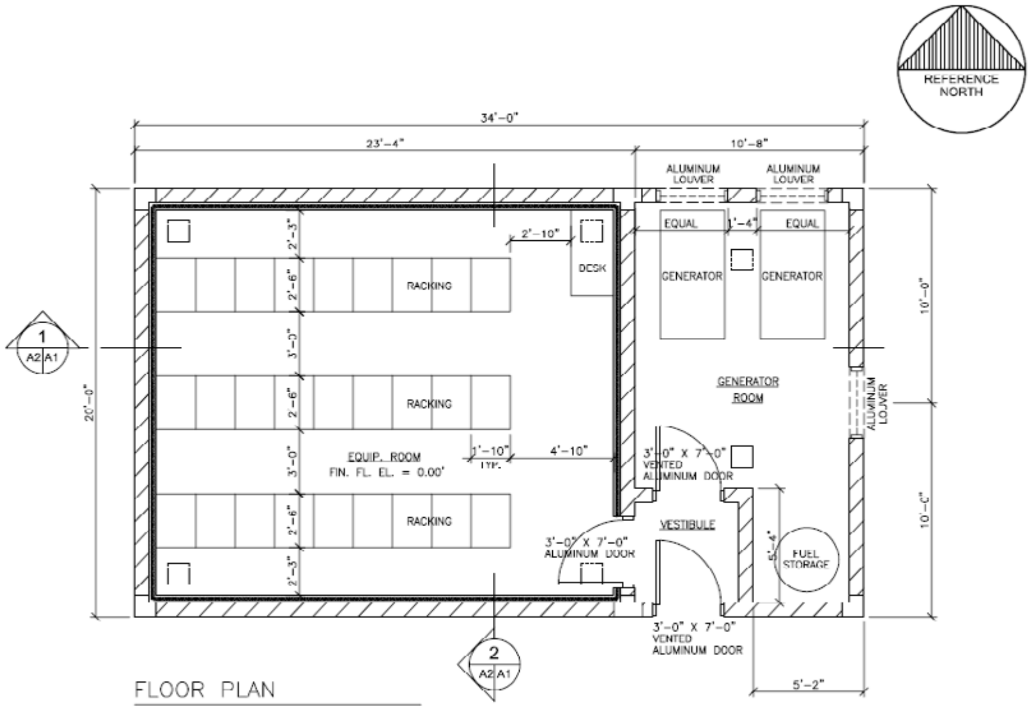
FIGURE 1-4: ARTICULATED PIPING TO PROTECT THE SUBMARINE CABLE

1.3.2 Landing Sites

FibraLink proposes three (3) landings on the Jamaican shores, based on dialogue with the Ministry, supporting the location of separate cables on the north and south coasts of the island. The proposed landing sites are:

- Bull Bay, St. Thomas (Existing AT&T Landing Site)
- Tower Isle, St. Mary
- Great River, Montego Bay, St. James

Landing site refers to the location that the cable comes ashore and may not be the location of the equipment building. In all cases, the equipment building will be located in a secured location close to the distribution network. Equipment buildings are ideally located in proximity to the landing site, with easy access to electricity and at an elevation in excess of 3 meters above sea level. The typical equipment building layouts and structural designs are detailed in Figure 1-8 below.



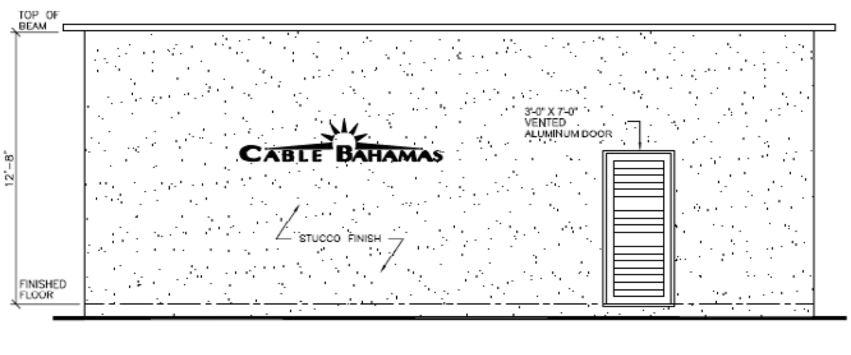
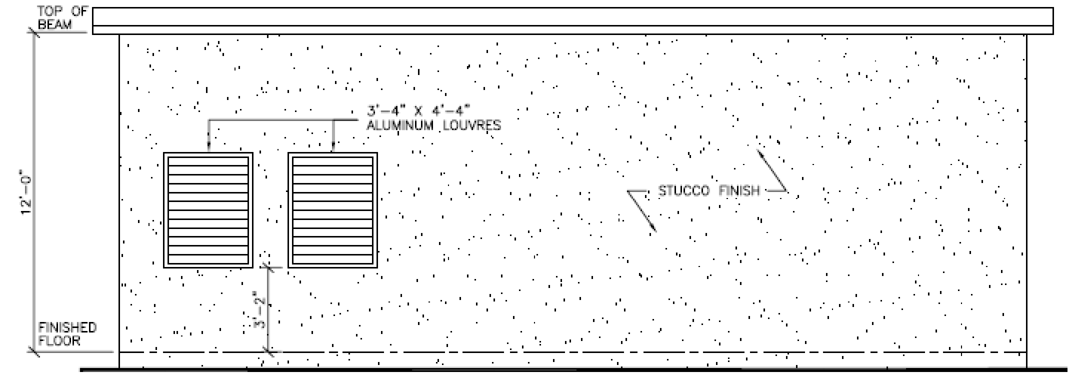
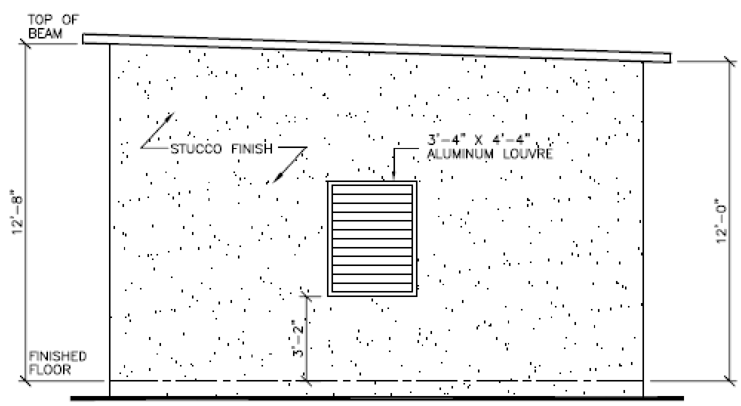


FIGURE 1-5: TYPICAL EQUIPMENT BUILDING LAYOUT – PLAN AND FRONT END ELEVATIONS

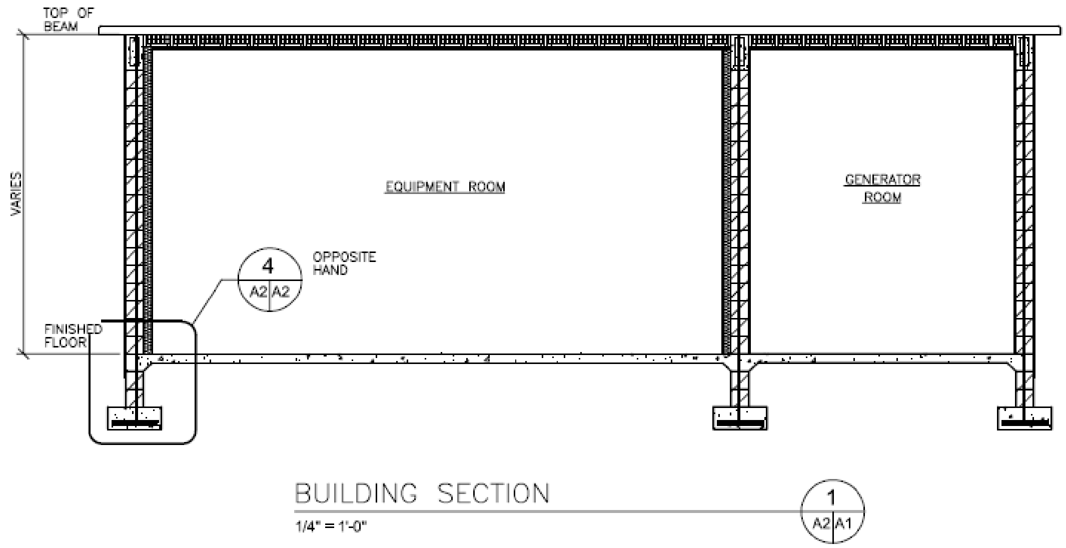


NORTH ELEVATION
1/4" = 1'-0"



EAST ELEVATION
1/4" = 1'-0"

FIGURE 1-6: TYPICAL EQUIPMENT BUILDING LAYOUT – SIDE END ELEVATIONS



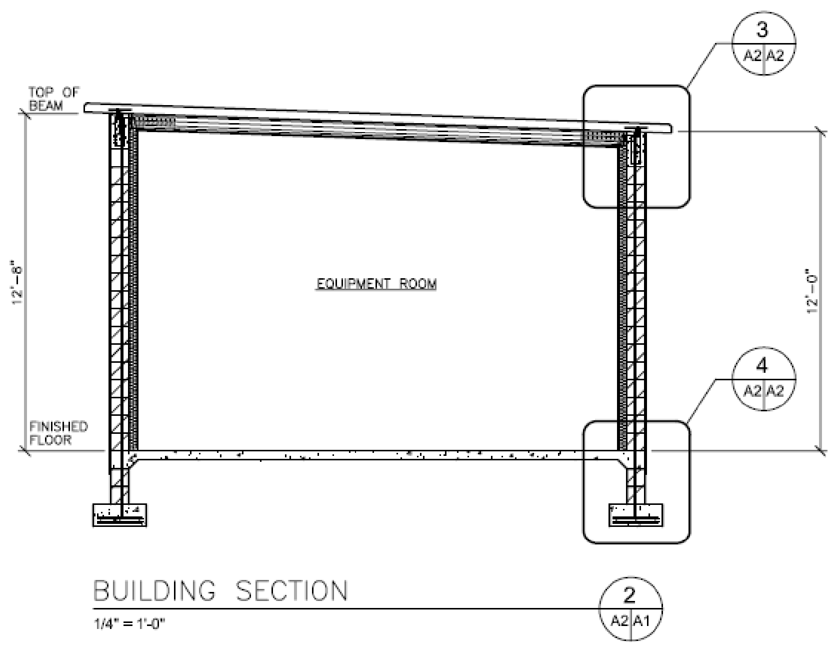
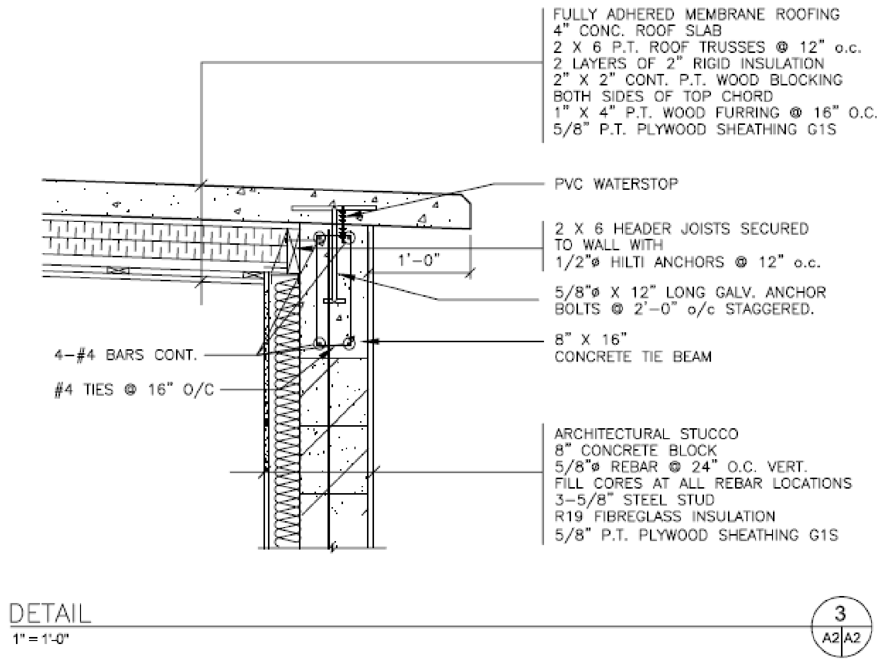


FIGURE 1-7: TYPICAL EQUIPMENT BUILDING STRUCTURAL DESIGN – KEY STRUCTURAL DESIGN AREAS HIGHLIGHTED



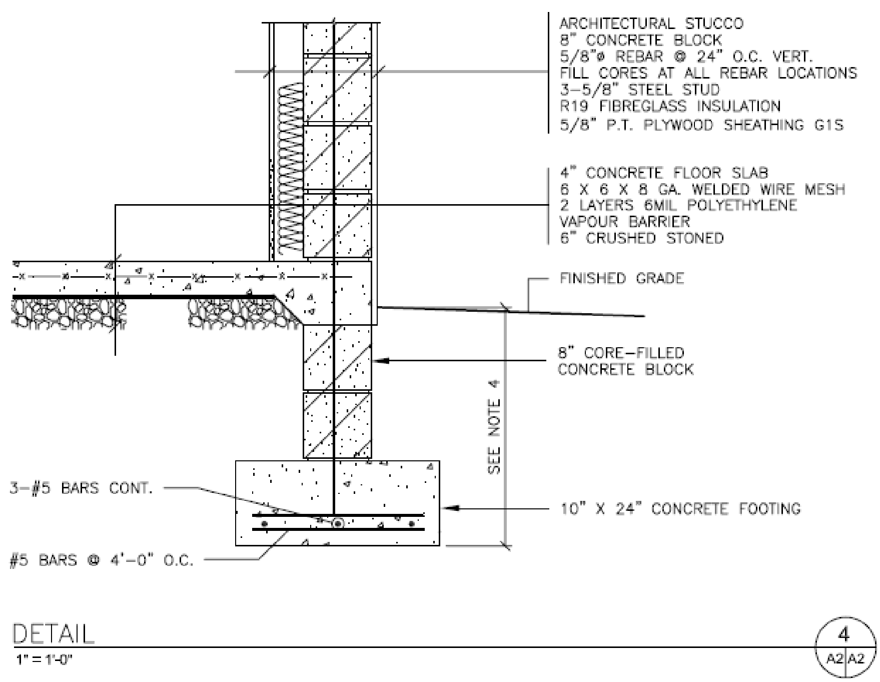


FIGURE 1-8; TYPICAL EQUIPMENT BUILDING STRUCTURAL DESIGN – DETAILED OVERVIEW OF KEY STRUCTURAL DESIGN AREAS

1.3.2.1 Bull Bay Site

Coordinates: Station - 17° 56.893’N – 76° 42.118’W

Landing Site - 17° 56.893N – 76° 42.118’W

1.3.2.1.1 Physical Description

The location of the cable station is on Highway A4 in Bull Bay, which is approximately 5 kilometers east of the Harbour View round about. The landing site in Bull Bay is the location of the existing AT&T cable station. Existing ducts would be used to bring the cable from the shore to the building. Duct length is estimated to be 600m. The ducts go from the sea, under a narrow strip of sand and small boulders beach and then under a narrow piece of land bordered on both sides by a small concrete wall. The cable route then goes across the coastal road and up towards the cable station that is approximately 35m above sea level. All underground cable routes will utilize existing ducts, thereby avoiding all disruption to the environment.

The building is a typical cable station; no windows, flat roof, with parking and loading dock access. Since this building is in existence and is operational, no external modifications will have to be made to the landing site or the building and environs as a result of this project. The map and pictures below show the proposed route into Bull Bay, existing building, landing site and environs at Bull Bay.

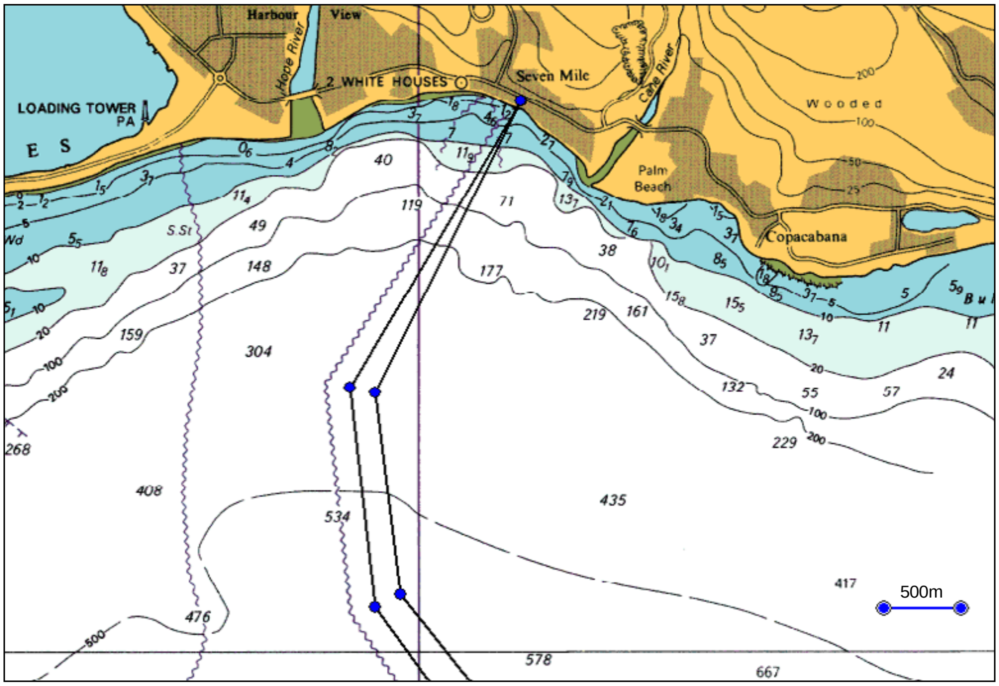


FIGURE 1-9: BULL BAY SITE LOCATION

FIGURE 1-10: – PROPOSED BULL BAY CABLE STATION

FIGURE 1-11: PROPOSED BULL BAY CABLE LANDING

FIGURE 1-12: PROPOSED BULL BAY CABLE LANDING

1.3.2.2 Tower Isles, St. Mary

Coordinates: Station - 18° 25.177’N – 077° 02.467’W

Landing Site - 18° 25.283’N – 077° 02.524’W

1.3.2.2.1 Physical Description

The landing site in Tower Isles/Frankfort, St. Mary is located on a narrow strip of beach just west of the Couples Resort Hotel.

The site is approximately 5 km east of Ocho Rios, St. Ann and approximately 10 km west of Oracabessa, St. Mary. The site is basically an undeveloped portion of land nestled between Highway A3 and the Caribbean Sea. It has a basically triangular orientation from a maximum width approximately 15m pinching down to approximately one (1) meter.

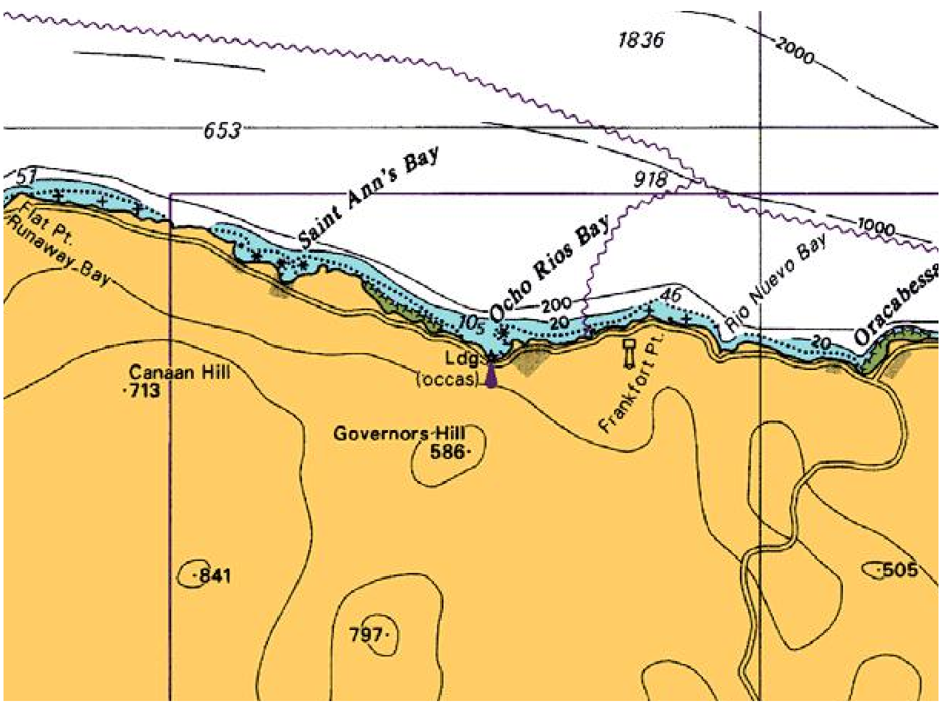
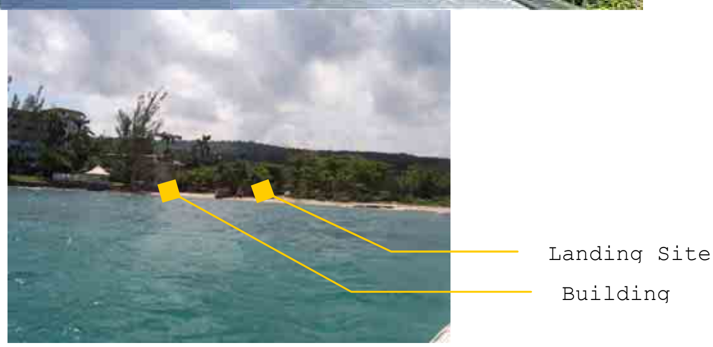


FIGURE 1-13: ST. MARY SITE LOCATION



The proposed location of the building is within the fenced boundary of the existing Couples Resort property. This location is approximately 400m from the landing site at an elevation of 6-8m above sea level. There are no obvious obstructions between the landing site and the building site and the location has existing 24 hour security.

The location of the building will not interfere with any operations at the resort. It is anticipated that the cable will be laid in a narrow trench from the landing site to the building.

1.3.2.3 Montego Bay Site

Coordinates: Station - 18° 26.742'N – 077° 57.369'W

Landing Site - 18° 26.999'N – 077° 59.153'W

1.3.2.3.1 Physical Description

The landing site proposed for the Montego Bay area is just east (within 200m) of the mouth of the Great River approximately 4.5 km to the west of Montego Bay on Highway A1. The landing site has been selected due to the fact that large pathways of silt and sand on coral reefs or sea grass beds are located around the mouth of the river which is most suitable for the laying of cable of this type. This is most likely due to the inflow of fresh water and sedimentation which occurs in the area.

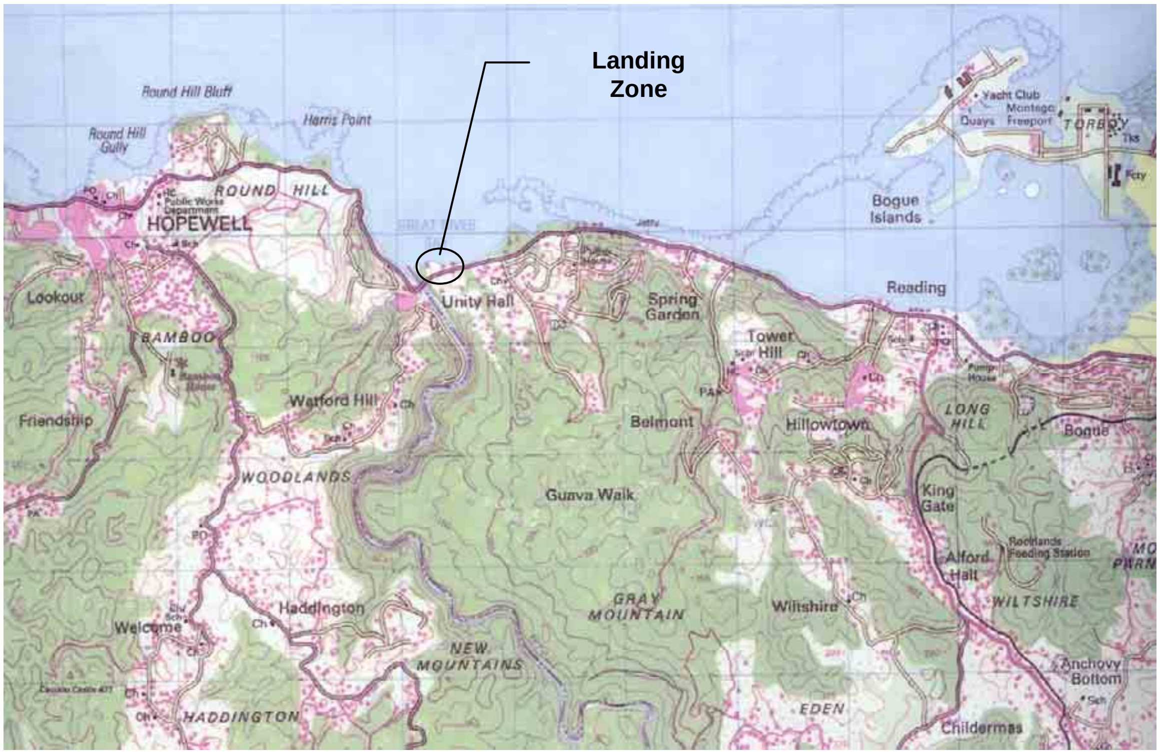


FIGURE 1-14: MONTEGO BAY CABLE LANDING ZONE

FIGURE 1-15: SITE PICTURE FROM MONTEGO BAY CABLE LANDING POINT

At present, the proposed building location is in Reading within the property of the Chas O. Ramson Limited facility. The site is approximately 2.5 km west of Montego Bay and approximately 2 km east of the landing site at coordinates 18°26.742’N, 077°57.369’W. The site is approximately 5-6 meters above sea level, has 24 hour security and electricity is available within 50 m of the site. It is proposed that Fibralink will work with the relevant property owners and regulatory agencies to gain the necessary access and easements required to extend the cable from the landing site to the equipment building.

FIGURE 1-16: PROPOSED BUILDING LOCATION IN READING

1.3.3 Recommended Installation Techniques

1.3.3.1 General

This section details preliminary installation operations based on available information, experience and standard technology

1.3.3.2 Route Surveys

A marine route survey has been conducted. The main objective of the marine route survey along the projected cable routes was to develop sufficient bathymetric data to engineer and install the fibre optic cable.

Diver swim surveys have also been conducted in the shallow water sections. This was done in order to find an appropriate route; thereby avoiding any kind of obstacles and sensitive features such as coral reefs and sea grass areas.

Based on the information obtained from the Route Surveys, a suitable cable route has been selected. Illustrations of the inshore topography for the various selected route segments of the installation are illustrated in Figure 3-2, Figure 3-4, and Figure 3-6 and respectively.

1.3.3.3 Cable Installation

There are two separate operations required for cable installation, which are:

- Shore end operations
- Deep-water operations

The shore end activities are more site specific and are detailed based on the landing site. The redundancy of the system allows for two-switch-traffic, where the two separate cables coming into Jamaica are independent of each other so that the end user will not experience a disruption in their service should any one cable becomes damaged and taken out of service for repairs.

1.3.3.3.1 Laying Vessel

A cable ship or converted flatback vessel (offshore supply) will be used to install the cable. If using a flatback vessel, all the necessary equipment to manipulate the cable should be installed and tested prior to the start of the operations. The main necessary equipment is:

- Cable tank with an internal cone respecting the minimum radii of curvature of the cable.
- Caterpillar or linear cable engine (5 tons capacity).
- 20 feet container for splicing operations
- Small crane (3 tons capacity)

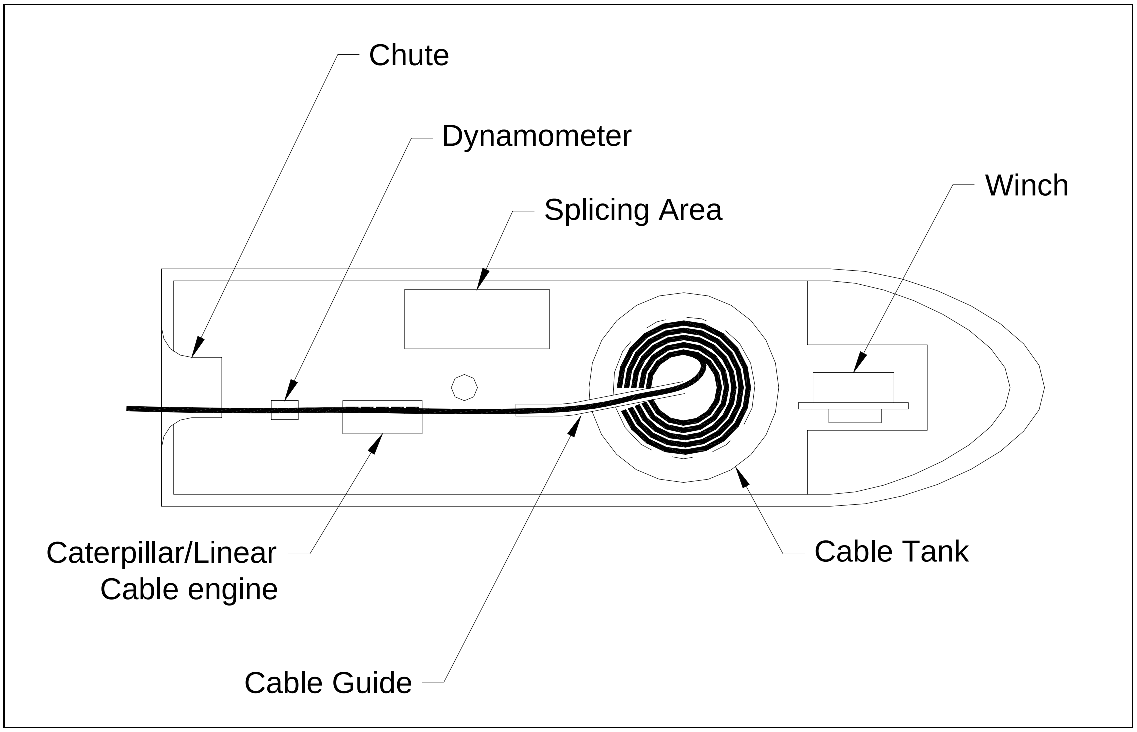


FIGURE 1-17: TYPICAL DECK LAYOUT

1.3.3.3.2 Shore End Operations

TABLE 1-2: TYPICAL SHORE END EQUIPMENT LIST

Equipment		Details
Support Vessel	Small Vessel such as a 16’ Zodiac equipped with an outboard motor for the shore crew and divers	
Shore vehicles	Line truck	Stand by vehicle to act as emergency backup or stopper
	Winch or winch vehicle	Min Capacity of 6 tons line pull
	Shore transportation (Car or Van)	
	Splicing van	
Special Equipment	2 x 18” diameter sheaves	To be set up in the manhole to guide and redirect the cable and maintain minimum bending radiuses
	Cable slider	
	5” snatch blocks (2)	
	2000’ of 1 1/8” diameter Uniline.	
	Cable guides	
	Shore power 5000 watt generator	
	Lights	
	Rotary impact drill or air tool with air supply	

Equipment		Details
	Hand tools (full set)	
	Barricades and safety tape	
	Traffic control and work area protection	

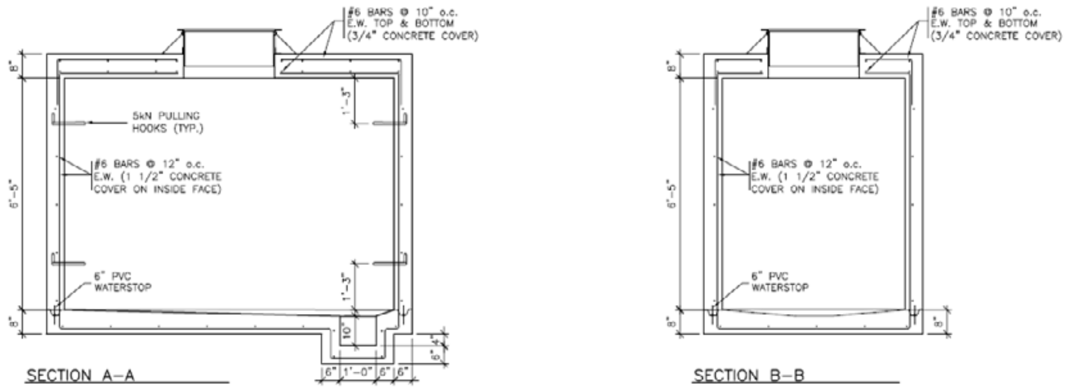
1.3.3.3.2.1 Procedure

The shore end superintendent will conduct a radio check prior to the start of cable pulling operations. The key personnel will be called and asked to respond individually -vessel aft deck, vessel bridge, winch operator and dive boat. The shore superintendent will then commence the shore end pulling operations.

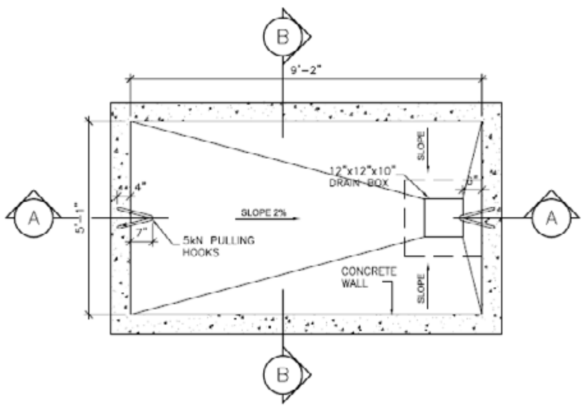
FIGURE 1-18: ILLUSTRATION OF INSTALLATION FROM SHIP WITH A SHEAVE

The main lay vessel will be positioned near the seaward end of the directionally drilled pipe, in approximately 11 meters of water. The pull wire in the pipe will be retrieved by the diver and handed off to the dive boat who will in-turn pass the line to the ship. A 1⅛” uniline will be attached to the pull wire and pulled ashore using the winch stationed near the manhole (See Figure 1-19 and Figure 3-16). When the uniline is secured on shore, the ship will be advised. The deck crew will attach the cable to the uniline using a 6000lb Miller or similar swivel and a Yale cable grip. The deck crew will then advise the shore-end superintendent that pulling can proceed. The divers will follow the cable end to the pipe and ensure that the cable enters the pipe smoothly. The deck crew aboard ship will closely monitor payout tensions and draw speed as the cable is pulled into the manhole.

FIGURE 1-19: ILLUSTRATION OF INSTALLATION WITH A WINCH ON THE SHORE; BUOYED CABLE ON THE RIGHT



TYPICAL MANHOLE DETAIL - MARINE CABLE LANDING LOCATIONS
SCALE 1/2"=1'-0"



PLAN
SCALE 1/2"=1'-0"

FIGURE 1-20: MANHOLE PLAN DETAILS

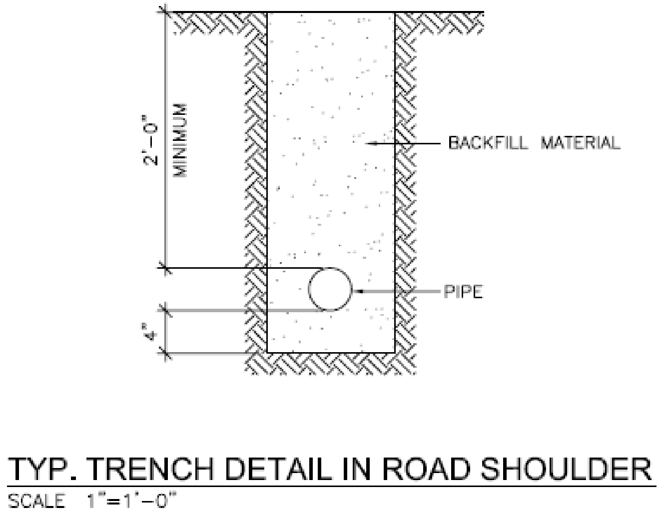


FIGURE 1-21: TYPICAL TRENCH DETAIL IN ROAD SHOULDER

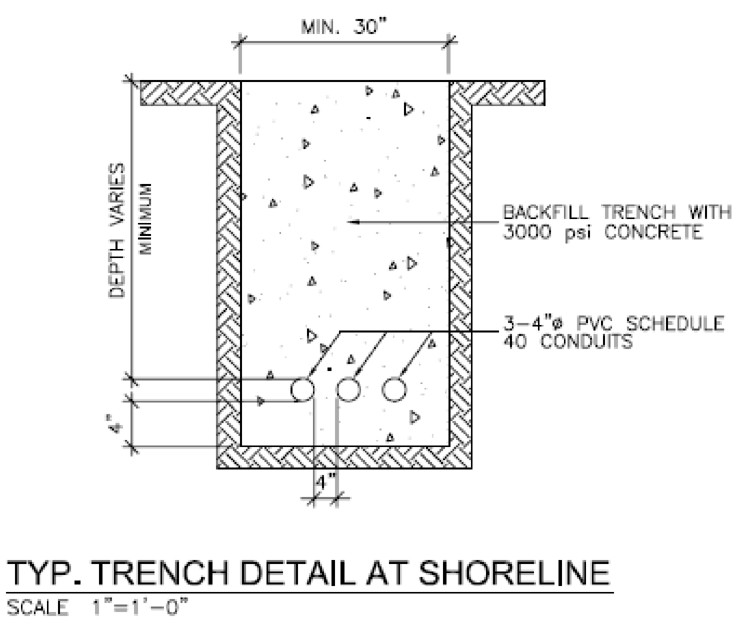


FIGURE 1-22: TYPICAL TRENCH DETAIL AT SHORELINE

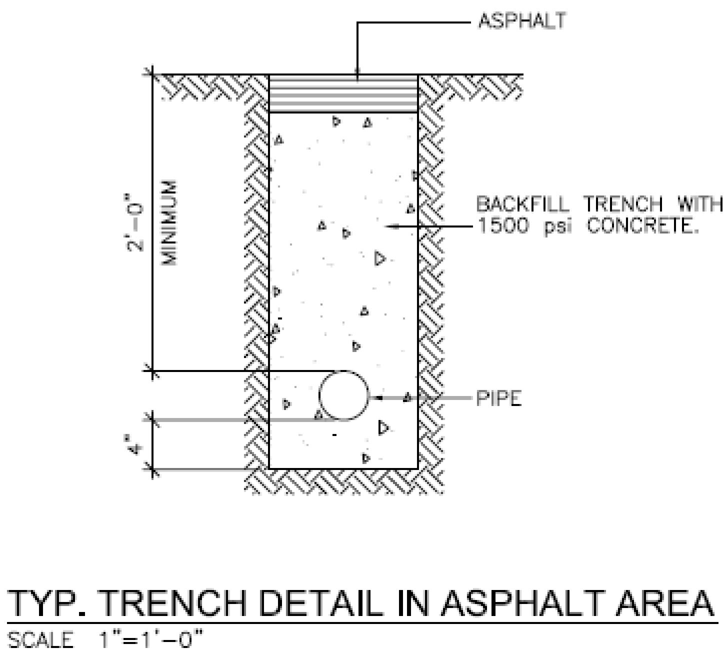


FIGURE 1-23: TYPICAL TRENCH DETAIL IN ASPHALT AREA

When the cable reaches the shore and sufficient cable slack has been brought ashore the cable will be stoppered off to the line vehicle. The ship will make ready to start laying cable and move off at a speed of approximately 1.0 knots. Cable will be surface laid throughout the route.

FIGURE 1-24: ILLUSTRATION OF INSTALLATION USING A LANDING CRAFT

In order to reduce the potential impact to hard-bottom substrate, the route has been designed to avoid crossing high-relief outcrops.

After the ship has laid the cable, the divers will swim the length of the cable from the end of the duct to a water depth of 85 ft to ensure that the cable is lying on the bottom and no suspensions exist. Any minor suspensions will be removed by hand. If the divers discover more severe suspensions the cable ship will evaluate recovering the cable, clear the suspension and re-lay the cable. Once divers have confirmed that the cable is satisfactorily positioned, the ship will resume laying. When approximately 2.5 km of cable have been laid, the stopper will be released on shore. The manhole clamp will be installed on the cable.

1.3.3.3.2.2 Splicing Operations

Splicing operations will start as soon as the clamp has been installed on the cable. The splicing will take place in a climate controlled environment vehicle. Upon completion of the manhole splice the cable will be tested bi-directionally using set-ups at the cable station and aboard ship. Satisfactory results will allow the splicers to permanently close the manhole joint.

1.3.3.3.3 Deep Water Operations

1.3.3.3.3.1 Laying Specifications

After receiving confirmation that cable is securely anchored, the vessel starts to move seaward.

Care must be exercised over the slack control as the vessel moves away from the shore end landing position to avoid pulling the cable and inducing suspensions.

The cable is surface laid throughout the whole lay. Cable is paid out from the linear cable engine as the vessel advances along the planned cable route.

Throughout lay operations, the cable tension will be monitored and adjusted as necessary to maintain the design level installation slack in the cable. The vessel shall move in a straight path from its position during landing operations to the first alter course. Movement between this alter course position and subsequent alter courses must also be a straight path.

The ship stops at the next site shore end position and starts shore end landing operations as described in corresponding shore end section.

1.3.3.3.3.2 Final Splice Optional Laying Scenario

In case of bad weather or unforeseen events, a direct lay as described in the previous section might not be possible. A 2-segment lay with a final splice would then be necessary.

1.3.3.3.3.3 First lay

After receiving confirmation that cable is securely anchored, the Master of the laying vessel instructs the tug (if used) to release the mooring lines. The vessel then starts to move seaward. Care must be exercised over the slack control as the vessel moves away from the shore end landing position to avoid pulling the cable and inducing suspensions.

The cable is surface laid throughout the whole lay.

Cable is paid out from the linear cable engine as the vessel advances along the planned cable route. Throughout lay operations, cable tension measured at the stern dynamometer is maintained in strict accordance with the provided tension tables. The vessel shall move in a straight path from its position during landing operations to the first alter course. Movement between this alter course position and subsequent alter courses must also be a straight path.

Lay operations then continue on the planned route. At the end of the lay i.e. at the final splice location, fifty (50) meters of line are streamed along the cable route and a temporary anchor (250 lbs. concrete clump) placed. The end of the Uniline is then buoyed off.

1.3.3.3.3.4 Cable Recovery

While proceeding to the buoy position, all required deck equipment, (i.e., hack lines, recovery line, lashing & stoppers) is staged as required.

Cable splicing equipment are broken out and tested prior to recovery of the cable.

Cable end buoy is recovered.

When the Uniline begins to take a lead to the cable end, the vessel begins moving to the cable end as the rope is recovered.

The vessel proceeds in this manner until a sufficient amount of the laid cable is onboard to perform the splice.

1.3.3.3.4 Final Splice

End of both cables is fed into the splicing area.

Splicing personnel proceed with the final splice.

The fibers are terminated and tested.

When the final splice is completed and the tests show no fault, the cable is out board. The system should be tested when touching the seabed, before cutting the lowering line.

1.3.4 Cable Repair Techniques

1.3.4.1 General

The following section briefly touches on cable maintenance and repair. All submarine cables are susceptible to failure from external sources, such as fishing activity and anchor mauls. The following table gives the percentage of failure causes for 380 reported cable faults. Careful planning and implementation can greatly reduce the risk of such failures. Initial prevention will result in a highly reliable telecommunications facility.

TABLE 1-3: PERCENTAGE OF FAILURE CAUSES FOR 380 REPORTED CABLE FAULTS

Cause	Count	%
Abrasion	18	4.7%
Anchor	49	12.9%
Branching Unit	2	0.5%
Cable or Survey Ship Activity	5	1.3%
Dredging/Drilling and Pipe Installation	12	3.2%
Earthquake or Seabed Movement	10	2.6%
Equaliser	1	0.3%
Fatigue	1	0.3%
Fishing Activity	184	48.4%
Impact by Hard Object	5	1.3%
Insulation Failure	3	0.8%
Jointing Box	5	1.3%

Cause	Count	%
Manufacturing Defect - Cable	4	1.1%
Repeater	17	4.5%
Unknown - Cable Deliberately Cut	1	0.3%
Unknown - Cable Mauled	6	1.6%
Unknown - Cable not repaired	1	0.3%
Unknown - Fibre Attenuation	5	1.3%
Unknown - Kinks, Twists, Loops	9	2.4%
Unknown - Shunt Fault	31	8.2%
Unknown - Tension Break	11	2.9%
TOTAL	**380**	

1.3.4.2 Canvassing Offshore Industries

Fibralink will make strong representations to the governments to have the cable route declared a prohibited anchorage.

If bottom fishing abounds in the vicinity of the route, it will be appropriate to establish a program of liaison and dialogue with the industry. Hydrographic charts could be personalized to highlight the route and carry suitable warnings and be distributed free with other promotional items.

1.3.4.3 Repair Methodology

When a cable system is interrupted, tests are made from terminals or suitable access points ashore to localize the trouble to an accurate geographical position, as derived from laying records. This localization will dictate the repair method to be selected, as follows:

1.3.4.3.1 In Diver-Depths

When the interruption is close inshore (preferably less than 20 meters), a barge can be mobilized and moored over the site. Diving inspection or an electronic probe will locate the damaged area.

In the case of an electronic probe, a low frequency tone (e.g. 25 Hz) is injected on the center conductor from the terminal. The probe in its various forms is deployed close to the cable. This will detect either the electromagnetic or electrostatic field developed along the cable. The range of the signal decreases with the length from the terminal but should cause no problems in this case. Probes can be a diver hand held device or attached to a two conductor cable towed from a surface vessel (towed electroding).

This technique permits accurate location of the cable and further, will usually indicate the fault location by registering a significant change in signal field strength at that point.

The ends will be hauled (or floated) to the surface and secured at the barge. After suitable electrical/optical tests have confirmed no other interruptions are present, a new spare piece is jointed/spliced in and the bight lowered, under controlled conditions, to the seabed. If appropriate the exposed cable will be diver-jetted into the seabed.

1.3.4.3.2 Conventional Method in Deep Water

The assigned repair vessel travels to the location and, if appropriate, establishes the precise position of the interruption by means of electroding. The vessel then using a special detrenching grapnel, grapples across the cable and raises it to the surface. The bight of cable is hauled inboard on the grapnel and secured. After cutting the bight, the ends are opened and tested. In the ideal case testing in one direction will establish its mechanical/transmission integrity while testing in the other direction will indicate the break to be close to the ship.

After sealing and buoying off the good end, the short stray end is recovered to a spare storage tank or coil space and the ship proceeds to grapple for the end on the far side of the break. She raises the bight of cable, boards it, cuts the bight and tests. If everything is satisfactory she then splices on replacement cable, from a storage tank or coil on board, to the good end and pays this down to the seabed while steaming towards the buoyed end.

When the cable buoy has been recovered and the first good end tested and confirmed to be still OK the payout is terminated and the replacement cable is cut on the foredeck. Its end is joined to the recovered end and a final splice is made, whereupon the bight of cable is lowered to the seabed. After appropriate transmission tests have been made, the system can be returned to traffic.

Mobilization would comprise loading the replacement cable, gathering such customer specialists and equipment as are required and proceeding to site.

The first alternative to a dedicated cable ship as above would be to engage an offshore flatback on spot-charter, if available, and spend some days fitting out and mobilizing as above for the repair. Then proceeding to site.

1.3.4.4 Spare Cable and Repair Facilities

Spare cable and repair plant will be located as close to the cable route as possible, or at the base of the dedicated cable ship or ship of opportunity. Spare cable will be stored in a sheltered, temperature-controlled environment and be readily available for loading to ship at a deep-water berth.

ALTERNATIVE ANALYSIS

2 Alternative Analysis

2.1 Outline

2.1.1 Landing Site Alternatives

The proponent also considered a number of alternate landing sites along the South-east and Northern coasts of the island. The landing sites were selected based on a number of factors. Of primary concern was the type and degree of impact the cable installation would have on the coastal and marine ecology. The sites that are proposed in this report represent the best selections from exhaustive considerations of a number of sites. Some of which were disqualified on the basis of:

- Estimated coastal and marine ecological impacts
- Impacts to and on cable laying installation, and
- Through consultations (such as the Montego Bay Marine Park).

The Bull Bay landing site is an existing cable landing site with the necessary infrastructure already in place (manhole and cable housing building). Other sites would have represented "green" sites which would have higher potential for impacts.

The alternative to the Tower Isle landing site was in the Port Antonio area. However, this area proved to be within a protected area and as such was not used.

The alternative to the Montego Bay landing site and cable routing would have taken the cable through large areas of sea grass in the Reading area, west of Montego Bay. In consultation with members of the Montego Bay Marine Park the Great River site was accepted. This site is on the edge of the marine park in an area with the least possible potential for impacts.

2.1.2 Technological Alternatives

The proponent evaluated a number of technological alternatives that either did not fulfill the purpose of the project or did not meet agreed criteria. The major factors that affected the acceptability of those options were potentially adverse environmental effects and problems related to technical feasibility. The following details the advantages of incorporating a high speed data fiber-optic cable in Jamaica, when compared with other technologies outlined below:

- **SPEED:** Fiber optic networks operate at high speeds - up into the gigabits
- **BANDWIDTH:** large carrying capacity
- **DISTANCE:** Signals can be transmitted further without needing to be "refreshed" or strengthened.
- **RESISTANCE:** Greater resistance to electromagnetic noise such as radios, motors or other nearby cables.
- **MAINTENANCE:** Fiber optic cables costs much less to maintain.

2.2 No-Action Alternative

The proposed submarine fiber-optic cable would not be installed. No operations and maintenance activities would occur. This alternative would not fulfill the purpose of the project or meet the identified needs for high-speed data transmission. The enormous economic and social development opportunities for Information Communication Technology (ICT) as well as the investment will be lost, including the potential for job creation. It therefore would be necessary to consider alternative methods of meeting data transmission requirements.

2.3 Radio

Other high-speed wireless providers, such as those using 24 GHz, 28 GHz and 38 GHz spectrum, have concentrated on the more densely populated urban areas because of transmission distance limitations. Signals using these radio frequencies are generally limited to a one to three-mile radius, or three to 28 square miles, which makes application in less densely populated areas less economical. These frequencies are inherently more susceptible to weather and environmental interference.

2.4 Telephony

The telephone industry predominantly uses copper twisted-pair for the delivery of communications services to commercial and residential customers. Plain old telephone systems have been the primary means of communicating both locally and long distance. The problem is that it was designed for the transmission of voice communications. It's a mature technology, but inadequate by design, the amount of bandwidth that can be delivered is restricted by the characteristics of the copper twisted-pairs installed between the customer and central office.

Fiber-optics span the long distances between local phone systems as well as providing the backbone for many network systems (such as cable television services, university campuses, office buildings, industrial plants, and electric utility companies).

The main difference is that fiber-optics use light pulses to transmit information down fiber lines instead of using electronic pulses to transmit information down copper lines.

Services such as DSL delivered across a local exchange carrier’s existing copper wire system are capable of delivering very high speeds. However, DSL suffers performance limitations based on the distance from the customer premises to the serving central office. Distances are limited to about four to five miles from a central office for the lowest speed solutions and 10,000 feet or less for the fastest. Additionally, much of the plant is physically incapable of providing broadband service.

2.5 Satellite Data Transmission

The proponent evaluated a non-cable option of replacing the proposed telecommunication and data transmission services with satellite communications. The use of communications satellites to provide the services identified as necessary would require no construction in the marine environment, but would not provide the capacity or quality of service proposed under the project.

Satellite networks, such as direct broadcast satellite, currently offer only one-way Internet access. Upstream access is limited to existing copper telephone lines. Other alternatives like Low Earth Orbit (LEO) Satellite Systems are not scheduled to be completed for years and have not proven capable of providing "carrier-class" voice or data services. Fibre optic cables transmit voice and data traffic with higher reliability and security at a cheaper rate than satellite. While a satellite call must travel 27,000 miles (35,780 km) from the earth to the satellite and then another 27,000 miles back, a Jamaica to Florida fibre optic call need only travel about 200 miles point-to-point. At the speed of light this helps to eliminate the delays suffered during a satellite telephone call.

The option does not meet the purpose of the project.

ENVIRONMENT SETTING & BASELINE

3 Environment Setting & Baseline

3.1 Physical Environment

3.1.1 Segment 1 – Bahamas to Bull Bay, St. Thomas

3.1.1.1 Bull Bay

3.1.1.1.1 Topography and Geology

3.1.1.1.1.1 General Topography and Geology

Elevations at the site increase gently from sea level along the shoreline to a maximum of 1.5 metres above sea level along the boundary with the Bull Bay to Kingston main road, in the vicinity of Seven Miles. The soil at the shoreline is dark silty-sand overlaid by coarse and smooth pebbles. The potential for erosion of soil materials during periods of moderate to heavy rainfall at the site is minimal as the area continuously undergoes strong wave action and is fairly stable.

3.1.1.1.1.2 Beach Topography and Geology

Along the beach, the substrate depth ranged from 0 cm to 10 cm, and consists of coarse, angular, highly sorted carbonate sand grains with large pieces of coralline material along with the numerous varied sized pebbles. This suggests recent (less than 50 years) storm surge deposits (possibly from Hurricane Ivan in September 2004). Sediments on the sandy shore are composed of typical dark sand grains as seen on Jamaica's south coast.

The site is in a major earthquake zone. Between 8 and 15 earthquake events of intensity greater than six (VI; Modified Mercalli Scale) have been reported in this fault area between 1874 and 1978.

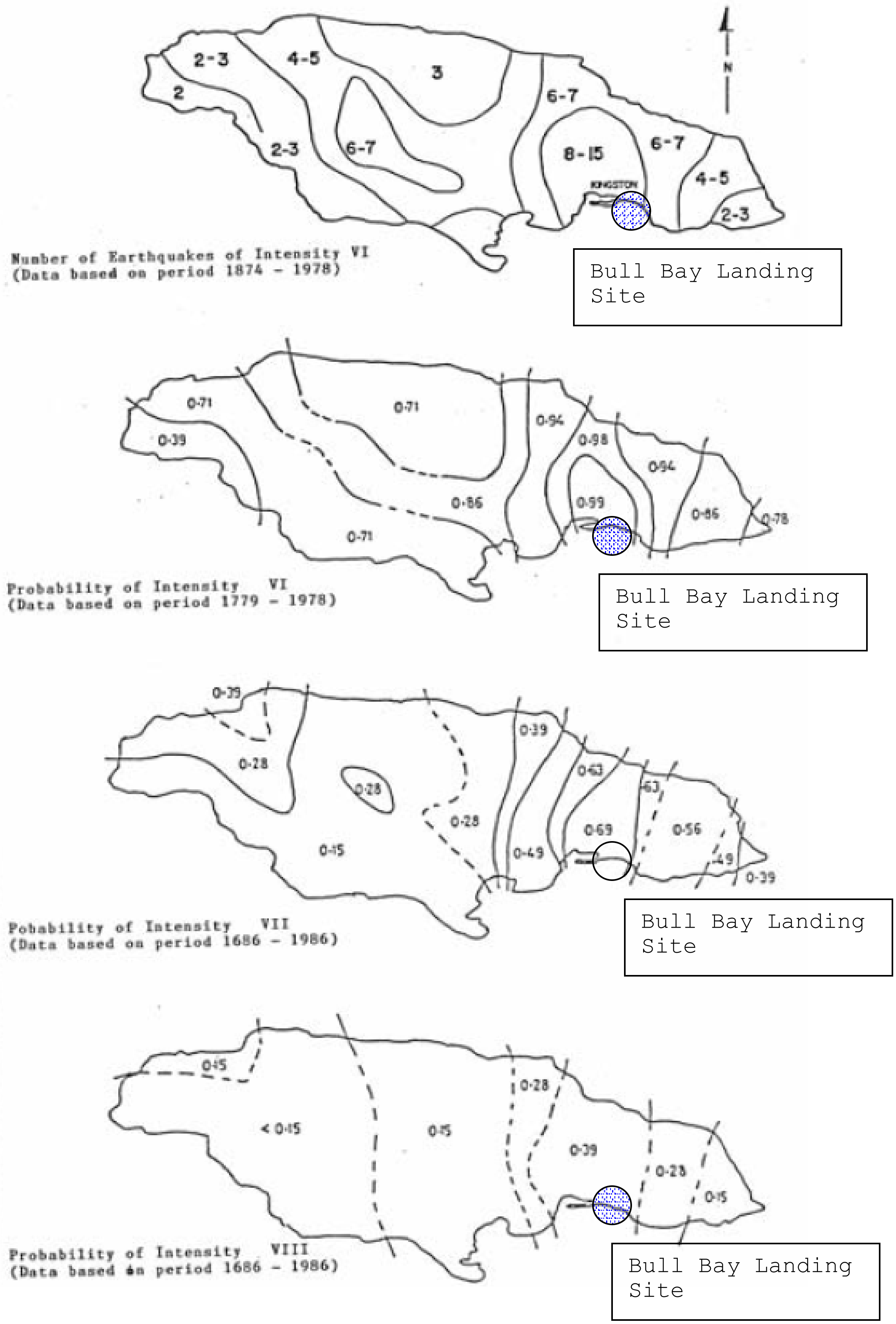


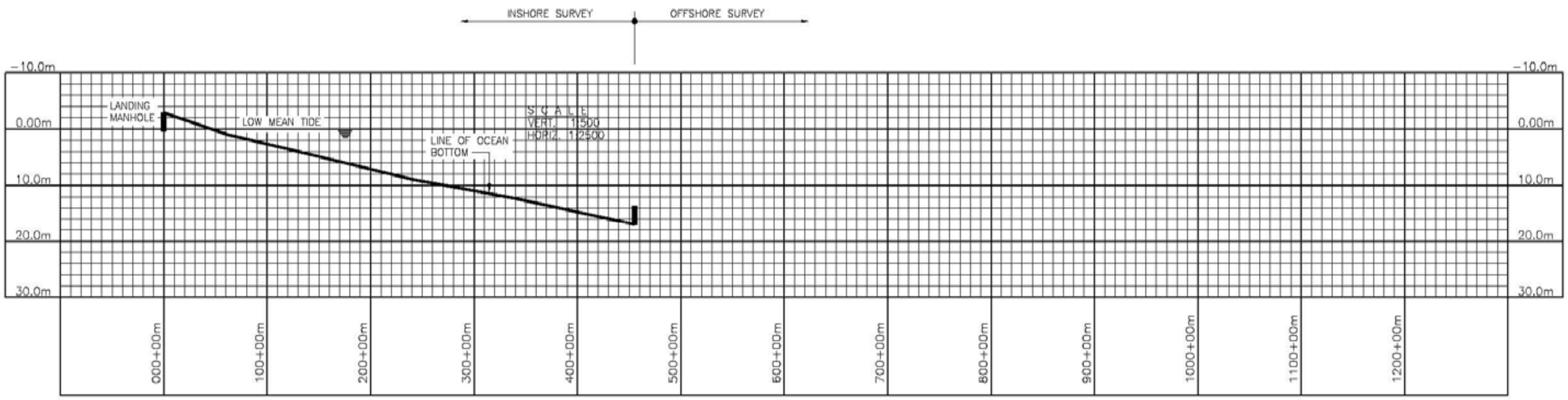
FIGURE 3-1: EARTHQUAKE HAZARD ZONATION OF JAMAICA WITH BULL BAY LANDING SITE AREA HIGHLIGHTED

It is not perceived that the present topography and geology of the site requires any special considerations prior to a development such as the one proposed being implemented.

3.1.1.1.1.3 Inshore Topography

The inshore has a relatively, consistent declining slope substrate of white calcareous sand from near shoreline to about 460m where offshore distinction is made (Figure 4-6 below). This represents a depth of no more than 18m. Based on video-photography taken during the marine survey, the area is made-up of soft sandy substrate.

There is no coral reef substrate along the survey path or rocky outcroppings.



STATION	NORTH COORDINATE	WEST COORDINATE	DEPTH		SOIL	ROCK	BRITISH UNIFIED SOILS CLASIFICATION	NOTES
			FEET	METRES				
Landing Manhole 000+00	N17°56.888'	W76°42.138'						
000+62	N17°56.857"	W76°42.125"	5'-0"	1.524	SAND / BOLDERS	MED-STRONG LIMESTONE	SMI	APPROX. 300mm SAND OVER LIMESTONE
100+43	N17°56.813"	W76°42.119"	15'-0"	4.572	SILTY SAND	MED-STRONG LIMESTONE	SMI	APPROX. 300mm SAND OVER LIMESTONE
200+42	N17°56.761"	W76°42.106"	30'-0"	9.144	SILTY SAND	MED-STRONG LIMESTONE	SMI	APPROX. 300mm SAND OVER LIMESTONE
300+38	N17°56.712"	W76°42.088"	40'-0"	12.192	SILTY SAND	MED-STRONG LIMESTONE		APPROX. 300mm SAND OVER LIMESTONE
End of Inshore Survey 400+55	N17°56.650"	W76°42.072"	60'-0"	18.288	SILTY SAND	MED-STRONG LIMESTONE		APPROX. 300mm SAND OVER LIMESTONE

FIGURE 3-2: INSHORE TOPOGRAPHY OF CABLE ROUTE IN BULL BAY WITH COORDINATES

3.1.2 Segment 2 – Bahamas to Tower Isle, St. Mary

3.1.2.1 Tower Isle

3.1.2.1.1 Topography and Geology

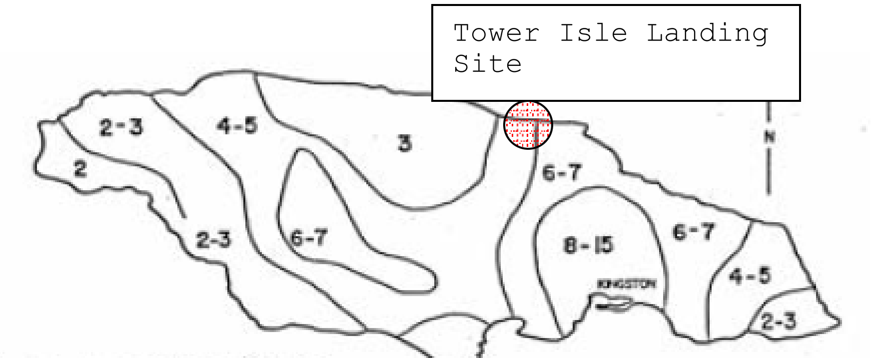
3.1.2.1.1.1 General Topography and Geology

Elevations at the site increase gently from sea level along the shoreline to a maximum of 1.5 metres above sea level along the boundary with the Tower Isle to Ocho Rios main road. The site is approximately 5km east of Ocho Rios and 10km west of Oracabessa. The soil at the shoreline consists of soft sand with intermittent silty-clay deposits. There is a minimal potential for erosion of soil materials at the site. The topsoil is on strong bedrock of limestone, possibly from the Hopgate Formation.

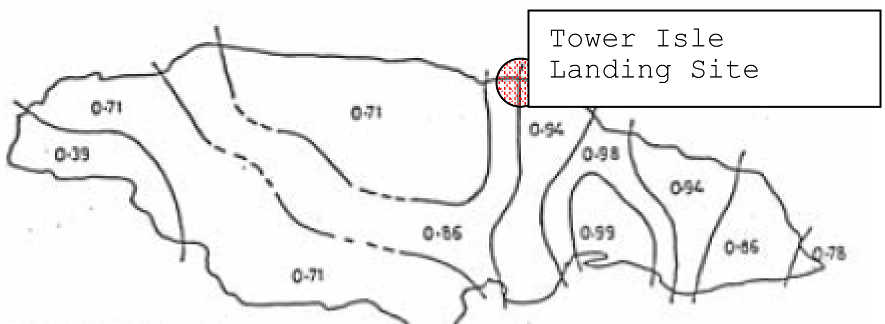
3.1.2.1.1.2 Beach Topography and Geology

Along the beach, the soil type at the site is typically dark-brown to black, sandy, organic and typically less than 0.3 m thick in most areas. Below the soil layer is a sequence of limestone sands mixed with silt and minor clay fraction.

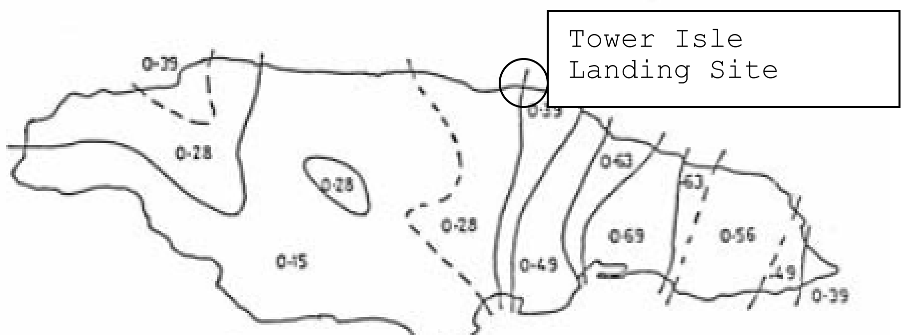
The site is in a moderate earthquake zone in terms of frequency. Between 4 and 5 earthquake events of intensity greater than six (VI; Modified Mercalli Scale) have been reported in this fault area between 1874 and 1978. It is also in close proximity to a region that experienced 6 – 7 earthquakes during the same period. The probability of intensity VII was 0.39 for the period 1686 – 1986. However, cable landings have been in this area for many years without any adverse impacts due to the effect of earthquakes or other natural disasters.



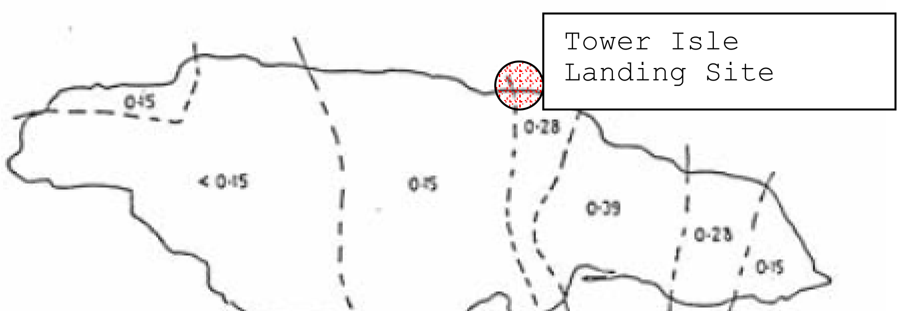
Number of Earthquakes of Intensity VI
(Data based on period 1874 – 1978)



Probability of Intensity VI
(Data based on period 1779 – 1978)



Pobability of Intensity VII
(Data based on period 1686 – 1986)



Probability of Intensity VIII
(Data based on period 1686 – 1986)

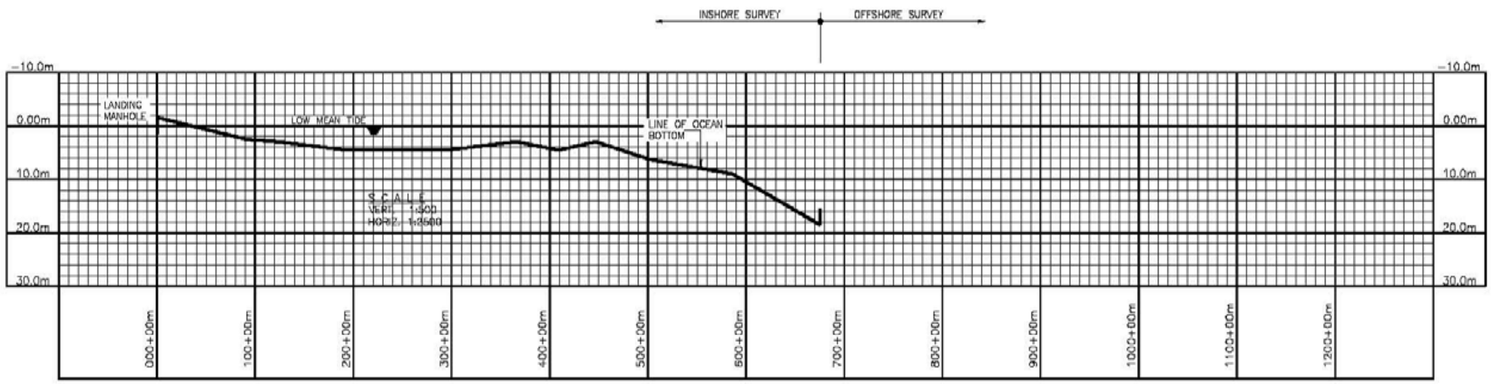
FIGURE 3-3: EARTHQUAKE HAZARD ZONATION OF JAMAICA WITH TOWER ISLE LANDING SITE AREA HIGHLIGHTED

It is not perceived that the present topography and geology of the site requires any special considerations prior to a development such as the one proposed being implemented.

3.1.2.1.1.3 Inshore Topography

The inshore has a relatively flat substrate of white calcareous sand from near shoreline to about 700m where offshore distinction is made (Figure 4-4 below). This represents a depth of no more than 20m. Based on video-photography taken during the marine survey, the area is made of soft sandy substrate.

There is no coral reef substrate along the survey path or rocky outcroppings.



STATION	NORTH COORDINATE	WEST COORDINATE	DEPTH		SOIL	ROCK	BRITISH UNIFIED SOILS CLASIFICATION	NOTES
			FEET	METRES				
LANDING MANHOLE 000+00	N18°25.296'	W77°02.524'						
000+92	N18°25.329'	W77°02.504'	8'-0"	2.438		STRONG LIMESTONE		
100+26	N18°25.345'	W77°02.496'	10'-0"	3.048	SILTY SAND		SMI	APPROX. 300mm SAND OVER LIMESTONE
100+94	N18°25.378'	W77°02.477'	15'-0"	4.572	SILTY SAND		SMI	APPROX. 300mm SAND OVER LIMESTONE
200+51	N18°25.404'	W77°02.460'	15'-0"	4.572	SILTY SAND		SMI	APPROX. 300mm SAND OVER LIMESTONE
200+95	N18°25.425'	W77°02.448'	15'-0"	4.572	SILTY SAND		SMI	APPROX. 450mm SAND OVER LIMESTONE
300+88	N18°25.462'	W77°02.436'	10'-0"	3.048	SILTY SAND		SMI	APPROX. 300mm SAND OVER LIMESTONE
400+09	N18°25.483'	W77°02.428'	15'-0"	4.572		MED-STRONG LIMESTONE		MINIMAL CORAL LIFE EVIDENT. LIMESTONE/CORAL OUTCROPS SCATTERED BUT ELEVATED. PASSAGEWAYS AROUND LIMESTONE/CORAL OUTCROPS TO BE UTILIZED AS CABLE ROUTE.
400+47	N18°25.501'	W77°02.415'	10'-0"	3.048		MED-STRONG LIMESTONE		
500+02	N18°25.528'	W77°02.401'	20'-0"	6.096		MED-STRONG LIMESTONE		
500+88	N18°25.569'	W77°02.381'	30'-0"	9.144		MED-STRONG LIMESTONE		
End of Inshore Survey 600+78	N18°25.609'	W77°02.352'	60'-0"	18.288		MED-STRONG LIMESTONE		

FIGURE 3-4 INSHORE TOPOGRAPHY OF CABLE ROUTE IN TOWER ISLE WITH COORDINATES

3.1.3 Segment 3 – Ocho Rios to Montego Bay

3.1.3.1 Montego Bay

3.1.3.1.1 Topography and Geology

3.1.3.1.1.1 General Topography and Geology

Elevations at the landing site increase from sea level along the shoreline to a maximum of 3 metres above sea level along the boundary with the Great River to Montego Bay main road. The soil at the shoreline consists of coarse, poorly sorted, calcareous sand with numerous smooth pebbles. Care will be taken in the designs to guarantee structural stability of manhole particularly on the slopes. There is a minimal potential for erosion of soil materials during periods of light to moderate rainfall. During the assessment of the site, no obvious sources or existing pollution or contamination was observed across the project area.

3.1.3.1.1.2 Beach Topography and Geology

Along the beach, the substrate depth ranged from 0 cm to 10 cm, and consists of coarse, angular, highly sorted carbonate sand grains with large pieces of coral and marine tests. This suggests recent (less than 50 years) storm surge deposits. Sediments on the sandy shore are composed of large, poorly sorted, angular sand grains, 50% of which were larger then 125 mm.

The site is in a moderate earthquake zone in terms of frequency (Figure 3-5: Earthquake hazard Zonation of Jamaica with Montego Bay Landing Site Area Highlighted). Between 4 and 5 earthquake events of intensity greater than six (VI; Modified Mercalli Scale) have been reported in this fault area between 1874 and 1978. The probability of an intensity VII earthquake was 0.39 for the period 1686 – 1986.

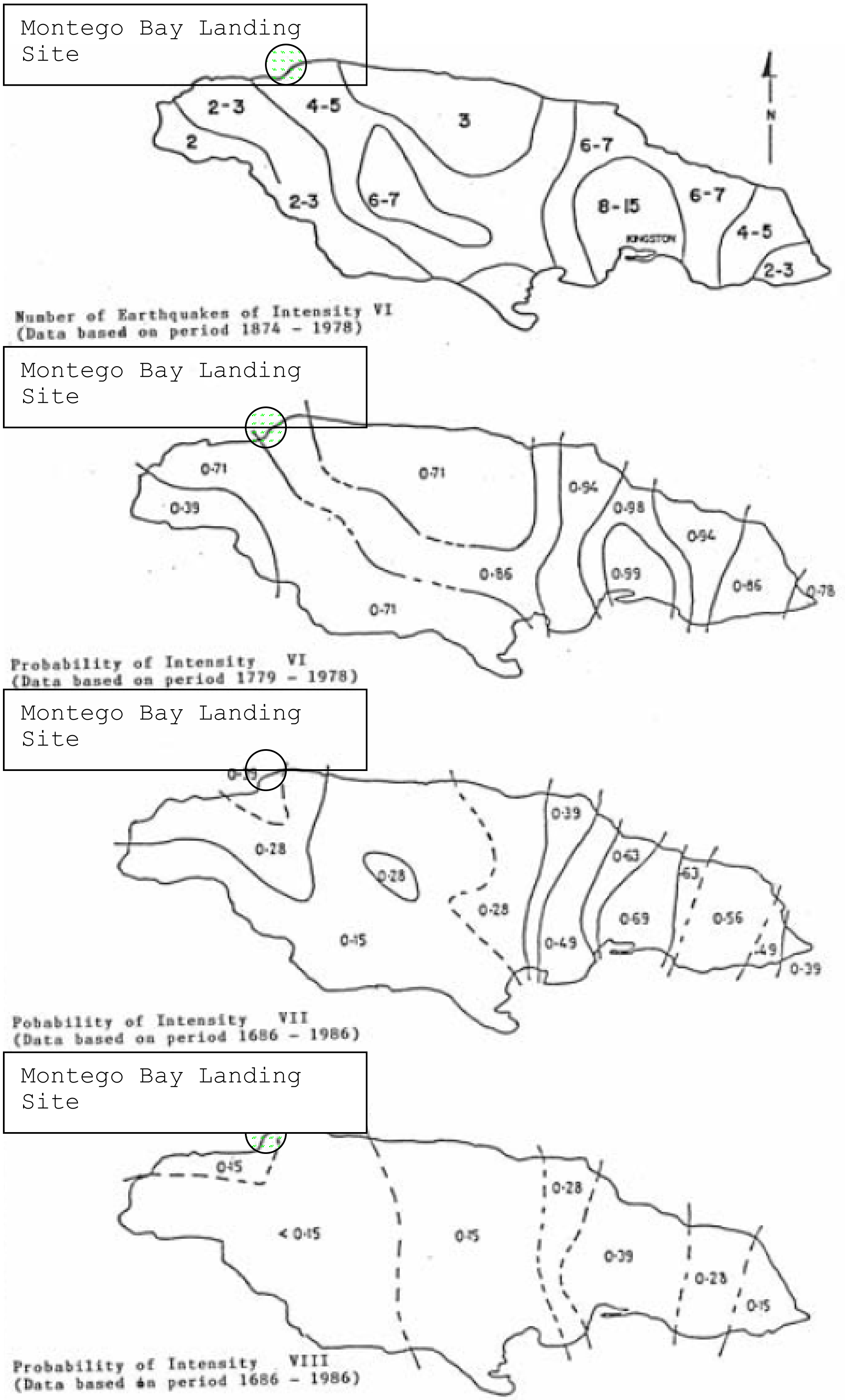


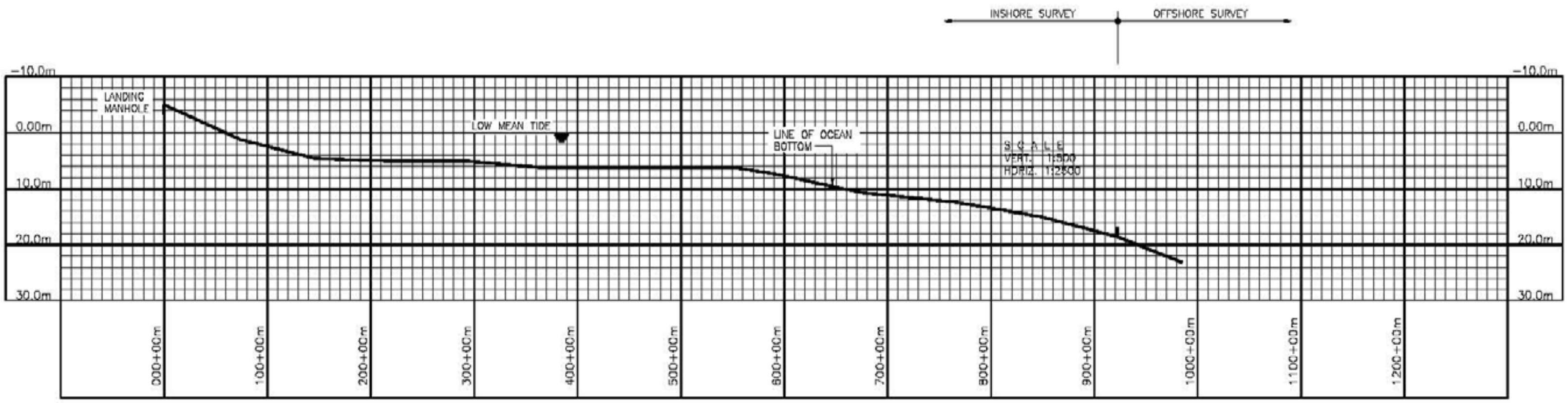
FIGURE 3-5: EARTHQUAKE HAZARD ZONATION OF JAMAICA WITH MONTEGO BAY LANDING SITE AREA HIGHLIGHTED

It is not perceived that the present topography and geology of the site requires any special considerations prior to a development such as the one proposed being implemented.

3.1.3.1.1.3 Inshore Topography

The inshore has a relatively flat undulating substrate from near shoreline to about 1000m where offshore distinction is made (Figure 4-2 below). This represents a depth of no more than 28m. Based on video-photography taken during the marine survey, the area is made of soft silty-sand substrate.

There is no coral reef substrate along the survey path or rocky outcroppings.



STATION	NORTH COORDINATE	WEST COORDINATE	DEPTH		SOIL	ROCK	BRITISH UNIFIED SOILS CLASIFICATION	NOTES
			FEET	METRES				
Landing Manhole 000+00	N18°28.932'	W77°59.330'						
000+74	N18°26.972'	W77°59.332'	6'-0"	1.624	SILTY SAND (MIN. 3'-0")		MS	
100+48	N18°27.011'	W77°59.331'	15'-0"	4.572	SILTY SAND (MIN. 3'-0")		MS	
200+18	N18°27.050'	W77°59.332'	17'-0"	5.182	SILTY SAND (MIN. 3'-0")		MS	
200+93	N18°27.091'	W77°59.328'	17'-0"	5.182	SILTY SAND (MIN. 3'-0")		MS	
300+64	N18°27.129'	W77°59.328'	20'-0"	6.096	SILTY SAND (MIN. 3'-0")		MS	
400+52	N18°27.177'	W77°59.323'	20'-0"	6.096	SILTY SAND (MIN. 3'-0")		MS	
500+52	N18°27.231'	W77°59.320'	20'-0"	6.096	SILTY SAND (MIN. 3'-0")		MS	
500+83	N18°27.253'	W77°59.317'	25'-0"	7.620	SILTY SAND (MIN. 3'-0")		MS	
600+76	N18°27.298'	W77°59.317'	35'-0"	10.668	SILTY SAND (MIN. 3'-0")		MS	
700+66	N18°27.347'	W77°59.314'	40'-0"	12.192	SILTY SAND (MIN. 3'-0")		MS	
800+49	N18°27.392'	W77°59.314'	50'-0"	15.240	SILTY SAND (MIN. 3'-0")	MED. TO STRONG LIMESTONE	MS	APPROX. 300mm SAND OVER LIMESTONE
End of Inshore Survey 900+23	N18°27.482'	W77°59.313'	60'-0"	18.288	SILTY SAND (MIN. 3'-0")		MS	

FIGURE 3-6 INSHORE TOPOGRAPHY OF CABLE ROUTE IN MONTEGO BAY WITH COORDINATES

3.2 Terrestrial Environment

3.2.1 Segment 1 – Bahamas to Bull Bay, St. Thomas

3.2.1.1 Bull Bay

The project site is located in a coastal area in an existing residential area and consists of the landing site and the cable housing. It is located just outside and to the east of the Port Royal Protected Area.

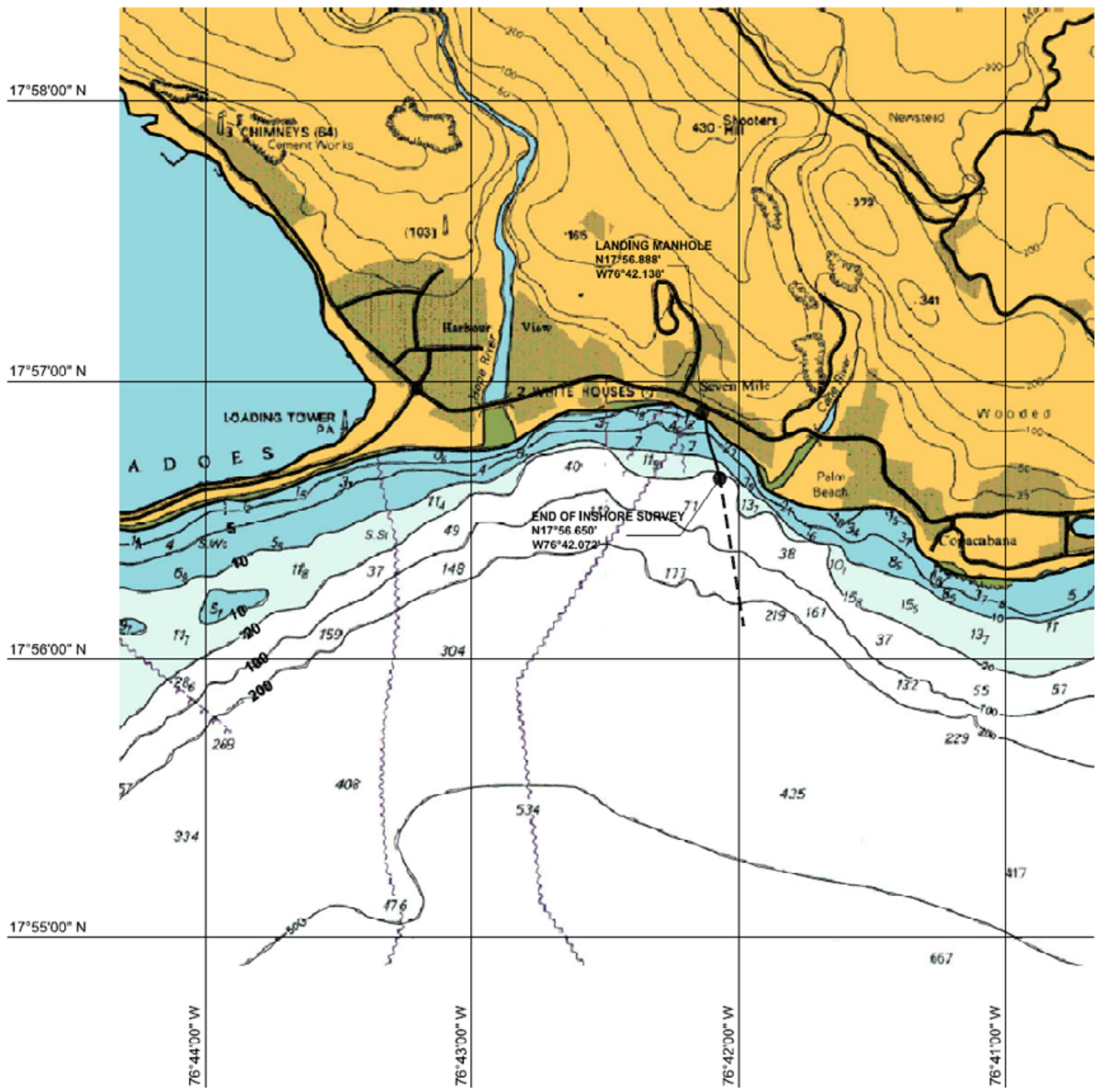


FIGURE 3: PROPOSED CABLE LANDING SITE FOR BULL BAY, ST. THOMAS

3.2.1.1.1 Vegetation

Landing Site - The landing site is located in the Seven Miles, Bull Bay region of St Thomas. The site has undergone some disturbance. There is no vegetation community at the site. The site is a rock strewn beach area beside the main road. The beach is composed of dark coarse sand with numerous washed up beach rocks. The area is prone to high winds and strong wave action and is a fully developed mix of formal and informal residential communities. The only plant life present is the grass at the road verge and it is not well represented either.

There is an existing manhole which will reduce the level of disturbance at the site.

Cable Housing Site - The cable house is to be sited at the existing AT&T facility which has manhole and underground conduits in place. As such, no disturbance of existing terrestrial community adjoining property is necessary.

3.2.1.1.2 Faunal Survey

The landing site is located on a narrow strip of coastal land bordered by the sea and the main road. There are no trees or plants on the narrow strip of beach; hence no nesting birds were seen in the area. Several marine bird species were observed such as gulls but none nest nearby or would be affected by cable laying activities on the seabed.

No crab holes or crabs were observed.

3.2.2 Segment 2 – Bahamas to Tower Isle, St. Mary

3.2.2.1 Tower Isle

The project site is located in a coastal area in an existing residential/resort area and consists of the landing site and the cable housing both at Tower Isle, St. Mary.

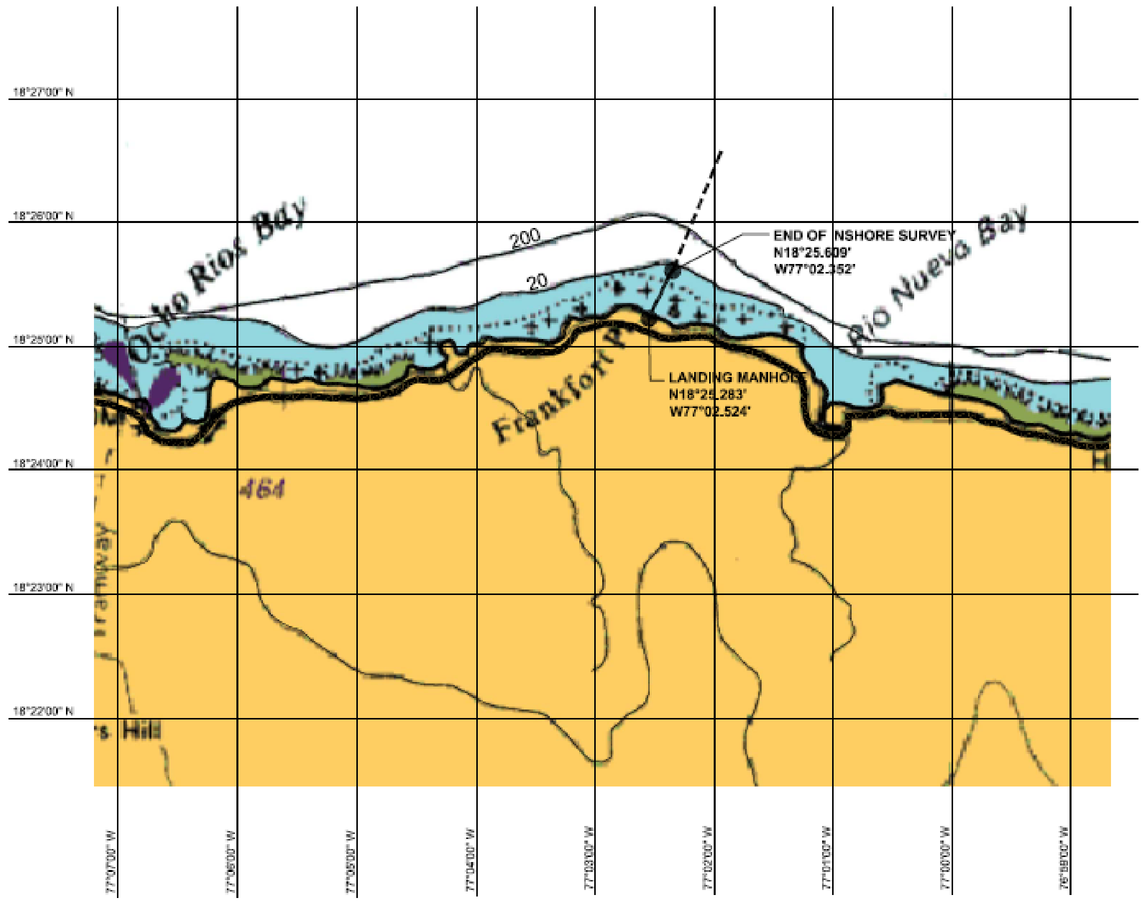


FIGURE 2: PROPOSED CABLE LANDING SITE AND ROUTE FOR TOWER ISLE, ST. MARY

3.2.2.1.1 Vegetation

Landing Site - The landing site is located in the vicinity of the Couples Ocho Rios Resort at Tower Isle, St Mary. The site has undergone some disturbance. The vegetation communities observed, are a remnant of the original coastal vegetation, and only contain a portion of the species usually found in a typical coastal community.

The foreshore can be classified as dark-brown to black sandy soil, with little organic content. Approximately 2m from the water's edge, beach pioneer plants such as *Coccoloba uvifera* (Sea grape) and *Sesuvium portulacastrum* (Seaside purslane) were present. These species are typical coastal species, which are adapted to hot, salty conditions. Further inland, succession in vegetation type was observed with a transition to shrubs and grasses. The majority of the trees at the site consisted of mature tree species, approximately 2m – 3m (6ft – 9ft) in height. The shrub layer was not well represented, and large areas under the trees were bare. The dominant plant was the West Indian Almond (*Terminalia catappa*) with an occasional seagrape (*Cocoloba uvifera*) and coconut (*Cocos nucifera*), trees common in coastal locations. The substrate included sand and loam. This vegetation type is sparse and merges into the road verge approximately 3m further inland. At the road verge were grassland clearings, with herbs such as *Wallenia tribolata* (Marigold), *Panicum maximum* (guinea grass), and Spanish needle.

There were no endemic, rare, threatened or endangered plant species observed at the site. Additionally, none of the plants have significant cultural or economic value. None of these trees will be removed to construct the manhole.

TABLE 2: OBSERVED SPECIES AT THE LANDING SITE

FAMILY	SCIENTIFIC NAME	COMMON NAME
Aizoaceae	*Sesuvium portulacastrum*	Seaside purslane
Combretaceae	*Terminalia catappa*	West Indian Almond
Gramineae	*Panicum maximum*	Guinea grass
	Bidens alba	Spanish needle
	Wallenia tribolata	Marigold
	Ipomea pes-caprae	Beach Morning Glory
Palmae	*Cocos nucifera*	Coconut
Polygonaceae	*Coccoloba uvifera*	Sea Grape

Cable Housing Site - The cable house is to be sited on the Couples Ocho Rios Resort property adjoining the landing site. The site has no significant plant community. The site consists of the existing access way and well manicured lawns.

3.2.2.1.2 Faunal Survey

The landing site is located on a narrow strip of coastal beach. The main road can be seen not 10m away. There are few trees or plants on the narrow strip of beach; however, there were no bird species observed on any occasion the site was visited. No crab holes or crabs were observed along the beach front. It should be noted however that the area do have land crabs, possible the burrowing *Cardisoma guanhumi* (Great land crabs).

The cable housing station is within a landscaped private property with few trees in the area it's to be sited. The area is bordered by few large trees such palms. No birds were observed in the vicinity of this area during on-site inspections.

3.2.3 Segment 3 – Ocho Rios to Montego Bay

3.2.3.1 Montego Bay

The project site occupies two locations in a residential coastal area, namely: the cable housing at the Chas O. Ramson Limited property in Reading and the landing site near Great River. The landing site is located within the Montego Bay Marine Park at its western boundary.

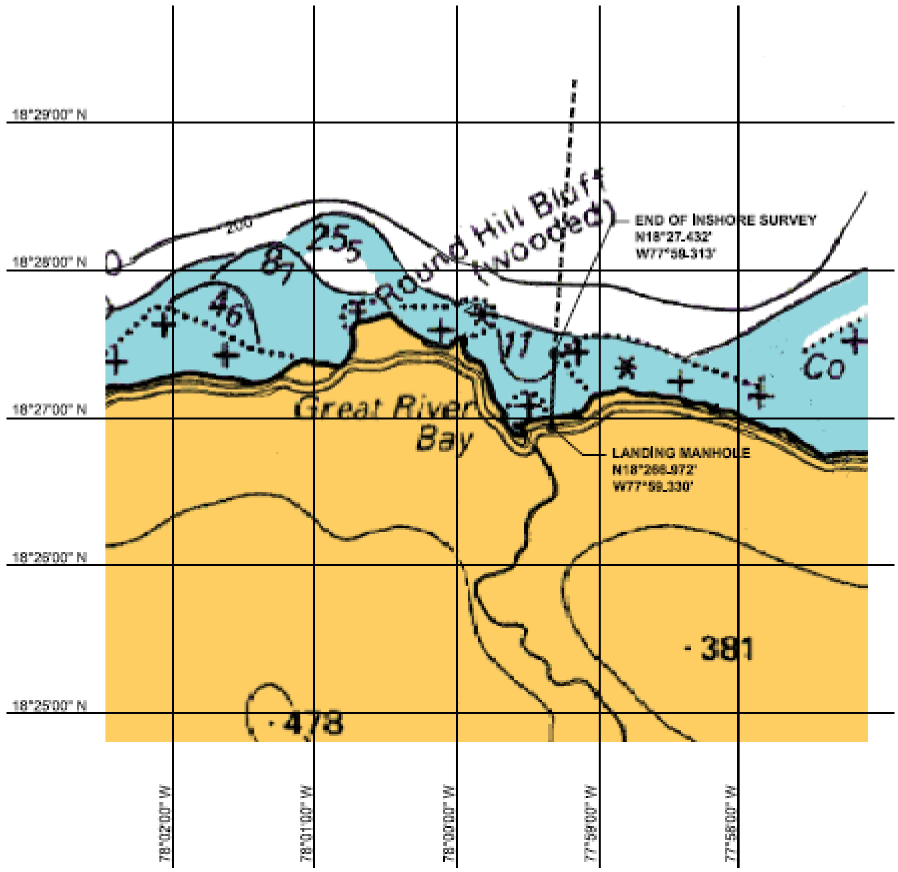


FIGURE 3-7: PROPOSED CABLE LANDING FOR MONTEGO BAY

3.2.3.1.1 Vegetation

Landing Site - The landing site is located in the vicinity of the community of Great River in St. James, directly across from a National Water Commission (NWC) Plant. The site has undergone some disturbance with a small informal settlement nearby, and a drain originating from the NWC Plant across the road. The vegetation communities observed, are a remnant of the original vegetation, and only contain a portion of the species usually found in a typical coastal community.

The foreshore can be classified as rocky with sand patches. Approximately 2m from the water's edge, beach pioneer plants such as ***Coccoloba uvifera*** (Sea grape), ***Sesuvium portulacastrum*** (Seaside purslane), and ***Panicum maximum*** (Guinea grass) were present. This vegetation type is sparse and merges into the road verge approximately 3 m inland.

In the open, unshaded areas at the foreshore was a herb layer of ***Sesuvium portucalastrum*** (Seaside purslane) and ***Ipomea sp.*** These species are typical coastal species, which are adapted to hot, salty conditions. Further inland, succession in vegetation type was observed with a transition to shrubs and grasses. The majority of the trees at the site consisted of mature tree species, approximately 2m (6ft) in height. The shrub layer was not well represented, and large areas under the trees were bare. The shrub layer was consistent with ***Panicum maximum*** (guinea grass). There was no tree canopy. The dominant plant was the Sea Grape (***Cocoloba uvifera***) with an occasional coconut (***Cocos nucifera***), trees common in coastal locations. The majority of the substrate was rocky but had variations including sand and loam.

There were no endemic, rare, threatened or endangered plant species observed at the site. Additionally, none of the plants have significant cultural or economic value. None of these trees will be removed to construct the manhole.

TABLE 3-1: OBSERVED SPECIES AT THE LANDING SITE

FAMILY	SCIENTIFIC NAME	COMMON NAME
Aizoaceae	*Sesuvium portulacastrum*	Seaside purslane
Combretaceae	*Terminalia catappa*	West Indian Almond
Gramineae	*Panicum maximum*	Guinea grass
	Ipomea pes-caprae	Beach Morning Glory
Palmae	*Cocos nucifera*	Coconut
Polygonaceae	*Coccoloba uvifera*	Sea Grape

Cable Housing Site - The cable house is to be sited on the Chas O. Ramson Limited facility in Reading. The site has no significant plant community. The site consist if the existing Ramson building and well manicured lawns.

3.2.3.1.2 Faunal Survey

No bird species were observed on the site. This may be due to the fact that there are few trees at the site and not many for the purposed of feeding or nesting.

In addition, there were less than 5 burrows belonging to the species *Cardisoma guanhumi* (Great land crabs) observed on the site.

3.3 Marine Environment

3.3.1 Segment 1 – Bahamas to Bull Bay, St. Thomas

3.3.1.1 Bull Bay

Landing Site - A marine assessment was conducted along a corridor no more than 1m wide; the cable is no more than 28.8mm wide, of the marine environment. Figure 4-6 details the coordinates along which the cable will be laid. The marine assessment utilized dives of the area, video and still photography to document the condition of the seabed and associated structures and marine life in the study area. The depth of the assessment was up to a maximum of 18.28m (60ft) which characterised the inshore (Fig. 4-6).

The selection of this landing site was due to the presence of an existing cable landing station and associated cable on sea bed.

3.3.1.1.1 Inshore Survey

The inshore has a relatively flat substrate of white calcareous sand from near shoreline to about 450m where offshore distinction is made (Figure 4-6). This represents a depth of no more than 18m (60ft). Based on video-photography taken during the marine survey, the area is made of soft sandy substrate. It is accepted that various fishes (reef and otherwise) and other marine fauna may traverse the cable route. However, due to the nature of the cable laying activities and size of the cables being laid any interactions with marine fauna will be negligible. Of importance is the fact that no coral reefs lie in the path of the cable route.

There is no coral reef substrate along the survey path or rocky outcroppings.

3.3.2 Segment 2 – Bahamas to Tower Isle, St. Mary

3.3.2.1 Tower Isle

Landing Site - A marine assessment was conducted along a corridor no more than 1m wide; the cable is no more than 28.8mm wide, of the marine environment. Figure 4-4 details the coordinates along which the cable will be laid. The marine assessment utilized dives of the area, video and still photography to document the condition of the seabed and associated structures and marine life in the study area. The depth of the assessment was up to a maximum of 18.288m (60ft) which characterised the inshore.

The selection of this landing site was due to the absence/lack of coral reefs or seagrass beds along the cable corridor.

3.3.2.1.1 Inshore Survey

Waters extending from the shore out to a depth of 20ft showed no significant marina flora or fauna. The substrate is composed of coralline sandy soil and calcareous sediments produced by the calcareous alga, ***Halimeda copiosa***. There were few patches of seagrass found; predominantly turtle grass (***Thallasia testudinum***). Few fish species were encountered during the survey, with trumpet fish being the predominant one. It is accepted that various reef fishes and other marine fauna may traverse the cable route. However, due to the nature of the cable laying activities and size of the cables being laid any interactions with marine fauna will be negligible. Of importance is the fact that no coral reefs lie in the path of the cable route.

The sandy substrate is inhabited mainly by the burrowing bivalve mollusk, *Donax sp.*, as well as other burrowing invertebrates.

3.3.3 Segment 3 – Ocho Rios to Montego Bay

3.3.3.1 Montego Bay

Landing Site - A marine assessment was conducted along a corridor no more than 1m wide; the cable is no more than 28.8mm wide, of the marine environment. Figure 4-2 details the coordinates along which the cable will be laid. The marine assessment utilized dives of the area, video and still photography to document the condition of the seabed and associated structures and marine life in the study area. The depth of the assessment was up to a maximum of 18.28m (60ft) which characterised the inshore (Fig. 4-2).

The selection of this landing site was due to the absence/lack of coral reefs or seagrass beds along the cable corridor. This route is also receiving significant inflow of fresh water and sedimentation from the Great River to the west. The near shore is predominantly rocky with sand patches on a small beach area with cliff formations on either side. The rocky area may be due to run-off influence from the roadway and informal settlement nearby, as well as the NWC drain that empties at the landing site.

3.3.3.1.1 Inshore Survey

Waters extending from the shore out to a depth of 60ft (a distance of 1000m) showed no significant marina flora or fauna. The substrate is composed of coralline sandy soil and calcareous sediments produced by the calcareous alga, *Halimeda copiosa*.

There were few patches of seagrass found; predominantly turtle grass (*Thallasia testudinum*). Few fish species were encountered during the survey, with trumpet fish being the predominant one. It is accepted that various reef fishes and other marine fauna may traverse the cable route. However, due to the nature of the cable laying activities and size of the cables being laid any interactions with marine fauna will be negligible. Of importance is the fact that no coral reefs lie in the path of the cable route.

The sandy substrate is inhabited mainly by the burrowing bivalve mollusk, *Donax sp.*, as well as other burrowing invertebrates.

3.4 Weather & Meteorology

3.4.1 Outline

Ideally, one should obtain data for weather and meteorological parameters from stations within the defined boundaries of the region in which an assessment is being made. However, there are only two groups of publicly accessible weather stations on the island that are in continuous operation – the ones at Norman Manley International Airport in Kingston and the other at Montego Bay International Airport in St. James. Therefore, all data for the weather and meteorology for any point on the island would have to be represented by data generated from one of these two weather stations on the basis of which ever is closest geographically and on the basis of land topography. Table 3-2 through to Table 3-6 represents summaries and averages of the data collected from the weather stations at the Norman Manley International Airport, and Table 3-7 through to Table 3-10 represents summaries and averages of the data collected from the weather stations at the Montego Bay International Airport. Both sets of tables show summaries and averages of the following parameters:

- Rainfall
- Air Temperature
- Dew Point Temperature
- Wind Direction (in degrees and by compass points)
- Wind Speed
- Relative Humidity
- Atmospheric pressure
- Solar Radiation (in Watts per metre square)

Two of the three project sites fall in reasonably close proximity to the weather stations from which data is available, namely the Bull Bay Site and the Montego Bay site. The third project site does not fall within any appreciable proximity to any publicly available weather station; therefore the weather data for that area will have to be determined on the basis described above. Although Tower Isle, St. Mary is geographically closer to the weather station at Norman International Airport, it is separated from southern Jamaica by the John Crow Mountains. Conversely, there is no dominant topographical elevation separating both North Coast Areas, both of which experience similar effects from the trade winds which blow North-easterly into the island. Therefore, Tower Isle, St. Mary is best compared with the weather data from Montego Bay International Airport, rather than the weather data generated at Norman Manley International Airport

3.4.2 Bull Bay, St. Thomas

The project area is located along the south-eastern coast of Jamaica, which is characterized by low and/or sporadic rainfall patterns during the course of the year (See Table 3-2 through to Table 3-6). This region is shielded by the John Crow Mountain and Blue Mountain ranges from the North-easterly trade winds which enter the island. This shielding effect results in the rapid condensation of the wind currents as they come off the mountain ranges, causing reduced precipitation as they flow into the Southern part of the island. This causes the above stated low and/or sporadic rainfall with not much overcast conditions being experienced.

Typical of coastal regions is the effect of land and sea breeze, in which there is an expected gentle moist breeze coming on-land from the sea during the course of the day, and a gentle breeze flowing off-land to the sea during the night time. This event is a characteristic of the thermal properties of both the land and the sea and would not significantly affect weather in a general way.

The nature of this project, from construction through to operation dictates that the weather regime experienced in this area, will not have any impact on this project.

TABLE 3-2: WEATHER DATA AVERAGES FOR 1997 – NORMAN INTERNATIONAL AIRPORT AUTOMATIC WEATHER STATIONS

Month	Relative Humidity %RH	Wind Direction/ º	Air Temperature/ ºC	Due Point / ºC	Wind speed/ Knts	Wind Direction/ LogUnits	Atmospheric Pressure Pressure/ mBar	Rainfall /mm	Solar Radiation W/m2
January	***	***	***	***	***	***	***	***	***
February	***	***	***	***	***	***	***	***	***
March	***	***	***	***	***	***	***	***	***
April	73.88	106.56	26.63	21.58	7.54	111.55	1013.43	0.00	3.76
May	***	***	***	***	***	***	***	***	***
June	***	***	***	***	***	***	***	***	***
July	***	***	***	***	***	***	***	***	***
August	72.22	142.68	29.99	24.29	10.53	151.03	1012.85	0.00	228.54
September	***	***	***	***	***	***	***	***	***
October	***	***	***	***	***	***	***	***	***
November	***	***	***	***	***	***	***	***	***
December	***	***	***	***	***	***	***	***	***
Average	73.05	124.62	28.31	22.93	9.03	131.29	1013.14	0.00	116.15

KEY: *** - Denotes data unavailability

TABLE 3-3: WEATHER DATA AVERAGES FOR 1998 – NORMAN INTERNATIONAL AIRPORT AUTOMATIC WEATHER STATIONS

Month	Relative Humidity %RH	Wind Direction/ º	Air Temperature/ ºC	Due Point / ºC	Wind speed/ Knts	Wind Direction/ LogUnits	Atmospheric Pressure Pressure/ mBar	Rainfall /mm	Solar Radiation W/m2
January	76.68	146.22	27.62	22.95	7.84	153.69	1012.42	0.56	186.33
February	73.14	161.03	27.10	21.66	10.36	166.44	1011.90	0.12	211.15
March	79.67	133.75	27.48	23.47	7.60	142.22	1012.01	1.16	205.63
April	72.08	144.79	28.27	22.52	6.85	156.31	1012.10	0.55	145.06
May	73.12	139.60	29.33	23.83	8.12	147.36	1011.70	0.09	268.45
June	73.26	135.96	30.46	24.98	10.76	142.58	1012.55	0.19	262.26
July	74.23	139.81	29.96	24.68	9.04	146.71	1012.66	0.28	221.76
August	77.65	145.05	30.06	25.66	6.89	153.95	1005.18	0.43	145.33
September	78.65	120.24	29.56	25.38	8.67	126.47	1003.76	4.27	22.12
October	81.03	141.51	30.11	26.06	7.48	146.19	1008.54	0.28	73.05
November	81.65	143.61	28.15	24.58	6.48	154.17	1004.92	3.79	0.15
December	80.12	143.90	27.48	23.54	5.81	155.09	1011.02	0.84	0.01
Average	76.77	141.29	28.80	24.11	7.99	149.26	1009.90	1.05	145.11

KEY: *** - Denotes data unavailability

TABLE 3-4: WEATHER DATA AVERAGES FOR 1999 – NORMAN INTERNATIONAL AIRPORT AUTOMATIC WEATHER STATIONS

Month	Relative Humidity %RH	Wind Direction/ º	Air Temperature/ ºC	Due Point / ºC	Wind speed/ Knts	Wind Direction/ LogUnits	Atmospheric Pressure Pressure/ mBar	Rainfall /mm	Solar Radiation W/m2
January	75.75	141.61	26.55	22.08	7.41	152.12	982.99	0.20	0.47
February	73.78	152.68	25.25	20.89	7.40	163.37	961.46	0.30	0.66
March	74.45	153.67	26.72	21.84	7.17	165.06	996.66	0.00	0.26
April	74.99	124.49	27.73	22.72	8.74	130.96	1013.46	0.00	0.00
May	78.52	123.00	28.44	24.24	8.50	128.57	1012.97	0.00	0.00
June	78.23	133.04	28.92	24.59	9.53	136.99	1012.31	0.21	0.06
July	77.42	146.62	29.30	24.77	9.21	153.79	1013.39	0.24	0.00
August	80.13	140.39	29.34	25.44	7.42	148.16	1011.78	0.32	0.00
September	83.75	138.69	28.82	25.68	6.22	147.46	1009.22	5.63	0.06
October	86.76	141.94	28.48	25.93	6.95	151.16	1010.74	0.60	0.00
November	85.31	130.13	27.30	24.39	5.94	141.21	1009.61	1.23	0.00
December	73.53	142.36	26.49	21.13	5.96	153.69	1010.21	0.19	0.01
Average	78.55	139.05	27.78	23.64	7.54	147.71	1003.73	0.75	0.13

KEY: ★★★ - Denotes data unavailability

TABLE 3-5: WEATHER DATA AVERAGES FOR 2000 – NORMAN INTERNATIONAL AIRPORT AUTOMATIC WEATHER STATIONS

Month	Relative Humidity %RH	Wind Direction/ º	Air Temperature/ ºC	Due Point / ºC	Wind speed/ Knts	Wind Direction/ LogUnits	Atmospheric Pressure Pressure/ mBar	Rainfall /mm	Solar Radiation W/m2
January	78.67	133.39	26.74	22.55	5.89	142.23	1010.22	0.00	0.00
February	***	***	***	***	***	***	***	***	***
March	***	***	***	***	***	***	***	***	***
April	***	***	***	***	***	***	***	***	***
May	***	***	***	***	***	***	***	***	***
June	***	***	***	***	***	***	***	***	***
July	***	***	***	***	***	***	***	***	***
August	***	***	***	***	***	***	***	***	***
September	***	***	***	***	***	***	***	***	***
October	***	***	***	***	***	***	***	***	***
November	***	***	***	***	***	***	***	***	***
December	***	***	***	***	***	***	***	***	***
Average	78.67	133.39	26.74	22.55	5.89	142.23	1010.22	0.00	0.00

KEY: ★★★ - Denotes data unavailability

TABLE 3-6: WEATHER DATA AVERAGES FOR 2004 – NORMAN INTERNATIONAL AIRPORT AUTOMATIC WEATHER STATIONS

Month	Relative Humidity %RH	Wind Direction/ º	Air Temperature/ ºC	Due Point / ºC	Wind speed/ Knts	Wind Direction/ LogUnits	Atmospheric Pressure Pressure/ mBar	Rainfall /mm	Solar Radiation W/m2
January	59.63	105.64	25.30	19.75	7.80	112.84	927.22	0.91	15.11
February	57.01	117.89	26.03	17.85	8.83	127.51	941.25	0.94	16.87
March	57.76	137.10	25.87	18.04	8.34	148.66	931.62	0.95	13.99
April	60.56	107.62	27.30	19.24	7.87	116.33	988.78	0.21	1.80
May	61.88	99.50	27.31	26.29	9.27	110.20	950.36	0.91	1.11
June	57.04	94.02	28.86	20.26	12.72	98.49	968.43	0.20	1.76
July	63.11	118.20	28.85	21.33	9.50	125.83	998.57	0.43	0.18
August	59.71	103.09	28.53	20.80	11.36	109.45	951.32	1.93	1.06
September	68.43	148.52	28.50	22.02	5.64	152.50	1011.14	3.35	1.21
October	64.51	183.26	28.66	21.21	5.29	182.51	1011.97	0.76	0.13
November	59.65	179.51	27.85	19.14	5.86	180.17	1013.20	0.07	0.62
December	64.24	161.21	26.87	19.44	5.43	161.41	1014.74	0.01	6.37
Average	61.13	129.63	27.49	20.45	8.16	135.49	975.72	0.89	5.02

KEY: ∗∗∗ - Denotes data unavailability

3.4.3 Montego Bay and Tower Isle, St. Mary

Tower, Isle St. Mary is located on the North-Eastern coast of the island and lies in close proximity to the base of the John Crow Mountain. This section of the island comes under direct influence from the North-easterly trade winds, which must ascend the mountain ranges that act as the backdrop to the St. Mary area. The ascent of these mountain ranges causes condensation that eventually leads to precipitation and rainfall in these areas. Therefore, this area is generally characterized by frequent rainfall or overcast conditions in comparison to the southern sections of the island. The weather data for the Tower Isle areas can be characterized but not completely mimicked by Table 3-7 through to Table 3-10

The Montego Bay area is located on the North-Western coast of the island and is also directly affected by the North-Easterly trade winds in a similar fashion as Tower Isle, St. Mary. However, it is not as close in proximity to a mountain range as the Tower Isle, St. Mary site, neither is its watershed area(s) as intact as those in St. Mary. As such, it is not expected to experience as much rainfall as the Tower Isle site. Typical weather data for the Montego Bay area is illustrated in Table 3-7 through to Table 3-10.

Typical of coastal regions is the effect of land and sea breeze, in which there is an expected gentle moist breeze coming on-land from the sea during the course of the day, and a gentle breeze flowing off-land to the sea during the night time. This event is a characteristic of the thermal properties of both the land and the sea and would not significantly affect weather in a general way.

No parameter of the weather regime reviewed indicates that the project would have any associated problems during any of its phases. The higher rainfall potential in this area will make it necessary for heightened consideration of the prevention of erosion, sedimentation, and silting which could be a possibility during the construction phase.

TABLE 3-7: WEATHER DATA AVERAGES FOR 2001 – MONTEGO BAY INTERNATIONAL AIRPORT AUTOMATIC WEATHER STATIONS

Month	Relative Humidity %RH	Wind Direction/ º	Air Temperature/ ºC	Due Point / ºC	Wind speed/ Knts	Wind Direction/ LogUnits	Atmospheric Pressure Pressure/ mBar	Rainfall /mm	Solar Radiation W/m2
January	***	***	***	***	***	***	***	***	***
February	***	***	***	***	***	***	***	***	***
March	***	***	***	***	***	***	***	***	***
April	74.27	95.69	27.28	22.27	7.38	96.37	1015.80	0.07	224.14
May	77.13	110.72	27.52	23.09	5.94	112.56	1013.10	3.67	203.05
June	73.59	100.69	28.72	23.48	7.22	101.49	1014.92	0.48	223.97
July	75.98	109.87	29.43	24.22	6.57	104.39	1018.00	4.00	247.55
August	75.50	99.20	29.33	24.48	6.94	99.92	1013.87	1.59	201.40
September	75.91	115.30	28.63	23.91	5.37	117.08	1011.15	2.60	185.28
October	78.39	104.84	28.17	23.98	5.97	106.20	1012.16	3.52	151.63
November	77.30	90.03	26.97	22.57	7.36	90.86	1012.54	2.73	131.18
December	80.28	89.60	26.87	23.13	7.14	90.57	1011.65	2.24	132.07
Average	76.48	101.77	28.10	23.46	6.66	102.16	1013.69	2.32	188.92

KEY: ★★★ - Denotes data unavailability

TABLE 3-8: WEATHER DATA AVERAGES FOR 2002 – MONTEGO BAY INTERNATIONAL AIRPORT AUTOMATIC WEATHER STATIONS

Month	Relative Humidity %RH	Wind Direction/ º	Air Temperature/ ºC	Due Point / ºC	Wind speed/ Knts	Wind Direction/ LogUnits	Atmospheric Pressure Pressure/ mBar	Rainfall /mm	Solar Radiation W/m2
January	77.79	88.06	26.31	25.25	8.14	90.68	1015.51	0.61	143.74
February	74.81	89.56	26.32	21.41	6.63	92.00	1015.63	0.32	167.08
March	72.78	86.51	26.94	21.56	7.35	88.63	1015.34	0.30	212.38
April	73.11	73.68	27.12	21.79	8.19	74.69	1014.71	0.28	230.11
May	77.22	87.57	27.80	23.35	7.19	88.79	1013.56	3.33	180.44
June	76.80	99.90	28.28	23.73	6.37	101.94	1013.91	3.55	197.92
July	73.96	93.63	29.14	23.94	6.97	95.17	1015.79	0.71	212.40
August	75.22	98.31	28.92	24.02	6.37	100.28	1014.15	1.52	187.20
September	77.65	104.35	28.29	23.92	5.32	106.66	1011.32	3.48	140.16
October	78.59	102.57	28.18	24.06	5.28	104.42	1010.98	2.18	164.85
November	78.61	99.98	28.00	23.87	5.39	101.51	1013.55	1.37	145.72
December	78.08	100.79	26.93	22.71	5.85	102.84	1015.01	1.26	127.45
Average	76.22	93.74	27.68	23.30	6.59	95.64	1014.12	1.58	175.79

KEY: ★★★ - Denotes data unavailability

TABLE 3-9: WEATHER DATA AVERAGES FOR 2003 – MONTEGO BAY INTERNATIONAL AIRPORT AUTOMATIC WEATHER STATIONS

Month	Relative Humidity %RH	Wind Direction/ º	Air Temperature/ ºC	Due Point / ºC	Wind speed/ Knts	Wind Direction/ LogUnits	Atmospheric Pressure Pressure/ mBar	Rainfall /mm	Solar Radiation W/m2
January	80.29	90.87	26.00	22.26	6.60	93.40	1015.52	5.73	115.70
February	76.08	99.52	26.64	24.55	5.91	101.54	1014.78	0.08	170.39
March	74.13	117.74	27.23	22.12	5.54	121.24	1012.79	0.46	191.81
April	77.26	109.61	27.37	22.97	6.55	112.45	1012.49	1.90	206.87
May	75.83	104.53	28.28	23.52	6.20	105.93	1013.18	1.87	202.88
June	76.50	108.08	28.37	23.77	5.83	109.65	1012.67	2.93	207.39
July	77.28	93.21	28.74	24.29	7.11	94.33	1014.63	1.12	207.19
August	81.34	105.40	28.59	25.01	5.58	106.91	1014.28	3.60	200.40
September	79.02	116.16	28.69	24.62	4.96	117.14	1012.63	0.47	191.03
October	79.98	111.72	28.49	24.64	4.40	113.26	1010.89	0.07	163.77
November	80.20	86.41	27.76	24.06	7.01	87.29	1011.59	12.60	138.91
December	78.69	87.80	26.59	24.47	7.74	90.90	1013.95	0.39	120.89
Average	78.05	102.59	27.73	23.86	6.12	104.50	1013.28	2.60	176.44

KEY: ★★★ - Denotes data unavailability

TABLE 3-10: WEATHER DATA AVERAGES FOR 2004 – MONTEGO BAY INTERNATIONAL AIRPORT AUTOMATIC WEATHER STATIONS

Month	Relative Humidity %RH	Wind Direction/ º	Air Temperature/ ºC	Due Point / ºC	Wind speed/ Knts	Wind Direction/ LogUnits	Atmospheric Pressure Pressure/ mBar	Rainfall /mm	Solar Radiation W/m2
January	76.10	89.52	25.95	21.34	6.99	92.81	1016.04	0.32	145.87
February	74.65	95.67	26.39	21.45	7.53	99.91	1016.18	0.26	161.29
March	76.38	94.12	26.50	21.94	8.23	94.29	1015.67	0.44	199.66
April	76.91	97.76	26.77	22.28	6.93	97.86	1014.04	2.09	222.19
May	80.74	99.64	27.73	24.06	6.91	100.27	1013.30	0.80	199.72
June	76.74	102.79	28.88	24.33	7.54	102.75	1015.33	0.76	216.87
July	78.38	120.33	28.69	24.49	5.65	120.82	1013.92	1.63	203.13
August	78.43	117.95	28.94	24.96	5.92	118.04	1013.16	1.12	206.93
September	74.71	135.47	26.60	23.80	4.77	136.43	915.69	5.56	158.13
October	78.76	108.84	28.29	24.32	5.66	109.01	998.24	0.73	177.39
November	75.57	98.47	29.28	22.74	8.62	98.49	1004.27	0.29	151.94
December	81.09	94.13	26.42	22.87	8.59	94.11	1012.80	2.35	124.40
Average	77.37	104.56	27.54	23.21	6.94	105.40	1004.05	1.36	180.63

KEY: ★★★ - Denotes data unavailability

3.5 Weather Impact on Project

While there are variations in the weather patterns between the north and south coasts of the island, it is not envisioned that any of the parameters assessed in this section will have any negative impacts on the establishment, operation or maintenance of the project.

3.6 Natural Hazard Vulnerability.

3.6.1 Outline

The proposed project consists of two concurrent operational phases:

1. An offshore operational phase.
2. An onshore operational phase.

The components of both phases will set the baseline for the operation of the proposed cable infrastructure, and therefore must be considered when estimating the vulnerability of the proposed infrastructure to nature. The operational infrastructure has the potential to be affected, to some degree, by existing climatic and potential weather patterns, geological activity (specifically tectonic activity) and the hydrostratigraphy (especially in relation to flooding potential) of the various regions where cable installation and laying is proposed to occur. For the purposes of this Environmental Impact Assessment offshore consideration will be given only up to the boundary of the Jamaican coastal waters – beyond that is beyond the jurisdiction of this assessment, however, if necessary, references to any pertinent and appropriate similarities in the region will be incorporated.

3.6.1.1 Offshore Cable Operations

The offshore cable operational phase is slated to occur in two distinct phases:

1. Deep-shore operations

2. Near shore operations (this is a transition into the onshore cable operational phase.)

Common to both phases is the medium of operation (water) and, as such, are likely to be affected by wave action that is generated from aggressive deep water movement, which is caused by storm surges and tectonic activity. Extreme occurrences of either of these events could cause unlikely cable failure through abrasion and or instantaneous or gradual extension of the cable beyond the elastic limits of its component materials. However, as with every event, there is a threshold required for noticeable occurrence and also a limit at which the event will cause unfavorable results; therefore, it is arbitrary to assume that any storm surge or tectonic activity will cause any unlikely cable failure. Although there is no pragmatic way to define exactly what level of displacement in the sea floor (vertical and horizontal) or what type of storm surge will generate a certain definable stress on the cable, it is statistically possible to conclude from Table 3-11 that both abrasion and tectonic activity rarely causes cable failure. Implicit in the data, is the fact that these events rarely generate the forces required to exceed the limits of the cable materials' strength. Therefore, one can assume that the combined material strength of the cable materials have been designed to withstand common abrasion forces resulting from water movement, and the effects of common minor plate movement. Keep in mind that there are miles of this type of cable deployed worldwide under a wide variety of marine and seismic conditions that are fully functional.

The deep shore aspect of the cable operations can be generally regarded as unaffected by storm surges. Storm surges do not usually disturb the ocean bottom in deep waters by virtue of deep water depth in relation to the volume of water that is displaced. However, pronounced effects are estimated as likely for near-shore operations as the cable makes the transition to onshore operations. However, as stated earlier, it is difficult to correlate storm surge magnitude with sustainable cable integrity – one can only assume that cable breakage is unlikely to occur due to the design and established track record of the industry. Cable breakage is unlikely in and of itself to result in environmental degradation or negative environmental impacts.

TABLE 3-11: PERCENTAGE OF FAILURE CAUSES FOR 380 REPORTED CABLE FAULTS

Cause	Count	%
Abrasion	18	4.7%
Anchor	49	12.9%
Branching Unit	2	0.5%
Cable or Survey Ship Activity	5	1.3%
Dredging/Drilling and Pipe Installation	12	3.2%
Earthquake or Seabed Movement	10	2.6%
Equaliser	1	0.3%
Fatigue	1	0.3%
Fishing Activity	184	48.4%
Impact by Hard Object	5	1.3%
Insulation Failure	3	0.8%
Jointing Box	5	1.3%
Manufacturing Defect - Cable	4	1.1%
Repeater	17	4.5%
Unknown - Cable Deliberately Cut	1	0.3%
Unknown - Cable Mauled	6	1.6%
Unknown - Cable not repaired	1	0.3%
Unknown - Fibre Attenuation	5	1.3%
Unknown - Kinks, Twists, Loops	9	2.4%
Unknown - Shunt Fault	31	8.2%
Unknown - Tension Break	11	2.9%
TOTAL	380	

3.6.1.2 Onshore Cable Operations

The onshore cable operation has two (2) distinct areas of operation:

1. Onshore shelter station where data relay is done
2. Terrestrial areas:
    a. Above ground, along existing electrical high tension wires
    b. Underground, on route to installation or relay areas

Given the degree and frequency of seismic activity in Jamaica (See Section 3.6.2), seismic activity is not expected to generally affect either the terrestrial areas or the on-shore shelter station area in a critical way. Further, it is assumed that existing infrastructure would have been approved for construction with considerations being given to flooding vulnerability, land slippage vulnerability and seismic activity. Given the relationship between existing infrastructure and the proposed cable network, the hazard vulnerability will depend largely on the approved infrastructure, in which the cable and associated equipment are housed.

Of considerable concern is the potential effect of storm surge on the on-land shelter station which houses the electronic equipment for data relay. Effects from flooding and battering due to these storm surges could pose problems for both the electronic equipment and the building's structural integrity. Therefore, the building has been designed to be at a proposed height of at least 3m above sea level, which is estimated to give it sufficient clearance from normal storm surge activity. Regardless, the terrain of the sites is estimated to exceed this proposed minimum requirement. It is not anticipated that even if the buildings and equipment were to be damaged by natural hazards that it would result in a negative environmental impact, since no chemicals, etc would be involved.

3.6.2 Seismic Activity

Jamaica lies in the seismically active northern plate boundary zone of the Caribbean Plate (Draper et al., 1994 and Figure 3-8). High magnitude earthquakes originating from as far away as the south coast of Cuba may be felt in Jamaica. For example the Cabo Cruz earthquake of magnitude 6.9 which occurred in May 1992 was felt with intensity 4 in Kingston, Jamaica. The 1993 earthquake of magnitude 5.4 which originated in Jamaica was felt in Cuba with intensities of 3-4. No damage was reported in either case from the distant country (pers. comm. M. Grandison).

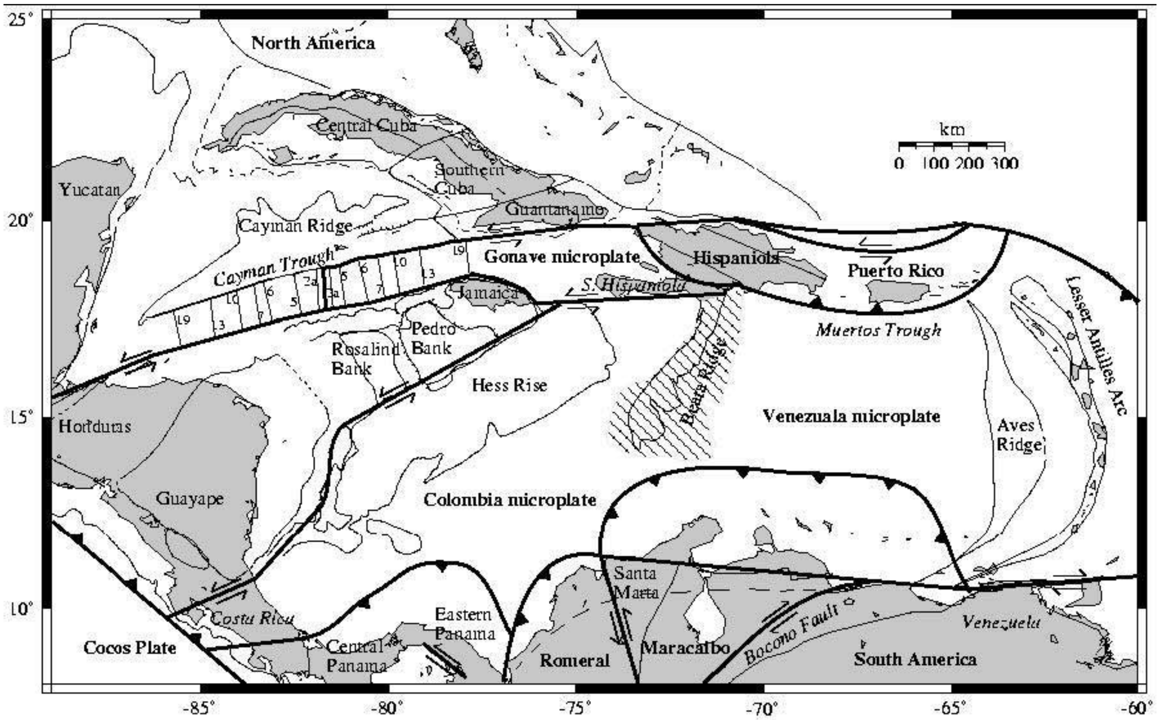


FIGURE 3-8: TECTONIC PLATES IN THE CARIBBEAN REGION

Figure 3-9 shows the epicenters of over one-hundred (100) earthquakes which have occurred in or near Jamaica between 1998 and 2001. With over 100 such occurrences, there was no significant damage to any approved infrastructure within the island to warrant consideration for the adjustment or revision of any building or construction codes for the island.

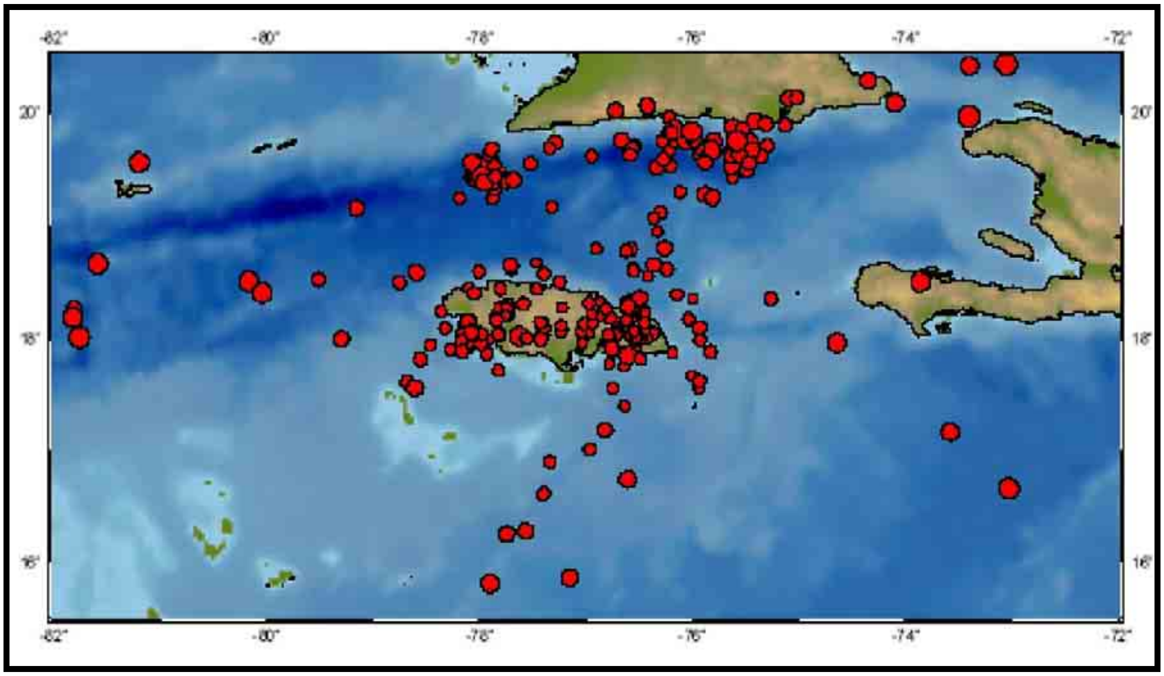


FIGURE 3-9: EPICENTRES OF EARTHQUAKES OCCURRING BETWEEN 1998 AND 2001 IN THE VICINITY OF JAMAICA[1]

Figure 3-10, Figure 3-11, and Figure 3-12 are summarized in Table 3-12 in relation to the proposed coastal landing sites. Table 3-13 allows one to conceptualize the type of effect the predicted values in Table 3-12 are likely to have. In analyzing Table 3-12, it becomes evident the most seismically active of all three sites is that of the Bull Bay site. As such, this site may be used as reference for the expected worst case scenario for any seismic activity which may be experienced by all three sites. From Table 3-12, it is expected that that there is only a 10% probability of any earthquake which occurs in or is felt by the Bull Bay area to exceed an intensity of 8 (VIII) within a 50 year period. An earthquake of such intensity is not likely to damage, or sufficiently damage buildings designated as *Masonry A* or *Masonry B* type construction (Table 3-13). This is significant because most buildings in Jamaica are designed to one of the two Masonry types mentioned above – the proposed onshore shelter station is no different (See Figure 1-8). Further inspection of Table 3-13

[1] Source: *Earthquake Unit, University of the West Indies, Mona*

reveals that earthquakes of such intensity are not likely to cause damage to underground pipes or disrupt their orientation significantly. The cables that will have to be laid underground are of greater strength and flexibility than conventional underground pipes, and do not transmit volatile or heavy fluids, whose dynamics or reactions might produce further stress on the pipes during an earthquake. Therefore, they are less likely to break under similar stress and strain conditions than the conventional underground pipes discussed in Table 3-13. Therefore, given the degree and frequency of seismic activity in the Bull Bay area, it is evident that the installation of the cable system in this area will not be greatly threatened by seismic activity. Further, if one were to extrapolate in consideration of the remaining two sites, one could conclude that these sites are less likely to be threatened by the same intensity of seismic activity as the Bully Bay site and are therefore less threatened by seismic activity.

It is important to note that the Bull Bay building site is an existing cable site that has been in existence long before the 1998-2001 period assessed during this project, and there has not been (to our knowledge) any record of cable failure due to seismic activity in the area.

TABLE 3-12: 10% PROBABILITY EXCEEDANCE IN ANY 50 YEAR PERIOD OF THREE EARTHQUAKE PARAMETERS FOR THE PROPOSED LANDING SITES

Landing Point	Horizontal Ground Acceleration /gals	Maximum Mercalli Intensity /MMI	Horizontal Ground Velocity /cms^{-1}
Bull Bay, St. Thomas	270-295	>8	18-20
Tower Isle, St. Mary	270-295	7-8	18-20
Great River, Montego Bay, St. James	145-190	6-7	10-14

TABLE 3-13: MERCALLI SCALE[2]

Intensity	Effects	PGA*(gals)
I	Not felt. Marginal and long-period effects of large earthquakes.	less than 1
II	Felt by persons at rest, on upper floors or favourably placed.	1 - 2
III	Felt Indoors. Hanging objects swing. Vibration like passing of a light truck. Duration estimated. May not be recognized as an earthquake.	2 - 5
IV	Hanging objects swing. Vibration like passing of heavy trucks: or sensation of a jolt like a heavy ball striking the walls. Standing motor cars rock. Car alarms activated. Windows, dishes, doors rattle. Glasses clink, crockery clashes. In the upper range of IV wooden walls and frames creak.	5 - 10
V	Felt Outdoors. Direction estimated. Sleepers wakened. Liquids disturbed, some spilled. Small unstable objects displaced or upset. Doors swing, close open. Shutters, pictures move, pendulum clocks stop, start, change rate.	10-25
VIa	Felt by all: many frightened and run outdoors. Persons walk unsteadily. Windows, dishes, glassware broken. Knickknacks, books etc. off shelves. Pictures off walls. Furniture moved or overturned. Weak plaster and masonry D cracked. Small church and school bells ring. Trees, bushes shaken (visibly or heard to rustle).	25-50
VII	Difficult to stand. Noticed by car drivers. Hanging objects quiver. Furniture broken. Damage to masonry D including cracks. Weak chimneys broken at roof line. Fall of plaster, loose bricks, stones tiles cornices unbraced parapets, and architectural ornaments. Some cracks in masonry C. Waves on ponds; water turned turbid with mud. Small slides and caving in along sand or gravel banks. Large bells ring. Concrete culverts damaged.	50-100
VIII	Steering of motor cars affected. Damage to masonry C: partial collapse. Some damage to masonry B, none to masonry A. Fall of stucco and some masonry walls. Twisting, fall of chimneys, factory stacks, monuments, towers, elevated tanks. Frame houses moved on foundations if not bolted down; loose panel walls thrown out. Decayed piling broken off. Branches broken from trees. Changes in flow or temperature of springs and wells. Cracks in wet ground and steep slopes.	100-250
IX	General panic. Masonry D destroyed; masonry C heavily damaged, sometimes with complete collapse; masonry B seriously damaged. General damage to foundations. Frame structures shifted off foundations if not bolted down. Serious damage to reservoirs. Underground pipes broken. Conspicuous cracks on ground. Sand boils, earthquake fountains, and sand craters.	250-500
X	Most masonry and frame structures destroyed with their foundations. Some well-built wooden structures and bridges destroyed. Serious damage to dams, dikes, embankments. Large landslides. Water thrown on banks of canals, rivers, lakes etc. Sand shifted horizontally on beaches and flat land. Rails bent slightly.	500-1000
XI	Rails bent greatly. Underground pipelines completely out of service.	**
XII	Damage nearly total. Large rock masses displaced. Lines of sight and level distorted. Objects thrown into the air.	**

Notes[3]:
* PGA is the effective Peak Ground Acceleration during the earthquake. That is the maximum horizontal ground acceleration excluding high frequency spikes. 1 gal = 1 cm/sec/sec. Since the intensity of gravity (g) is about 10 meters/sec/sec 10 gals is about 1% of gravity
** At the highest intensity levels damage potential is determined increasingly by the effects of ground failure. Most types of ground are unable to sustain prolonged accelerations much greater than 500 gals.

[2] http://www.uwiseismic.com/Earthquakes/eq_monitoring.html#Anchor-MEASURIN-48543
[3] http://www.uwiseismic.com/Earthquakes/eq_monitoring.html#Anchor-MEASURIN-48543

Masonry A. Good workmanship, mortar and design: reinforced especially laterally and bound together using steel, concrete etc. Designed to resist lateral forces.
Masonry B. Good workmanship and mortar. Reinforced but not designed in detail; to resist horizontal forces.
Masonry C. Ordinary workmanship and mortar. No extreme weaknesses like failing to tie in at corners but neither reinforced nor designed to resist horizontal forces.
Masonry D. Weak materials such as adobe; poor mortar; low standards of workmanship; weak horizontally.
(From Elementary Seismology by C.F. Richter, Published by W.F. Freeman and Company, San Francisco 1958)

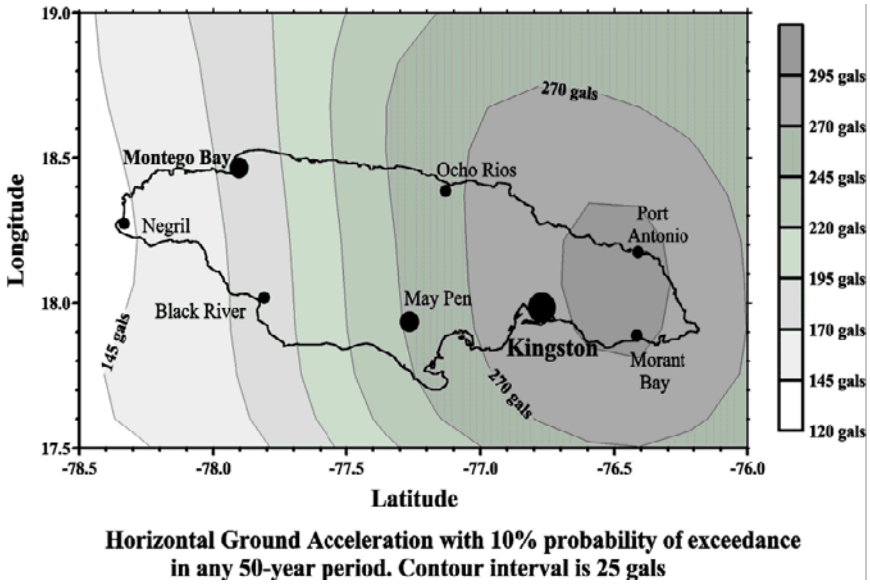


FIGURE 3-10: HORIZONTAL GROUND ACCELERATION IN JAMAICA[4]

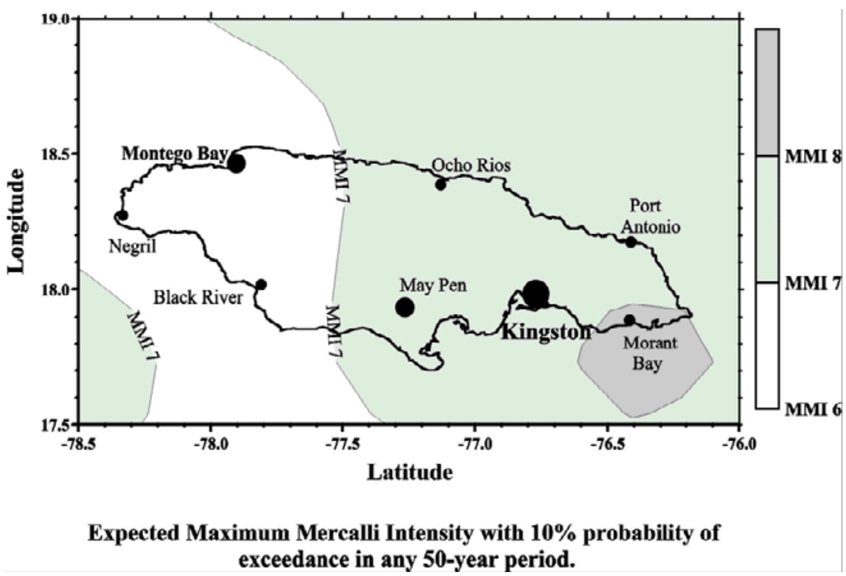


FIGURE 3-11: MAXIMUM MERCALLI INTENSITY IN JAMAICA[5]

4 http://www.oas.org/CDMP/document/seismap/
5 http://www.oas.org/CDMP/document/seismap/

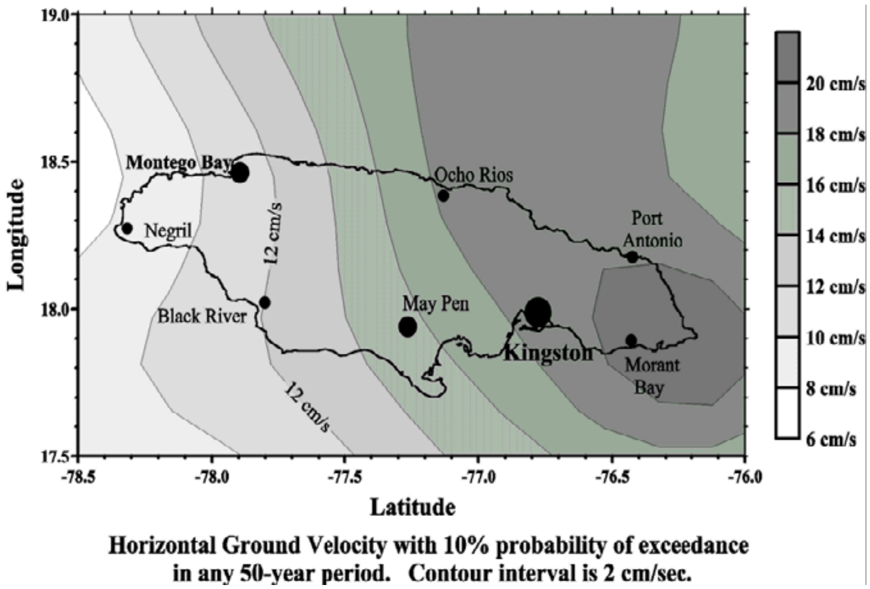


FIGURE 3-12: HORIZONTAL GROUND VELOCITY IN JAMAICA[6]

3.6.3 Hurricane/Cyclone Activity

Generating the data commonly associated with storm activity, and the consequent probable trends, for each landing point of the island is not necessarily feasible or a pragmatic assessment given the scope of this Environmental Impact Assessment. However, an appreciable approach would be to consider a reference point on the island, namely the center of the port of Kingston, and then use recorded cyclone activity over a period of time within the Caribbean region to estimate any associated trends related to the cyclone activity and the return period of such activities to the island[7]. This can be done confidently as Jamaica is a small island and is likely to be affected wholly regardless of the point of approach of a tropical depression or storm system.

Based on the values recorded in Table 3-14, Jamaica is estimated to have a 95% chance of experiencing, at the most, the wind

[6] http://www.oas.org/CDMP/document/seismap/
[7] ***Organization of American States General Secretariat Unit for Sustainable Development and Environment USAID-OAS,*** **Return Period Estimation of Hurricane Perils in the Caribbean,** Caribbean Disaster Mitigation Project April 1999

speeds associated with a '*Category 1*' hurricane every 10 years; and a similar chance of experiencing, at the most, the wind speeds associated with a '*Category 4*' hurricane every 50 years.

TABLE 3-14: KINGSTON CENTRAL PORT WIND RESULTS (KNOTS): MAXIMUM LIKELIHOOD ESTIMATES AND UPPER PREDICTION LIMITS FOR VARIOUS RETURN PERIODS (1 MINUTE SUSTAINED WIND AT 10 METERS ABOVE GROUND).[8]

Return Period	MLE	50%	75%	90%	95%	99%
10 year	57	58.2	61.2	63.9	66.0	70.4
25 year	76	77.0	81.6	86.7	90.6	104.4
50 year	89	90.5	97.0	105.0	111.4	130.4
100 year	102	103.1	112.8	124.0	133.1	157.8

The MLE (maximum likelihood estimate) column provides the best estimate as to the mostly likely extreme one minute-ten meter sustained wind for the various time frames.

Consultation of Table 3-15 shows that, within a 10 year period, the maximum storm surge expected is approximately 3.397m, and, within a 50 year period, the storm surge is unlikely to exceed 7.111m. Therefore, if the proposed minimum height for the construction of the on-shore shelter station of 3m above sea level is adhered to, the storm surge influence on the on-shore shelter station is not likely to occur in an overwhelming way, outside of a twenty-five year period. However, as stated earlier, the terrain of the sites is estimated to exceed the proposed minimum requirement, it is also expected to exceed the maximum storm surge within 100 years (Table 3-15). At all three landing sites the equipment building shares or exceeds the elevation of the resort hotels, residences and business establishments in their vicinity.

[8] ***Organization of American States General Secretariat Unit for Sustainable Development and Environment USAID-OAS,*** **Return Period Estimation of Hurricane Perils in the Caribbean,** Caribbean Disaster Mitigation Project April 1999

Table 3-15: Kingston Central Port Storm Surge Results (meters): Maximum Likelihood Estimates and Upper Prediction Limits for Various Return Periods[9].

Return Period	MLE	50%	75%	90%	95%	99%
10 year	2.737	2.758	2.958	3.122	3.193	3.397
25 year	3.848	3.897	4.193	4.519	4.791	5.505
50 year	4.693	4.714	5.157	5.636	5.932	7.112
100 year	5.539	5.586	6.136	6.941	7.542	8.777

Table 3-16: Kingston Central Port Wave Height Results (untransformed deep water significant wave height in meters): Maximum Likelihood Estimates and Upper Prediction Limits for Various Return Periods.[10]

Return Period	MLE	50%	75%	90%	95%	99%
10 year	7.1	7.2	7.5	7.8	8.1	8.9
25 year	8.9	9.1	9.6	10.3	11.1	14.8
50 year	10.2	10.3	11.0	11.9	13.1	18.0
100 year	11.5	11.6	12.6	14.0	16.0	22.3

[9] ***Organization of American States General Secretariat Unit for Sustainable Development and Environment USAID-OAS,*** **Return Period Estimation of Hurricane Perils in the Caribbean,** Caribbean Disaster Mitigation Project April 1999

[10] ***Organization of American States General Secretariat Unit for Sustainable Development and Environment USAID-OAS,*** **Return Period Estimation of Hurricane Perils in the Caribbean,** Caribbean Disaster Mitigation Project April 1999

TABLE 3-17: TROPICAL CYCLONES AFFECTING JAMAICA (1900-2003)[11]

No.	Year	Dates of passages over or when closest to island	Type of weather system	Name	Section of island most affected	Nearest distance to island	WARNING MESSAGES
1	1900	August 3	Hurricane		St. Mary, Portland, St. Thomas and St. Ann	115 miles	
2	1901	July 5-6	Tropical Storm		South Coast	173 miles	
3	1901	September 13-14	Tropical Storm		North Coast	115 miles	
4	1903	August 10-11	Hurricane		Manchester, Clarendon, St. Elizabeth and Westmoreland		
5	1904	June 12-13	Tropical Storm		Westmoreland and Hanover		
6	1904	October 13-14	Tropical Storm		Western Jamaica	86 miles	
7	1905	October 4-5	Hurricane		Eastern Jamaica	23 miles	
8	1906	October 14	Hurricane		South Coast	115 miles	
9	1906	November 6-7	Tropical Storm		Western Jamaica	58 miles	
10	1907	June 24-25	Tropical Storm		South Coast	138 miles	
11	1908	September 29	Tropical Storm		Portland, St. Thomas and St. Mary	173 miles	
12	1909	July 16-17	Tropical Storm		South Coast	29 miles	

[11] Supplied by *Jeffrey Spencer*, **Climate Branch Head, Meteorological Service**

No.	Year	Dates of passages over or when closest to island	Type of weather system	Name	Section of island most affected	Nearest distance to island	WARNING MESSAGES
13	1909	August 6	Tropical Storm		South Coast	86 miles	
14	1909	August 23-24	Hurricane		Portland, St. Thomas, St. Mary and St. Ann	46 miles	
15	1909	September 15-16	Tropical Storm		Westmoreland and St. Elizabeth	115 miles	
16	1909	October 08	Hurricane		Westmoreland and St. Elizabeth	115 miles	
17	1909	November 11-12	Tropical Storm		St. Thomas and St. Andrew	144 miles	
18	1910	August 25-25	Tropical Storm		Manchester, St. Elizabeth and Clarendon		
19	1910	September 8-9	Hurricane		Portland, St. Mary, St. Ann and Trelawny	29 miles	
20	1911	October 24	Tropical Storm		Portland and St. Mary	58 miles	
21	1912	October 11	Tropical Storm		Hanover and Westmoreland	144 miles	
22	1912	November 18	Hurricane		Hanover and Westmoreland		
23	1915	August 12-13	Hurricane		St. Ann		
24	1915	September 01	Hurricane		Westmoreland	86 miles	

No.	**Year**	**Dates of passages over or when closest to island**	**Type of weather system**	**Name**	**Section of island most affected**	**Nearest distance to island**	**WARNING MESSAGES**
25	1915	September 25	Hurricane		St. Elizabeth and Clarendon	115 miles	
26	1916	August 15-16	Hurricane		Clarendon, St. Elizabeth, Manchester and Hanover		
27	1916	August 30-31	Hurricane		South Coast	69 miles	
28	1916	October 13	Hurricane		South Coast	144 miles	
29	1917	September 23	Hurricane		St. Mary	29 miles	
30	1918	August 3-4	Tropical Storm		South Coast	58 miles	
31	1923	October 18	Tropical Storm		Western Jamaica	144 miles	
32	1924	November 7-8	Tropical Storm		Clarendon and St. Ann		
33	1927	October 18	Tropical Storm		Hanover	86 miles	
34	1928	August 10-11	Hurricane		Portland, St. Mary and St. Thomas	115 miles	
35	1928	September 2-3	Tropical Storm		St. Catherine, Clarendon and Manchester		
36	1930	September 4-5	Tropical Storm		North east Coast	173 miles	
37	1931	August 13-14	Tropical Storm		South Coast	173 miles	
38	193	September 8-9	Tropical Storm		South Coast	58 miles	

No.	Year	Dates of passages over or when closest to island	Type of weather system	Name	Section of island most affected	Nearest distance to island	WARNING MESSAGES
	1						
39	1931	September 12-13	Tropical Storm		St. Thomas, St. Catherine, Manchester Clarendon and St. Elizabeth		
40	1932	September 28-29	Tropical Storm		St. Thomas, St. Catherine, Manchester and Clarendon		
41	1932	November 8-9	Hurricane		Hanover and Westmoreland	150 miles	
42	1933	July 1-2	Hurricane		South Western Coast	173 miles	
43	1933	July 16-17	Tropical Storm		St. Mary and St. Ann		
44	1933	August 16	Tropical Storm		St. Elizabeth and Westmoreland	96 miles	
45	1933	September 19-20	Hurricane		South Coast	81 miles	
46	1933	October 29-30	Hurricane		Westmoreland, Hanover and St. James		
47	1934	October 20-21	Tropical Storm		St. Catherine, St. Ann and Trelawny		
48	1935	September 24	Hurricane		Hanover and Westmoreland	58 miles	
49	193	October 21-23	Hurricane		East- north-	58 miles	

No.	**Year**	**Dates of passages over or when closest to island**	**Type of weather system**	**Name**	**Section of island most affected**	**Nearest distance to island**	**WARNING MESSAGES**
	5				west coast		
50	1938	August 11-12	Hurricane		South Coast	58 miles	
51	1938	August 23-24	Hurricane		South Coast	144 miles	
52	1939	November 1-3	Hurricane		North west coast	58 miles	
53	1942	August 24-25	Hurricane		North Coast	144 miles	
54	1942	September 18-19	Tropical Storm		North Coast	29 miles	
55	1944	July 26-27	Tropical Storm		South Coast	115 miles	
56	1944	August 20-21	Hurricane		St. Thomas to Negril		
57	1944	October 13-14	Hurricane		West Coast	144 miles	
58	1945	October 11	Hurricane		West Coast	144 miles	
59	1947	August 11	Tropical Storm		South-west coast	173 miles	
60	1947	September 20	Tropical Storm		St. James and Hanover		
61	1948	September 18	Tropical Storm		Hanover		
62	1949	October 12-13	Tropical Storm		Westmoreland, Hanover and St. James		
63	1950	October 15-16	Hurricane	King	Westmoreland and Hanover	58 miles	

No.	**Year**	**Dates of passages over or when closest to island**	**Type of weather system**	**Name**	**Section of island most affected**	**Nearest distance to island**	**WARNING MESSAGES**
64	1951	August 17-18	Hurricane	Charlie	St.Andrew, St. Catherine, Manchester and Clarendon		
65	1951	September 4-5	Tropical Storm	Dog	South Coast	144 miles	
66	1953	September 23-24	Tropical Storm	Florence	South Coast	46 miles	
67	1953	October 3-4	Tropical Storm		North-west Coast	58 miles	
68	1954	October 11-12	Hurricane	Hazel	Eastern Coast	115 miles	
69	1955	August 23	Tropical Depression		South Western Coast	115 miles	
70	1955	September 14	Tropical Storm	Hilda	North Coast	127 miles	
71	1955	September 26-27	Hurricane	Janet	South Coast	144 miles	
72	1956	October 30-31	Tropical Depression	Greta	East Coast	58 miles	
73	1958	September 1-2	Hurricane	Ella	North-east Coast	115 miles	
74	1958	September 15	Tropical Storm	Gerda	North Coast	58 miles	
75	1961	October 15-16	Tropical Depression	Gerda	Kingston, St. Andrew, St. Catherine and St. Ann		
76	1963	October 4-6	Hurricane	Flora	Eastern half	173 miles	
77	1964	August 24-25	Hurricane	Cleo	St. Ann, St. Mary and	58 miles	

No.	Year	Dates of passages over or when closest to island	Type of weather system	Name	Section of island most affected	Nearest distance to island	WARNING MESSAGES
					Portland		
78	1966	September 29-30	Hurricane	Inez	St.Mary and Portland	144 miles	
79	1967	September 12-13	Tropical Storm	Beulah	St. Thomas	52 miles	
80	1969	August 31	Tropical Storm	Francelia	South Coast	144 miles	
81	1970	May 20-22	Tropical Storm		Hanover and Westmoreland	121 miles	
82	1973	October 17	Tropical Storm	Gilda	Hanover, Westmoreland and St. James	121 miles	
83	1974	August 31	Hurricane	Carmen	South Coast	46 miles	
84	1974	September 15	Tropical Storm	Fifi	South Coast	52 miles	
85	1975	August 25	Tropical Depression	Caroline	North Coast	150 miles	
86	1975	September 18	Tropical Storm	Eloise	North Coast	115 miles	
87	1979	June 12	Tropical Depression		St. James, Hanover, St.Elizabeth and Westmoreland	86 miles	
88	1979	September 02	Hurricane	David	Eastern half	173 miles	
89	1979	September 11-13	Hurricane	Frederic	South eastern section	127 miles	
90	1980	August 5-6	Hurricane	Allen	East and North Coasts	35 miles	

No.	Year	Dates of passages over or when closest to island	Type of weather system	Name	Section of island most affected	Nearest distance to island	WARNING MESSAGES
91	1981	August 7-21	Tropical Depression	Dennis	Southwestern Jamaica		
92	1988	September 8-19	Hurricane	Gilbert	The entire island E-W		
93	1994	November 8-21	Tropical Storm	Gordon	Central Jamaica		
94	1996	November 18-26	Hurricane	Marco	Southern Jamaica	479 miles	
95	1998	September 15-October 1	Hurricane	Georges	Northern and Eastern Jamaica	151 miles	
96	1998	October 22- November 5	Hurricane	Mitch	Southern and Western Jamaica	138 miles	
97	1999	November 13-15	Hurricane	Lenny	Southern Jamaica	90 miles	
98	2000	August 22-25	Hurricane	Debby	Eastern Jamaica	90 miles	
99	2000	September 19-20	Tropical Depression 10		Kingston, St. Andrew, St. Thomas, St. Catherine & Clarendon		
100	2001	August 15-23	Tropical Storm	Chantal	Southern Parishes of Jamaica, and Pedro Banks		
101	2001	October 4-9	Hurricane	Iris	Southern Parishes of Jamaica, and Pedro Banks		
102	2001	October 5	Tropical Depression 11				News Release- System could

No.	Year	Dates of passages over or when closest to island	Type of weather system	Name	Section island most affected	Nearest distance to island	WARNING MESSAGES
							affect the island
103	2001	October 9	Tropical Wave, Remnants of Tropical Storm	Jerry			News Release
104	2001	Oct 30-31	Tropical Depression		Most Parishes		2 Flash flood Warnings for northeastern and southern parishes, Flash flood watch for the rest of the island. 2 Flash Flood Warnings for northern and southwestern parishes. Flash flood watch for the rest of the island
105	2001	October 29-November 6	Hurricane	Michelle	Indirect effect on entire island, especially northeastern parishes		4 Flash flood warnings for northern and southwestern parishes. Flash flood watch for the rest of the island. 3 Flash flood warnings for entire island. 1 News Release

No.	**Year**	**Dates of passages over or when closest to island**	**Type of weather system**	**Name**	**Section of island most affected**	**Nearest distance to island**	**WARNING MESSAGES**
106	2001	November 26	Hurricane	Olga			News release not expecting direct impact but system could affect the island
107	2002	September 15	Tropical Depression 10				Special news release
108	2002	September 16-17	Tropical Wave		Northern and Southeastern		2 flash flood watches, flash flood watch for the entire island
109	2002	September 17-19	Tropical Depression 10 Regenerates		Northern and southeastern parishes, Gale force winds over southeastern sections		Bulletin 1-6, Tropical Storm Warning.Bulletin 1-6 Tropical storm warning . Bulletin 1-6 Tropical Storm Warning, Bulletin 7 Tropical storm Warning Lifted, 9 Flash Flood warnings
110	2002	September 20-24	Tropical Storm Spiral Bands from Hurricane Isidore	Isidore			

No.	**Year**	**Dates of passages over or when closest to island**	**Type of weather system**	**Name**	**Section of island most affected**	**Nearest distance to island**	**WARNING MESSAGES**
111	2002	September 24-October 1	Tropical Storm, Tropical Depression, Hurricane	Lilli	All parishes and some offshore areas		Bulletin 1-5 (No watch or warning) Bulletin 6-8 Tropical Storm Watch in effect , Bulletin 9 Tropical storm watch Lifted, Bulletin 10, Bulletin 11, Bulletin 12-26 Tropical storm Warning Bulletin 27 Tropical Storm Warning Bulletin 28 Tropical Storm Warning Lifted, Flood warning in effect. *Flash flood warning, news release (warning lifted)*
112	2002	October 14-16	Tropical Depression 14		Southern and Western Parishes		4 Flash Flood Watches, 1 Flash Flood Warning, 1 News Release

No.	Year	Dates of passages over or when closest to island	Type of weather system	Name	Section of island most affected	Nearest distance to island	WARNING MESSAGES
113	2003	July 8-9	Tropical Storm	Claudette	Most Parishes		Bulletin 1 Tropical Storm Watch Bulletin 2-8 Tropical Storm Warning Bulletin 9 Tropical Storm Warning Lifted
114	2003	July 23	Tropical Wave, Remnants of Tropical Depression 6		St.Mary, Portland, St. Thomas, St. Ann, Trelawny		2 News Releases
115	2003	August 29	Tropical Wave, Remnants of Tropical Depression 9		Most Parishes		1 News Release, 1 Severe Weather Alert
116	2003	December 4	Tropical Depression 20 Tropical Storm	Odette	North-Central and northeastern parishes, sections of southern parishes		Bulletin 1-2 Tropical Storm Watch Bulletin 3-9 Tropical Storm Warning Bulletin 10 Tropical Storm Warning Lifted.

3.6.4 Flooding Vulnerability

Assessing whether an area is prone to flooding or not, not only requires a hydrostratigraphic assessment of the area, but also the collection of physical data such as rainfall run-off patterns, topography and information obtained from actual flooding events (especially as perceived by individuals who reside or frequent the area during such events) over a statistically appreciable period. Such information is not readily available from relevant statutory agencies in a compiled an organized format and is beyond the scope of this Environmental Impact Assessment. However, conclusions may be drawn from available data, including informal reports of flooding, or the absence thereof.

It is estimated that the project sites are located in areas where the soil can be permeable to semi-permeable, with the exception of the site in Tower Isle St. Mary, which is described as impermeable (See Figure 3-13 through to Figure 3-15). Permeability or semi-permeability of the areas implies that water should percolate through the ground and drain into the underlying aquifers or aquicludes. Hence, in the absence of extreme weather conditions, namely heavy consistent and prolonged rainfall, the mentioned areas should not flood readily. Further, none of the sites are located in sink holes or areas of deep depression, therefore, issues related to runoffs from surrounding areas should not add to the flooding vulnerability of the areas to flooding.

There has been no specifically reported flooding for the Great River area, or the Tower Isle area. There has been, however, reported flooding in the Frankfort area just west of the Tower Isle area. However, the conclusive cause of such a flooding event has not been determined. (pers. comm. – A. Haiduk, WRA) The extent of flooding from a significant flooding event in 2001 for the Bull Bay area is seen in Figure 3-16, which is some distance from the proposed project site, and is not estimated to have had any significant effect on the proposed project site in that period. It should be noted that the project sites in Bull Bay and Tower Isle, are located on presently occupied properties, with Bull Bay at an elevation of approximately 60m above sea level, well above potential flood levels. None of two these sites have reported issues of flooding.

FIGURE 3-13: HYDROSTRATIGRAPHIC MAP OF BULL BAY SITE

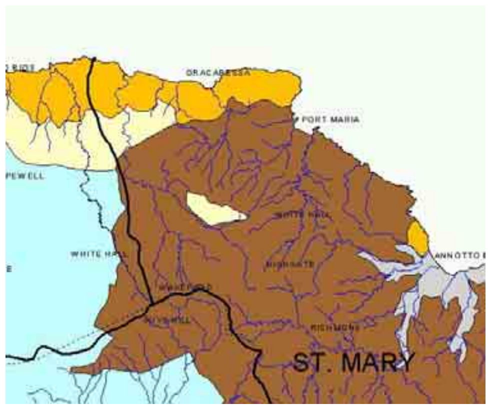


FIGURE 3-14: HYDROSTRATIGRAPHIC MAP OF ST. MARY

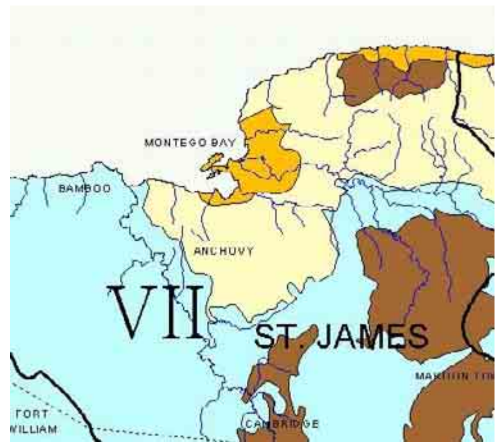
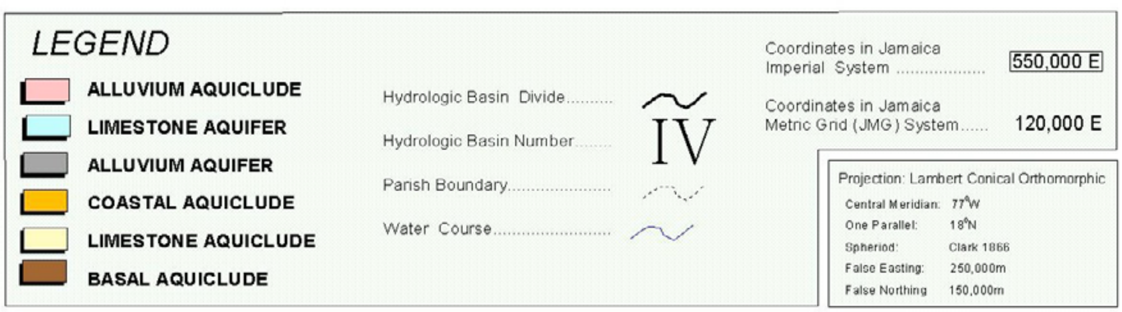


FIGURE 3-15: HYDROSTRATIGRAPHIC MAP OF MONTEGO BAY



Hydorstraigphic Images and Legend are extracted from a Larger Hydrostraigrphic Map of Jamaica[12]

[12] Provided by *The Water Resources Authority (WRA),* Jamaica

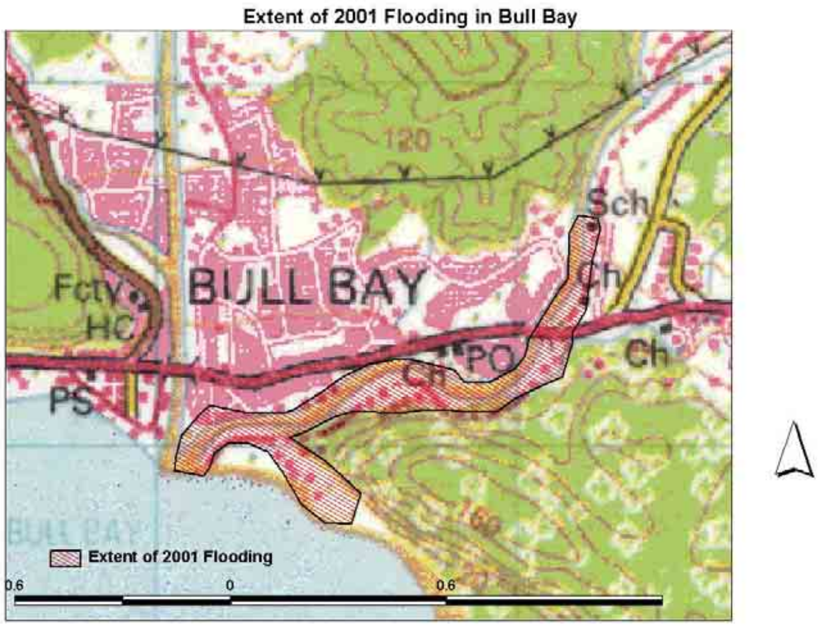


FIGURE 3-16 EXTENT OF 2001 FLOODING IN BULL BAY[13]

3.6.5 Land Slide Vulnerability

Currently, the Mines & Geology division of the Land Services arm of the government has not generated Landslide Susceptibility maps for every parish of the island. Consequently, only two of the three areas proposed currently have any landslide vulnerability data available. Such information is currently available only for the Bull Bay, St. Thomas site and the Tower Isle, St. Mary Site; no accessible susceptibility maps have been generated for St. James, and consequently no maps are available for Great River area.

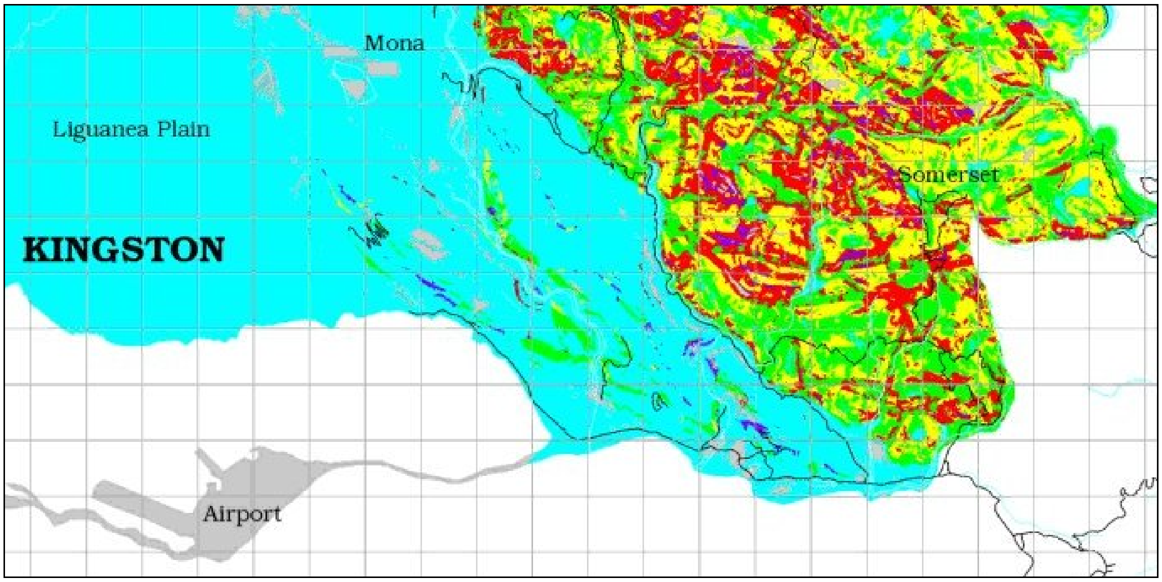
A landslide is a natural disaster that cannot be definitely predicted or practically monitored during its occurrence; therefore one cannot be absolute in classifying an area in its susceptibility. In fact much of the classification process is done and defined through measurements which must be updated within a period that is discretionary and based on numerous factors. Landslides can be triggered directly and indirectly by

[13] Courtesy of *The Water Resources Authority (WRA)*, Jamaica

things such as tectonic activity, rainfall, terrain alteration, geology, etc.

Landslides have the potential to affect every aspect of the fibre optic cable operation. Landslides can remove building foundations or simply swallow entire buildings. Therefore, it would be prudent to build the on shore shelter stations in areas that are not considered to be susceptible to the type of landslides which have such overwhelming and destructive capabilities or to provide the necessary engineering to offset the possibility. Landslides can also trigger wave action if there is an instant collapse of sections of the land into the sea. The degree of wave action varies across a spectrum of generic wave to mega tsunami, which depends on the amount of land mass which collapses instantly into the sea. Such events, however, are unlikely in Jamaica given the geology and the level of volcanic activity on the island. Landslides in this regard can affect the near shore operations of the cable system through these wave actions (Section 3.6.1.1)

Figure 3-17 shows the land slide susceptibility of parts of Kingston & St. Andrew. According to Figure 3-17, the proposed project area has a low susceptibility to deep landslides, meaning that the probability of any occurrence of a deep landslide is anywhere between 0-0.02.



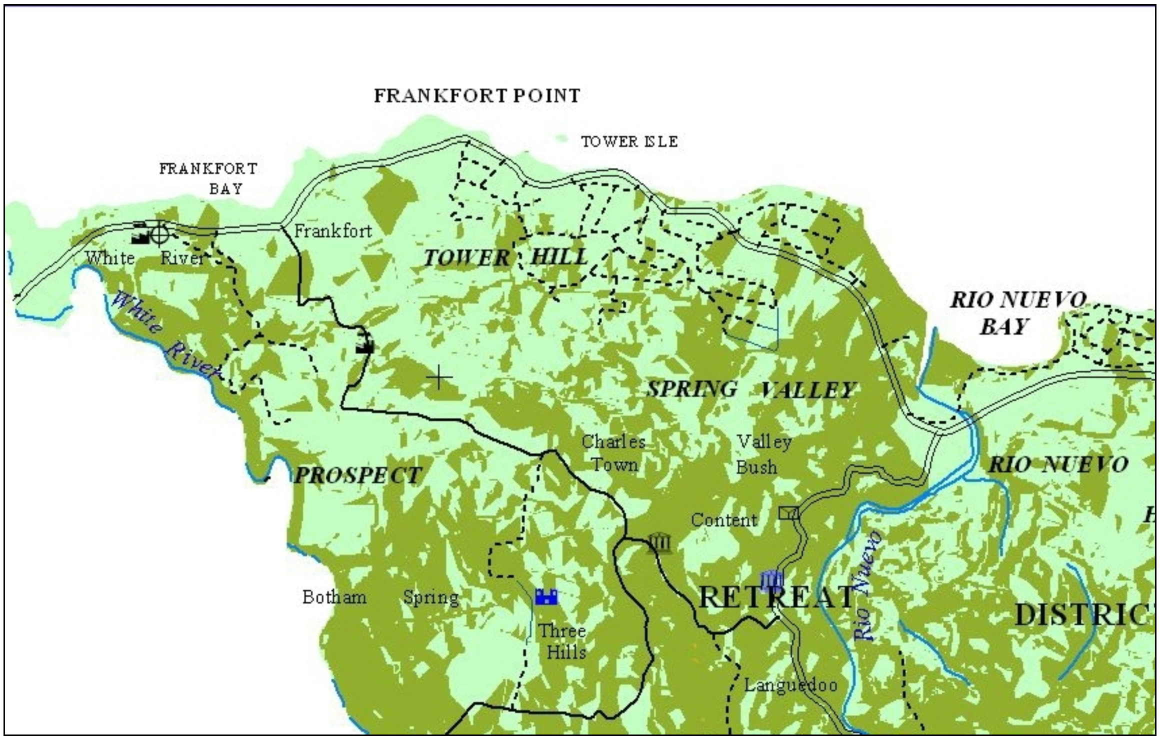
KEY

	Non-Susceptibility
	Low susceptibility (0-2%)
	Moderate Susceptibility (2-3.5%)
	Moderate-High Susceptibility (3.5-4.5%)
	High Susceptibility (4.5-6%)
	Very High Susceptibility (6-83%)

Figure 3-17: Land Slide Susceptibility Map for Bull Bay, St. Thomas Site[14]

Figure 3-18 shows the landslide susceptibility of the upper north-western corner of St. Mary, which borders the parish of St. Ann. The colour coded key indicates that this region is ***'Negligible to Low'*** or ***'Moderate'*** in its classification as being susceptible to landslides. From the same map, The Tower Isle area is classified as being ***'Negligible to Low'*** in its susceptibility to landslides.

[14] http://www.oas.org/CDMP/document/kma/landslmap.htm



KEY

	Negligible-Low Landslide Susceptibility
	Moderate Landslide Susceptibility

FIGURE 3-18: LAND SLIDE SUSCEPTIBILITY MAP FOR TOWER ISLE, ST. MARY SITE

*Extracted from a larger Landslide susceptibility map, which details the entire parish of St. Mary.[15]

3.6.6 Overall Assessment of Natural Hazard Vulnerability of Sites

Tremendous effort has been made by Fibralink to both identify and select cable routes and landing sites that will satisfy as best as possible the majority of areas of concerns associated with this project. As such, a lot of effort has been put into selecting routes that will have minimal impact on marine life and structures, land sites that will be limited in exposure and impact to natural hazards or have the potential to cause any major damage than the existing structures that will be in proximity to them.

[15] Provided by Mines & Geology

All of the onshore facilities and sites have been designed to withstand hurricane force winds and sea conditions, thereby enabling the system to remain active during times when they are most needed. This includes the back-up power generation.

SOCIAL ENVIRONMENT

4 Social Environment

4.1 Introduction

As mentioned several times in this report, the project is relatively non-intrusive and would therefore have a very narrow sphere of physical influence on people or communities. It is for this reason that the socio-economic survey was not issued to smaller groups of people who are in the closest proximity to the project sites. It was estimated that each Enumeration District (ED) in its entirety would have been a much larger sphere than necessary. The ED populations were therefore halved and a sample of approximately 5% was taken.

4.2 Methodology

15 surveys each were administered in St. Mary and Montego Bay, while 18 were administered in the 7-mile Bull Bay area. These numbers were more than adequate in comparison to the figures calculated using the reasoning stated above. Please see the calculations in the table following.

Enumeration District	Total Population	Estimated # Total House Holds	Sample Population
Tower Isle, St. Mary			
W2	235	67	
W3	551	157	
W4	546	156	
Total	*1332*	*380*	9.5
Montego Bay, St. James			
WC79	318	91	
WC80	528	151	
WC81	1407	402	
Total	*2253*	*644*	16
7-Mile, Kingston			
ER84	703	201	

ER85	1197	342	
Total	*1900*	*543*	14

Note
The estimated number of Total Housing Developments was calculated with the assumption that there are 3.5 people per household.
The sample population is approximately 2.5% of the Estimated Total Housing Developments

4.3 Survey Analysis

4.3.1 St. Mary

4.3.1.1 Summary

The focal location in St. Mary was the community of Tower Isle, in the vicinity of the Couples Ocho Rios Resort. As a result, the Enumeration Districts (EDs) surveyed were W2, W3 and W4. (Please see Figure 4-1 for clarification.) In general, the survey revealed that the majority of those interviewed viewed the project in positive terms, with some admitting to limited knowledge of the technology. The results are presented below.

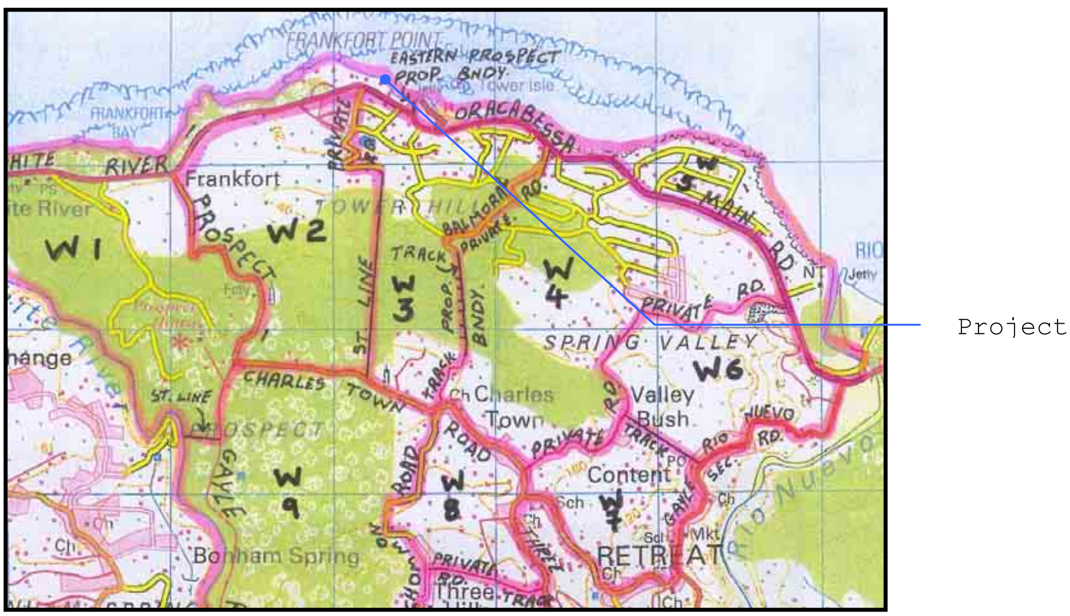


FIGURE 4-1: ED AREAS SURVEYED FOR ST. MARY

4.3.1.2 Demographic

Of the 15 people surveyed, 10 were male and 5 were female. All were more than 22 years old. 8 of the respondents had been living in the community for more than 20 years. 1 resided there for 6-10 years while the other 6 were equally divided with 3 having lived there 0-5 years and 3 for 10-20 years.

4.3.1.3 Technology

100% of the respondents owned cellular phones. 11 had land phones while 9 had cable TV and 9 Computers.

4.3.1.4 Internet

7 of the 15 respondents (46.7%) had access to the Internet at home. Of all 15 respondents, 14 of their households had members who used the Internet regularly either at home, school, work, or the library.

4.3.1.5 Fiber Optics

75% of respondents admitted not knowing what fiber Optic cables were, in contrast, almost 50% said they were aware of it's benefits. Although only 50% knew of the benefits, 80% thought it would benefit them, mostly because of access to better services.

They also thought it would impact their finances by causing them to spend less or improving business and speeding up transactions. Two people pointed out that more money might have to be spent in obtaining new equipment.

4.3.1.6 Effect of the cables

Only one person thought that the cables would impact air quality. 10 respondents thought that there would be no effect while the remaining 4 respondents required more information in order to decide.

Although 4 people rely on the sea for their livelihood by fishing and 3 use it for swimming, no one stated that they would have a problem with cables being present in their communities, 3 persons required more information to decide.

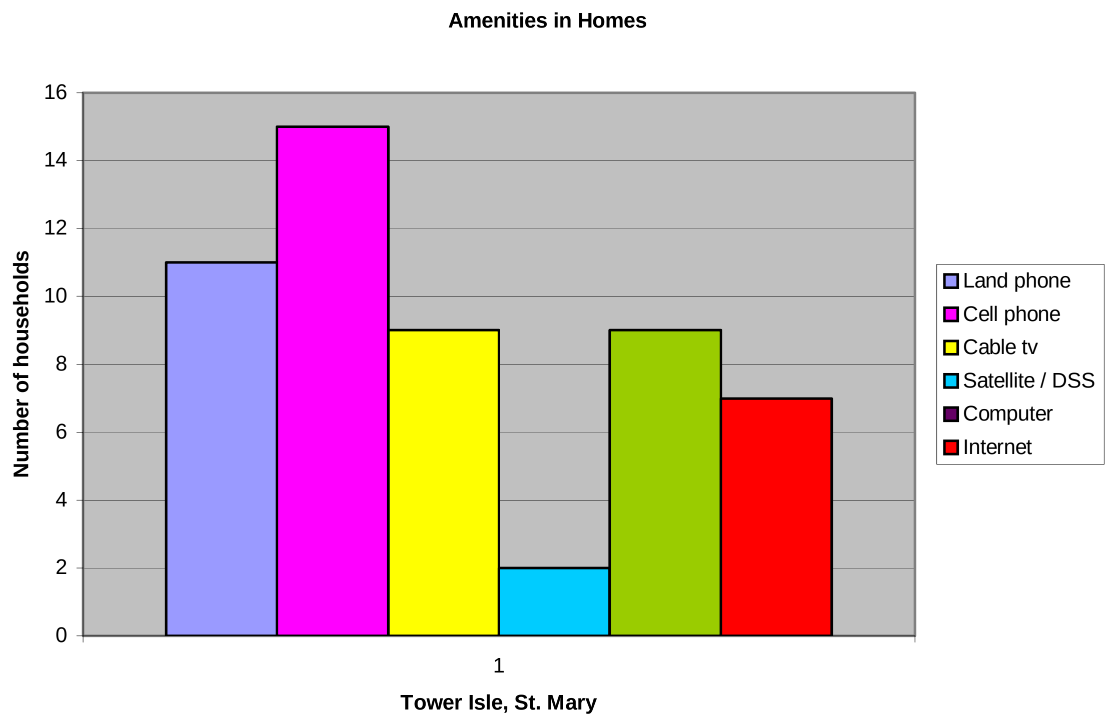


FIGURE 4-2: AMMENITIES IN HOMES

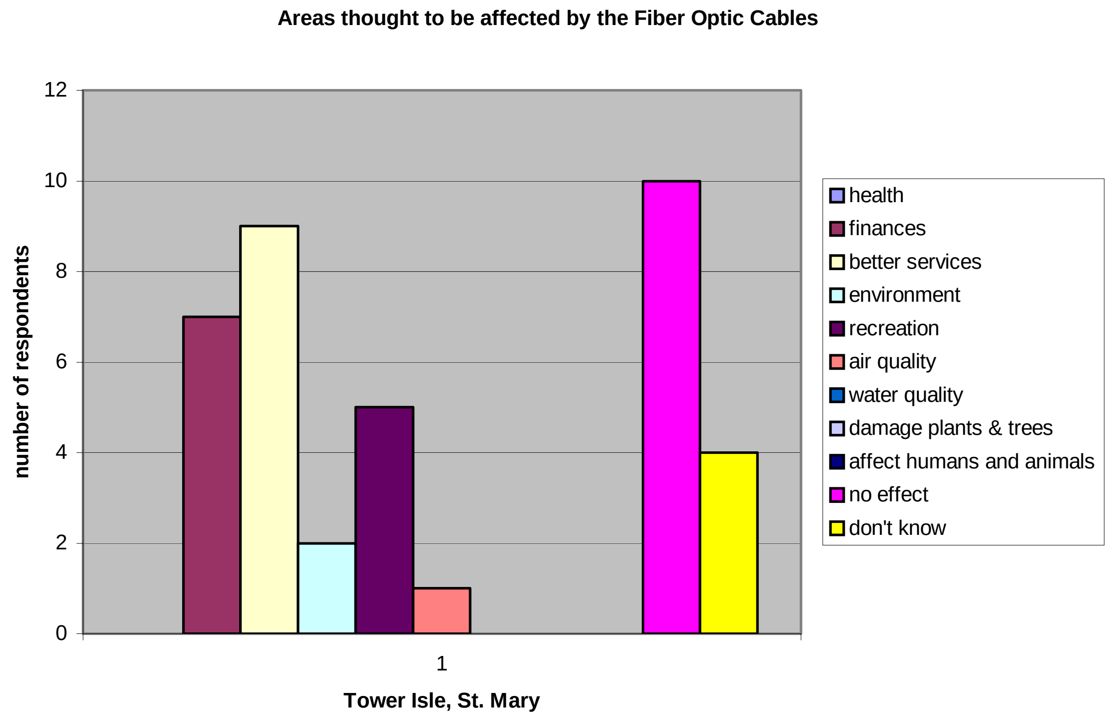


FIGURE 4-3: AREAS THOUGHT TO BE AFFECTED BY THE FIBRE OPTIC CABLES IN ST. MARY

4.3.2 Montego Bay

4.3.2.1 Summary

Locations of interest were Reading and the Great River. The EDs surveyed were WC 79, WC 80 and WC 81. (Please see Figure 4-4 map for clarification.) As with the St. Mary location, there appears to be limited knowledge of the fibre optics and the project specifically, however, many respondents are of the belief that the project may be beneficial to their quality of life.

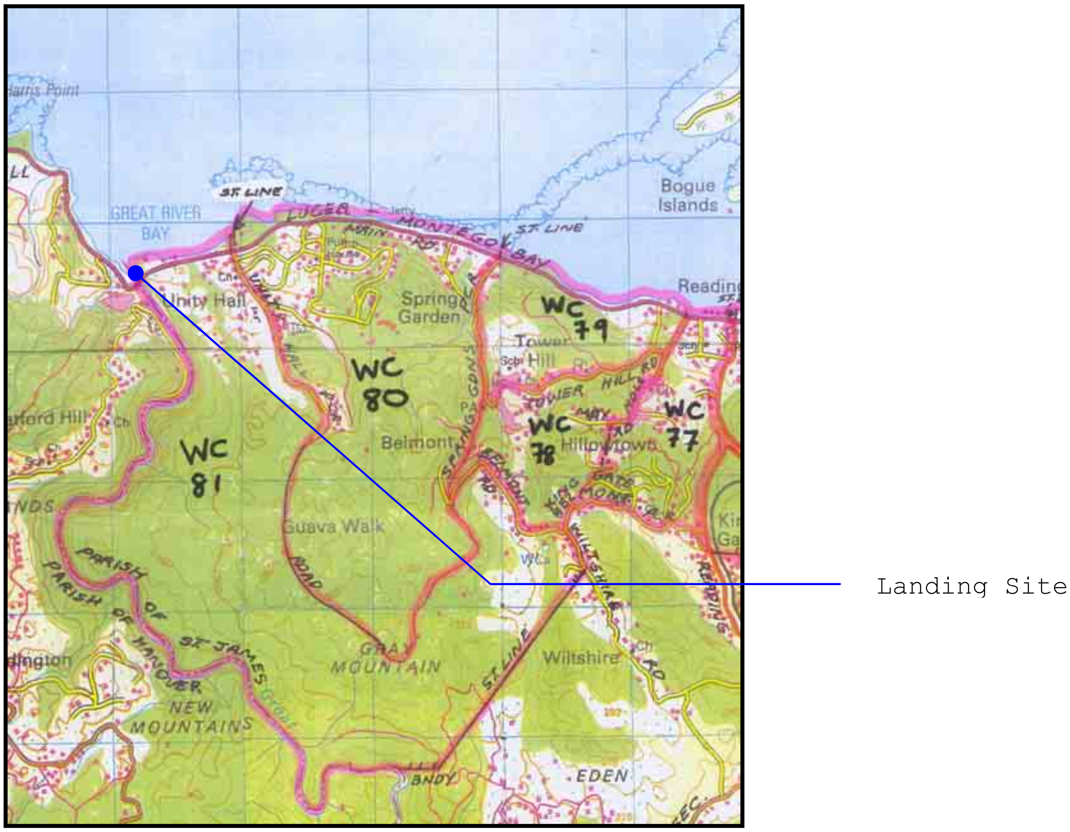


FIGURE 4-4: EDS SURVEYED IN MONTEGO BAY

4.3.2.2 Demographic

Of the fifteen people surveyed, 10 were male while 5 were female. The majority of respondents (8) were between the ages of 36 and 50 years while 5 were older than 50 years. One respondent was between 16 and 21 years old while the other was between 22 and 35 years old.

67% (10/15) of respondents were living in the area for more than 20 years. 3 have lived there between 10 and 20 years. The other 2 have lived there for less than 10 years.

In the 15 households represented by the respondents, there were 24 persons between 5 years old and 20 years old.

4.3.2.3 Amenities

80% of respondents owned cellular phones while 60% had land telephones at home. Nearly 50% (7/15) owned computers with 5 of them having Internet access at home. 11 Respondents had Cable TV and/or DSS systems.

4.3.2.4 Internet

Besides the 5 respondents who use the Internet at home, 2 others reported that they or members of their households use the Internet at work. Members of 9 households used the Internet regularly either at home, school, work or the library. Only one person did not know what the Internet was.

4.3.2.5 Fiber Optics

Ten respondents admitted to not knowing what fiber optic cables were. Three knew, while two persons did not respond. In spite of this, 11 said they knew the benefits while 14 (almost 100%) thought it would benefit them. One person did not respond to the latter two issues.

4.3.2.6 Effect of the cables

Thirteen respondents said that the cables would have no environmental effect. The other two required more information. Twelve said it would bring better services, 8 indicated that it would affect their finances while health, recreation and environment were nominated by one person each, as aspects which might be affected by the cables.

Similarly, 14 respondents said they would have no problem with the cables in their communities. One person required further information in order to make a decision.

Five people use the sea for fishing, while two use it for swimming.

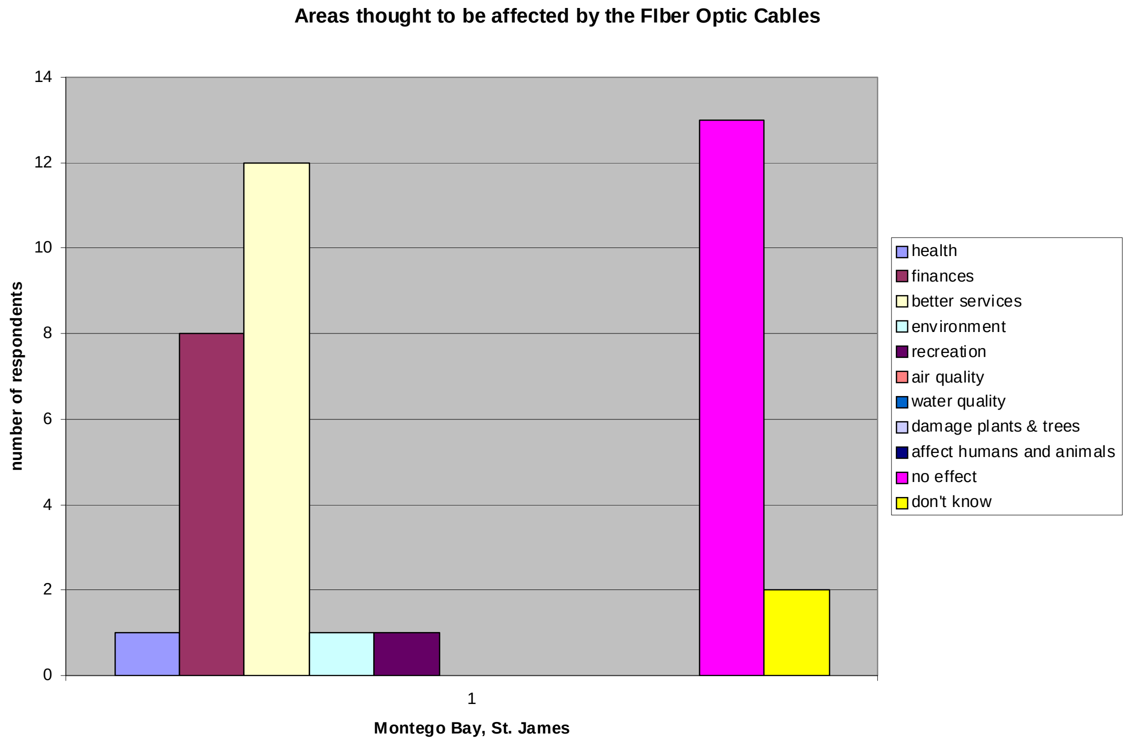


FIGURE 4-5: AREAS THOUGHT TO BE AFFECTED BY THE FIBRE OPTIC CABLES IN MONTEGO BAY

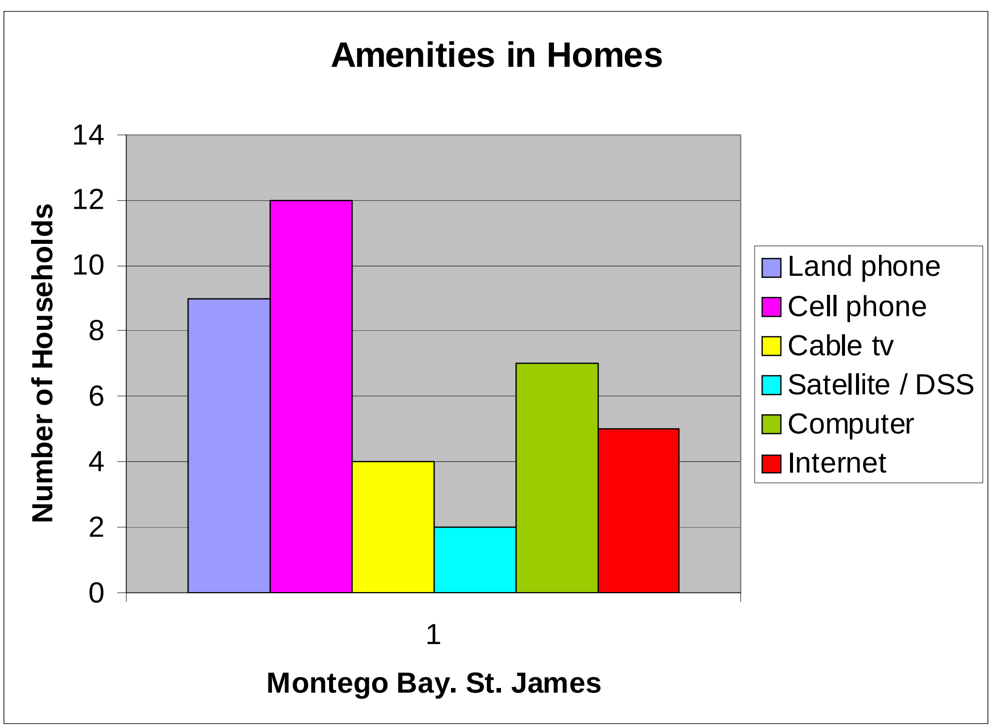


FIGURE 4-6: AMENITIES IN HOMES (MONTEGO BAY)

4.3.3 Seven mile

4.3.3.1 Summary

The focal location was the border of EDs ER 84 and ER 85. These were therefore the two EDs surveyed. Please see Figure 4-7 for further clarification.

FIGURE 4-7: EDS SURVEYED IN 7-MILES

4.3.3.2 Demographic

Of the eighteen persons surveyed, 7 were male and 11 female. One person was between 16 and 20 years old. 8 were between 22 and 35 years old while 7 were between 36 and 50 years old. 2 persons did not give their age range.

In the 18 households represented, there were 36 members between the ages of 5 and 20 years old.

4.3.3.3 Technology

All 18 respondents owned cellular phones. Cable TV was also very popular, found in 12 of the respondent's homes. Only four households were equipped with land telephone lines. None of the respondents had Internet access, computers or satellite/DSS systems at their homes.

4.3.3.4 Internet

Members of 11 households use the Internet regularly at school, work or the library. Members of 14 of the households represented in the survey use the Internet at school.

4.3.3.5 Fiber Optics

Only 3 respondents (20%) knew what fiber optic cables were, however 11 respondents said they knew its benefits and 14 thought that fiber optics would benefit them. 5% people admitted not knowing its benefits while 2 said it would not benefit them. In both cases, 2 persons did not answer.

All 14 who thought they would be benefited highlighted better services as one of the benefits.

4.3.3.6 Effect of the Cables

Six respondents said that they thought that the cables would impact their health with several of them citing possible cancer and respiratory illnesses as results of the cables' presence. Health, finances, better service, environment and recreation were nominated as aspects that would be affected by the cables. All 15 respondents also said they thought that air quality, and/or water quality, and/or humans, and/or animal, plants and/or trees would be affected. Four did not know and 7 said there would be no effect.

Fourteen respondents said they would have no problem with the cables in their communities, while the remaining 4 were equally divided between needing more information and believing that they would have a problem with the cables in their communities.

Three people rely on the sea for their livelihood by fishing.

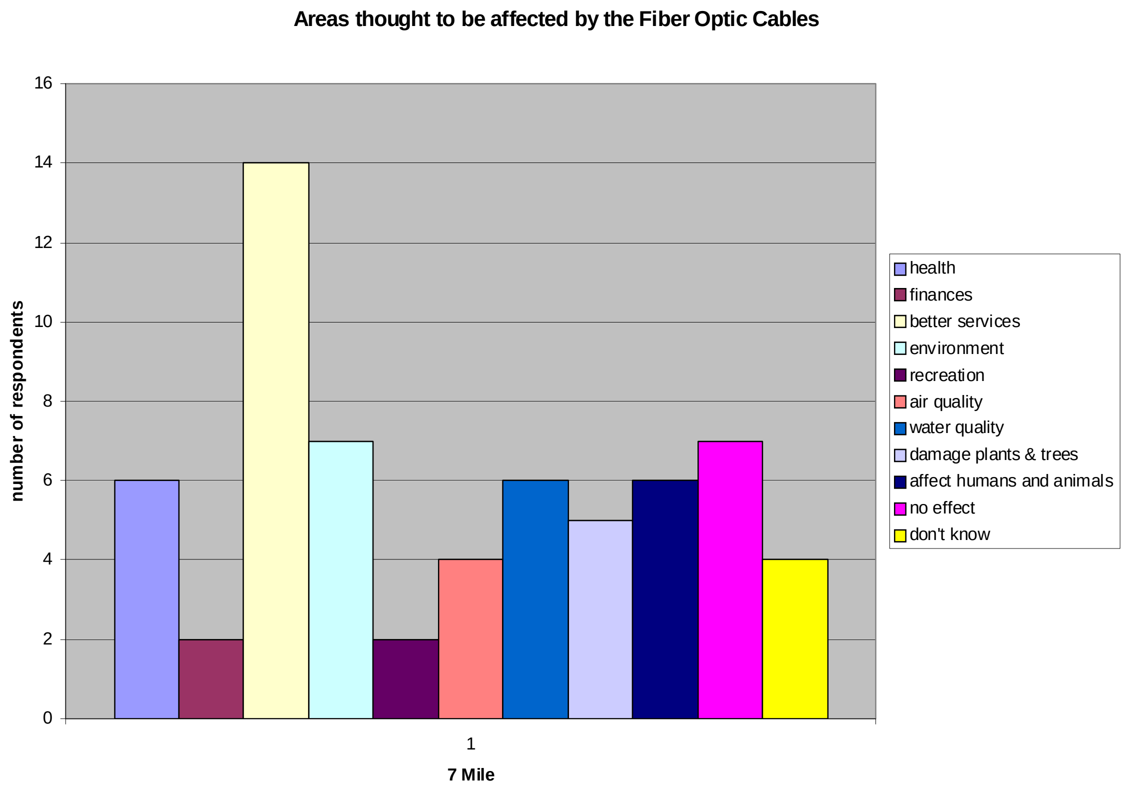


Figure 4-8: Areas thought to be Affected by the Fibre Optic Cables in Seven Miles

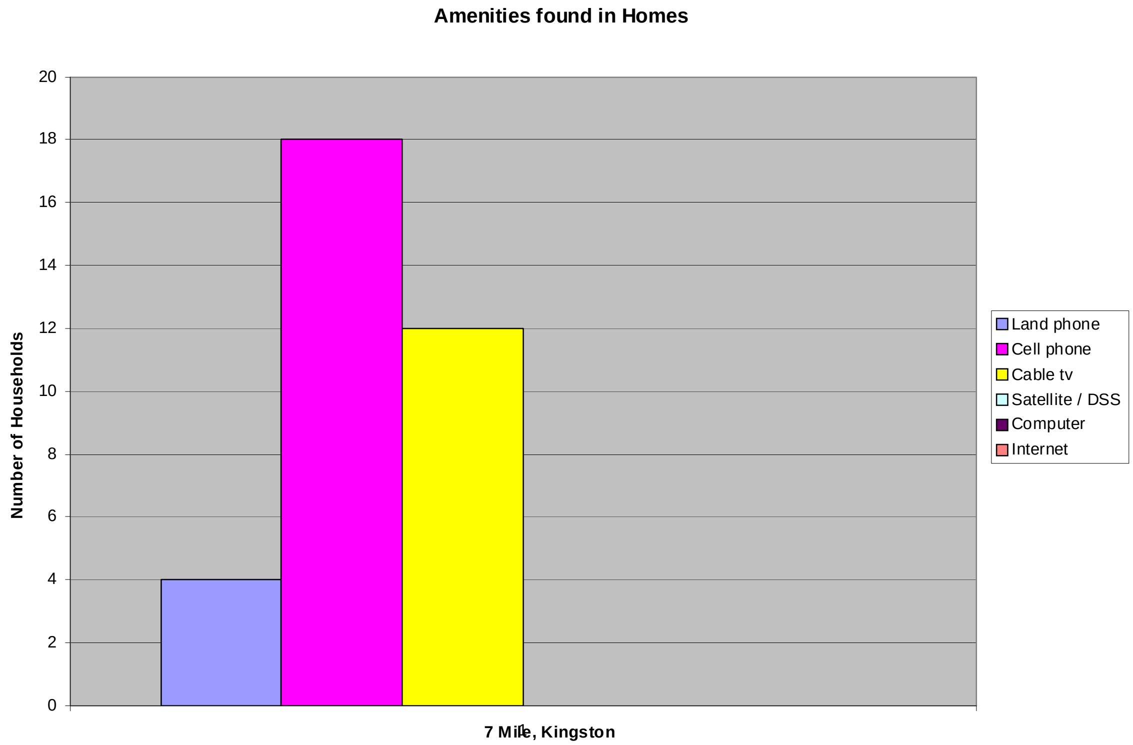


FIGURE 4-9: AMENITIES FOUND IN HOMES IN SEVEN MILES

4.3.4 Interpretation

The majority of the total residents surveyed are open to the installation of the fiber optic cables. They are willing to learn more about the opportunities and effects, and believe that it will generally make a positive impact on them.

Many highlighted that Businesses would be boosted by this new development, as a result of faster transactions internationally and locally, and also the reduced maintenance cost of the cables in comparison to traditional wires. Some felt however, that more would have to be spent on purchasing new equipment. This did not seem to be a deterrent though.

From past occurrences, cancer is a major concern of residents in proximity to cables, cellular towers etc. In this survey it was seen that health (cancer and respiratory illnesses) was a concern to mostly the residents of the 7-mile area. As a point of note, these residents all had cellular phones, which are also alleged to cause cancer. This possibly reflects the attitude that supports the response that the majority of them would still not have a problem with the cables being in their communities.

One of the concerns raised prior to the survey was how the installation of the cables would affect those who depended on the sea for livelihood. 12 of the 48 persons surveyed (25%) said that they relied on the sea for their livelihood by fishing. Their methods of fishing were not specified, however, approximately 17% indicated that they thought the fibre optic cable would impact on their livelihood. This is further assessed in the Impact Identification section of this report.

POLICY, LEGISLATION, AND REGULATORY FRAMEWORK

5 Policy, Legislation, and Regulatory Framework

5.1 National Policies

5.1.1 THE NRCA ACT

The NRCA Act addresses the designation of National Parks and Protected areas, and their development. It is also concerned with

Designation of national park, protected area, etc

5.-

(1) The Minister may, on the recommendation of the Authority after consultation with the Jamaica National Heritage Trust, by order published in the Gazette designate-

a. any area of land as a national park to be maintained for the benefit of the public;

b. any area of land or water as a protected area in which may be preserved any object (whether animate or inanimate) or unusual combination of elements of the natural environment that is of aesthetic, educational, historical or scientific interest; or

c. any area of land lying under tidal water and adjacent to such land or any area of water as a marine park.

(2) The Authority shall cause any order made under subsection (1) to be published once in a daily newspaper circulating in Jamaica.

Permit required

9.-

(1) The Minister may, on the recommendation of the Authority, by order published in the Gazette, prescribe the areas in Jamaica, and the description or category of enterprise, construction or development to which the provisions of this section shall apply; and the Authority shall cause any order so prescribed to be published once in a daily newspaper circulating in Jamaica.

(2) Subject to the provisions of this section and section 31, no person shall undertake in a prescribed area any enterprise, construction or development of a prescribed description or category except under and in accordance with a permit issued by the Authority.

(3) Any person who proposes to undertake in a prescribed area any enterprise, construction or development of a prescribed description or category shall, before commencing such enterprise, construction or development, apply in the prescribed form and manner to the Authority for a permit, and such application shall be accompanied by the prescribed fee and such information or documents as the Authority may require.

(5) In considering an application made under subsection (3) the Authority-

a. shall consult with any agency or department of Government exercising functions in connection with the environment; and

b. shall have regard to all material considerations including the nature of the enterprise, construction or development and the effect which it will or is likely to have on the environment generally, and in particular on any natural resources in the area concerned and the Authority shall not grant a permit if it is satisfied that any activity connected with the enterprise, construction or development to which the application relates is or is likely to be injurious to public health or to any natural resources.

(6) The Authority may-

a. grant a permit subject to such terms and conditions as it thinks fit; or

b. refuse to grant a permit, and where the Authority refuses to grant a licence it shall state in writing the reasons for its decision and inform the applicant of his right under section 35 to appeal against the decision.

(7) Any person who contravenes any provisions of subsection (2) shall be guilty of an offence and shall be liable on summary conviction before a Resident Magistrate to a fine not exceeding fifty thousand dollars or to imprisonment for a term not exceeding two years or to both such fine and imprisonment, and-

a. where a person defaults in the payment of a fine imposed under this subsection, he shall be liable to imprisonment for a term not exceeding one year; and

b. where the offence is a continuing offence, he shall be liable to a further fine not exceeding three thousand dollars for each day on which the offence continues after conviction.

Power of Authority to request Environmental Impact Assessment, etc

10.-

(1) Subject to the provisions of this section, the Authority may by notice in writing require an applicant for a permit or the person responsible for undertaking in a

prescribed area, any enterprise, construction or development of a prescribed description or category-

a. to furnish to the Authority such documents or information as the Authority thinks fit, or

b. where it is of the opinion that the activities of such enterprise, construction or development are having or are likely to have an adverse effect on the environment, to submit to the Authority in respect of the enterprise, construction or development, an environmental impact assessment containing such information as may be prescribed, and the applicant or, as the case may be, the person responsible shall comply with the requirement.

(2) A notice issued pursuant to subsection (1) shall state the period within which the documents, information or assessment, as the case may be, shall be submitted to the Authority.

(3) Where the Authority issues a notice under subsection (1), it shall inform any agency or department of Government having responsibility for the issue of any licence, permit, approval or consent in connection with any matter affecting the environment that a notice has been issued, and such agency or department shall not grant such licence, permit, approval or consent as aforesaid unless it has been notified by the Authority that the notice has been complied with and that the Authority has issued or intends to issue a permit.

(4) Any person who, not being an applicant for a permit, refuses or fails to submit an environmental impact assessment as required by the Authority shall be guilty of an offence and shall be liable on summary conviction before a Resident Magistrate to a fine not exceeding thirty thousand dollars.

Revocation of permit

11.-

(1) Subject to subsection (2), the Authority may by notice addressed to the person to whom a permit was issued revoke or suspend the permit if it is satisfied that there has been a breach of any term or condition subject to which the permit was granted, or if such person fails or neglects to submit to the Authority, in accordance with section 10, any documents, information or assessment required thereunder.

(2) Except as provided in subsection (3), the Authority shall, before revoking a permit, serve on the person to whom it was granted a notice in writing-

a. specifying the breach or default on which the Authority relies and requiring him to remedy it within such time as may be specified in the notice, and

b. informing him that he may apply to the Authority to be heard on the matter within such time as may be specified in the notice.

(3) The Authority shall not be obliged to serve a notice pursuant to subsection (2) in relation to any breach if a cessation order pursuant to section 13 or an enforcement notice pursuant to section 18 is in effect in relation to that breach.

Cessation order

13.-

(1) Without prejudice to the provisions of section 9 (7), 10 (4),11 and 12 (3)-

a. where a person fails to comply with the provisions of section 9 (2); or

b. where the person responsible fails to submit an environmental impact assessment within the time specified by the Authority; or

c. where a person fails to comply with the provisions of section 12 (1),the Authority may issue an order in writing to such person directing him to cease, by such date as shall be specified in the order, the activity in respect of which the permit, licence or environmental impact assessment, as the case may be, is required.

(2) Where the person to whom an order is issued under subsection (1), fails to comply with the order, the Minister may take such steps as he considers appropriate to ensure the cessation of the activity to which the order relates.

(3) Where authorized by the Minister acting pursuant to subsection (2), a member of the Jamaica Constabulary Force may use such force as may be necessary for the purpose of ensuring compliance with an order referred to in that subsection; and any person who hinders or obstructs any such member acting as aforesaid shall be guilty of an offence and shall be liable on summary conviction before a Resident Magistrate to a fine not exceeding ten thousand dollars or to imprisonment for a term not exceeding one year.

5.1.2 The Watershed Protection Act, 1963

This Act governs the activities operating within the island's watersheds, as well as protects these areas. The watersheds that are designated under this Act include all three water sheds

5.1.3 The Beach Control Act (1956)

This act was passed in an effort to properly manage the coastal and marine resources of Jamaica. This occurs through the necessary licensing of activities on the foreshore and the floor of the sea.

The Act also addresses access to the shoreline, fishing, public recreation, and the establishment of marine protected areas.

5.1.4 THE TOWN AND COUNTRY PLANNING ACT

The Town & Country Planning Law (1987)

The Town and Country Planning Act covers the development and use of land. In accordance with this law, the Town Planning Department is the Agency that reviews any plans involving industrial development.

This law allows specific conditions to be stipulated and imposed on any approved plans. This planning decision is based upon several factors including;

- the location of the development
- the nature of the industrial process to be carried out
- the land use and zoning
- the effect of the proposal on amenities and traffic among other things.

Applications to local planning authority for permission

11.-

(1) Subject to the provisions of this section and section 12, where application is made to a local planning authority for permission to develop land, that authority may grant permission either unconditionally or subject to such conditions as they think fit, or may refuse permission; and in dealing with any such application the local planning authority shall have regard to the provisions of the development order so far as material thereto, and to any other material considerations.

(1) (A) where the provisions of section 9 of the Natural Resources Conservation Authority Act apply in respect of a development which is the subject of an application under subsection (1), planning permission shall not be granted unless-

a. an application to the Natural Resources Conservation Authority has been made as required by such provisions as aforesaid; and
b. that Authority has granted or has signified in writing its intention to grant, a permit under that Act.

(2) Without prejudice to the generality of subsection (1), conditions may be imposed on the grant of permission to develop land thereunder-

for regulating the development or use of any land under the control of the applicant (whether or not it is land in respect of which the application was made) or requiring the carrying out of works on such land, so far as appears to the local planning authority to be expedient for the purposes of or in connection with the development authorized by the permission;

(3) Provision may be made by a development order for regulating the manner in which applications for permission to develop land are to be dealt with by local planning authorities, and in particular

a. for enabling the Minister to give directions restricting the grant of permission by the local planning authority, during such period as may be specified in the directions in respect of any such development, or in respect of development of any such class, as may be so specified

b. for authorizing the local planning authority, in such cases and subject to such conditions as may be prescribed by the order, or by directions given by the Minister thereunder, to grant permission for development which does not appear to be provided for in the order or in any plan or statement deposited with the order and is not in conflict therewith;

c. for requiring the local planning authority, before granting or refusing permission for any development, to consult with such authorities or persons as may be prescribed by the order or by directions given by the Minister thereunder;

d. for requiring the local planning authority to give to any applicant for permission, within such time as may be prescribed by the order such notice as may be so prescribed as to the manner in which his application has been dealt with;

e. for requiring the local planning authority to furnish to the Minister and to such other Persons as may be prescribed by or under the order, such information as may be so prescribed with respect to any application for permission made to them, including information as to the manner in which such application has been dealt with.

f. Every local planning authority shall keep, in such manner as may be prescribed by the development order a register containing such information as may be so prescribed with respect to applications for permission made to such authority, including information as to the manner in which such applications have been dealt with; and every such register shall be available for inspection by the public at all reasonable hours.

Applications to determine whether permission required

14.-

(1) If any person who proposes to carry out any operations on land or make any change in the use of land wishes to have it determined whether the carrying out of those operations or the making of that change in the use of the land would constitute or involve development of the land within the meaning of this Act, and, if so, whether an application for permission in respect thereof is required under this Part having regard to the provisions of the development order, he may, either as part of an application for such permission, or without any such application, apply to the local planning authority to determine that question.

(2) The foregoing provisions of this Part shall, subject to any necessary modifications, apply in relation to any application under this section and to the determination thereof as they apply in relation to applications for permission to develop land and to the determination of such applications.

5.1.5 Jamaica National Heritage Trust Act (1985)

The Jamaica National Heritage Trust, formerly the Jamaica National trust, administers the Act. This Act provides for the protection of important areas, including the numerous monuments, forts, statues, and buildings of historic and architectural importance in Jamaica.

This Act will prove applicable if any structures of archaeological and/or architectural importance are located on the site, affected by the site activities or unearthed during site activities. Since this project is in an area that may contain items of archaeological importance, an Archaeological Retrieval Plan is included as part of this document.

5.2 International Policy

5.2.1 Agenda 21

Jamaica is signatory to the convention (Agenda 21) which came out of a United Nations hosted conference on the Environment and Development, held in Rio de Janeiro in June 1992 (EARTH SUMIT '92). Twenty-seven (27) environmental principles were outlined. Not all these principles are applicable to the project, but those deemed relevant and appropriate are outlined below:

> Principle 1 Human beings are at the centre of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature.
>
> Principle 3 The right to development must be fulfilled to equitably meet developmental and environmental needs of present and future generations.
>
> Principle 4 In order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it.
>
> Principle 10 Environmental issues are best handled with the participation of all concerned citizens, at the relevant level, each individual shall have appropriate access to information concerning the environment that is held by

public authorities, including information on hazardous materials and activities in their communities, and the opportunity to participate in decision-making processes. States shall facilitate and encourage public awareness and participation by making information widely available. Effective access to judicial and administrative proceedings, including redress and remedy, shall be provided.

Principle 11 States shall enact effective environmental legislation, Environmental Standards, management objectives and priorities should reflect the environmental and developments context to which they apply.

Principle 5 In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.

IMPACT IDENTIFICATION & MITIGATION

6 Impact Identification & Mitigation

6.1 Potential Impacts

6.1.1 Socio-Economic Impacts

- Due to the services which can be received via installation of Fiber Optic cables, such as, faster remittance, faster transmission of data (sending and receiving), over broad band internet, better telecommunications, safer and less vulnerable international connections etc., there will be several positive impacts on the entire island. These include:

  - Remittances would be received more quickly, therefore there could be an increase in the number of remittances sent to the and the security of this and other such businesses island. This would in turn mean an increase in revenue for the country.

  - Due to easier access to information (internet), the scope of knowledge of individuals would increase. Also, the less time spent obtaining this information, the more time would be left available for other activities.

  - Jamaica would become an example in the Caribbean of high quality international telecommunications. I

  - In inclement weather, the risk of service disruption would be very lowered due to the technology and the redundancy factor of having two (2) lines into the island. This ensures that productivity is not disrupted.

  - The establishment of the island as a leader in Call Centers, data management services is a strong possibility as a result of the technological capacity that this project will offer.

- Cheaper communication service. With this decrease in cost, the service would be affordable to more people, improving the overall standard of living.

THESE ARE POSITIVE IMPACTS, THEREFORE, NO MITIGATION IS REQUIRED

- Employment

  - When fully implemented, i.e. the cable has been installed and the infrastructure has been prepared, the project will result in significant job creation across the island. Jobs will be realized though increased telecommunication and other related industries on the island.

  - All the phases of the project implementation will generate local employment (some more than others) but the cumulative impact will be significantly and positive for the Jamican economy.

  POSITIVE IMPACT – NO MITIGATION REQUIRED

6.1.2 Environmental

- Noise nuisance

  - It is not expected that the project will cause a prolonged noise nuisance at any point, that is, neither during installation nor operation. Where necessary, work requiring heavy equipment will be scheduled for day-time and will be brief to minimize the potential for disruption of residents and guests. Operation will not produce any significant noise.

MITIGATION: All equipment used will be properly serviced and in good working condition. Any equipment that is deemed to be too noisy will be removed from service for repair or replacement. Work will be scheduled to minimize the potential for impacting the people. Personnel should wear ear protection (e.g. ear plugs)

- Air Quality

  - Fugitive Dust: It is possible that a small amount of fugitive dust may be produced during manhole construction at the landing site. If trenching along the roadway must be done, then there is a potential for observable fugitive dust. Otherwise, this project should not result in any negative air quality events.

    MITIGATION: Excavated soil and exposed soil surfaces will be sprinkled as necessary and not allowed to dry out enough to become entrained in wind. Soils will be removed or reused for backfill in a timely manner to lessen the possibility of fugitive dust formation.

  - Gaseous Emissions: limited heavy equipment will be used and only for short periods. Emissions will therefore not be prolonged, and this is confined to the installation period. Operation will not generate any appreciable amounts of emissions.

MITIGATION: Heavy equipment will be maintained in proper working condition to produce minimal emissions.

- Water Quality
  - It might be suggested that the presence of the cables in the water may decrease the water quality; however, they should pose no threat and will not alter the quality of the water since they are built to exist in, and survive the harshest marine environment without decay and are usually colonized by local plant and animal life if exposed. Temporary impacts on water quality may be realized during the cable landing operations. This however, should be short in duration and limited in the amount of sedimentation that it causes. No chemical impacts are anticipated on water quality.

    MITIGATION: Where necessary, proper mitigative devices, such as silt curtains, etc will be used to contain sedimentation in the water.

- Visual Aesthetics:
  - There will be very little change to the visual aesthetics due to this project. The small buildings that will house the equipment will be of low profile and footprint (except for the Bull Bay site which is existing), and fit into the existing surroundings.

MITIGATION: Landscaping and building orientation will be utilized where necessary to enhance the visual aesthetics of the areas.

- Silting/Sedimentation: May occur as a result of excavation of soil for the manhole, trenching for laying the cable, or from directional drilling (which may be required).

  MITIGATION: The timely removal of stockpiled soils and the use of containment (berms, bunds or containers) to secure soils and avoid siltation, etc. during incidence of rainfall. Proper securing of stockpiles

- Loss of vegetation, loss of habitat:
  - The landing site does not require any land clearance. The manhole to be constructed is not large and is mostly underground. Directional drilling used will not disturb the soil surface.
  - The cable station will be constructed on land that currently has buildings on them. There may be need to remove vegetation but since the properties are not primarily vegetative, the loss of habitat will not be significant.

  MITIGATION: Limit the amount of vegetation to be removed to a minimum. Introduce landscaping as necessary to the area.

- Disruption of Sea Grass and other marine life on the sea floor:
  - It may be assumed that laying of any form of cables on the sea floor would disrupt marine

life, however, it is in the best interest of those laying the cables to avoid corals or other structures in order to protect the cable. The cable is to be laid completely flat on the sea floor. In the case of the Tower Isle, St. Mary landing site, there is a small area of sea grass that may be unavoidable. Every effort will be made to minimize the areas of sea grass interrupted and mitigation measures will be implemented.

MITIGATION: In few areas where sea grass is unavoidable it is proposed to utilized a knife to cut the sea grass causing a narrow opening that can be raised and the small fibre-optic cable placed just below the sea grass mat, the sea grass is replaced and in places where necessary it will be held in place by weights. Otherwise, the cable could be laid across the sea grass bed and the grass allowed to grow over the cable.

6.2 Summary of Potential Impacts

There are no adverse unavoidable negative environmental impacts related to the proposed project. The potential environmental impacts identified for the pre-construction, construction and operating phases of the proposed project includes:

Negative

- Minimal suspended solids during cable laying
- Minimal noise and vibration during construction
- Minimal aesthetics and transient change of land and marine use

Positive

- Improved broadband access by connection to other islands
- Potential vast increase in investment revenue and job creation due to improvements in the telecommunications industry from this project.
- No loss of biodiversity
- No loss of archaeological and historical heritage resources
- No loss of aesthetic appeal
- No loss of commercial and recreational fishing needs.

TABLE 6-1: POTENTIAL SOURCES OF ENVIRONMENTAL IMPACTS

No.	Types of likely environmental issues	Construction Phase	Operational Phase
1	Gaseous emissions	✓	✗
2	Dust	✓	✗
3	Odour	✗	✗
4	Noise	✓	✗
5	Night-time operations	✗	✗
6	Traffic generation	✗	✗
7	Liquid effluents, discharges, or contaminated runoff	✗	✗

No.	Types of likely environmental issues	Construction Phase	Operational Phase
8	Generation of waste or by-products	✗	✗
9	Storage, handling, transport or disposal of hazardous materials or wastes	✗	✗
10	Risks of accidents which would result in pollution or hazard	✗	✗
11	Loss of vegetation	✓	
12	Disposal of spoil material	✗	✗
13	Disruption of water movement or bottom sediments	✓	✗
14	Unsightly visual appearance	✗	✗
15	Ecological impacts (Marine)	✓	✗

Key	Potential to cause concern	✓
	Unlikely to cause concern	✗

TABLE 6-2: IMPACT IDENTIFICATION TABLE FOR BULL BAY PROJECT SITE

	EIA Activities															
	Landing Site Preparation				Cable Installation				Cable Station Construction							
	Site Surveying	Site Clearance	Solid Waste Disposal	Manhole Construction	Cable Laying (marine)	Cable routing (land)	Trenching	Materials Sourcing	Materials Transport	Construction Camp/Materials Storage	Construction Works	Solid Waste Disposal	Sewage Treatment	Increased workforce	Landscaping	**Cable Station Operation**
TOPOGRAPHY																
GEOLOGY																
VIBRATION																
GASEOUS EMISSIONS/ ODOUR																
AMBIENT NOISE																
DUST																
DRAINAGE																
TEMPERATURE																
NATURAL HAZARD VULNERABLITY																
Water Quality																
SEDIMENTATION																
CHEMICAL IMPACT																
Ecological Parameters:-																
TERRESTRIAL ECOSYSTEMS																
VEGETATION																
BIRDS																
OTHER FAUNA																
AQUATIC ECOSYSTEMS																
VEGETATION																
FAUNA																

	EIA Activities															
	Landing Site Preparation				Cable Installation				Cable Station Construction							
	Site Surveying	Site Clearance	Solid Waste Disposal	Manhole Construction	Cable Laying (marine)	Cable routing (land)	Trenching	Materials Sourcing	Materials Transport	Construction Camp/Materials Storage	Construction Works	Solid Waste Disposal	Sewage Treatment	Increased workforce	Landscaping	**Cable Station Operation**
SENSITIVE HABITATS																
Socio-Economic Parameters:-																
AESTHETICS																
LAND USE COMPATIBILITY																
EMPLOYMENT																
FOREIGN EXCHANGE EARNINGS																
IMPROVED SERVICE																
STRUCTURES/ROADS																
WASTE MANAGEMENT																
TRAFFIC																
INCREASED CRIME																
HAZARD VULNERABILITY																
SOLID WASTE GENERATION																
SEWAGE																
FISHING INDUSTRY																
Occupational Health & Safety																

KEY

	Major Negative
	Minor Negative
	No Impact
	Major Positive
	Minor Positive

TABLE 6-3: IMPACT IDENTIFICATION TABLE FOR TOWER ISLE PROJECT SITE

	EIA Activities															
	Landing Site Preparation				Cable Installation				Cable Station Construction							
	Site Surveying	Site Clearance	Solid Waste Disposal	Manhole Construction	Cable Laying (marine)	Cable routing (land)	Trenching	Materials Sourcing	Materials Transport	Construction Camp/Materials Storage	Construction Works	Solid Waste Disposal	Sewage Treatment	Increased workforce	Landscaping	**Cable Station Operation**
TOPOGRAPHY																
GEOLOGY																
VIBRATION																
RAINFALL																
GASEOUS EMISSIONS/ ODOUR																
AMBIENT NOISE																
DUST																
DRAINAGE																
TEMPERATURE																
NATURAL HAZARD VULNERABLITY																
Water Quality																
SEDIMENTATION																
CHEMICAL IMPACT																
Ecological Parameters:-																
TERRESTRIAL ECOSYSTEMS																
VEGETATION																
BIRDS																
OTHER FAUNA																
AQUATIC ECOSYSTEMS																
VEGETATION																
FAUNA																
SENSITIVE HABITATS																
Socio-Economic Parameters:-																
AESTHETICS																
LAND USE COMPATIBILITY																
EMPLOYMENT																
FOREIGN EXCHANGE EARNINGS																
STRUCTURES/ROADS																
WASTE MANAGEMENT																
TRAFFIC ON THE ACCESS ROAD																

	EIA Activities															
	Landing Site Preparation				**Cable Installation**				**Cable Station Construction**							
	Site Surveying	Site Clearance	Solid Waste Disposal	Manhole Construction	Cable Laying (marine)	Cable routing (land)	Trenching	Materials Sourcing	Materials Transport	Construction Camp/Materials Storage	Construction Works	Solid Waste Disposal	Sewage Treatment	Increased workforce	Landscaping	**Cable Station Operation**
INCREASED CRIME	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact
HAZARD VULNERABILITY	No Impact	No Impact	No Impact	No Impact	Minor Negative	Minor Negative	Minor Negative	No Impact	Minor Negative	No Impact	No Impact	No Impact	No Impact	No Impact	Minor Positive	No Impact
SOLID WASTE DISPOSAL	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	Minor Negative	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact
SEWAGE DISPOSAL	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	Major Positive	No Impact	No Impact	No Impact
FISHING INDUSTRY	No Impact	No Impact	No Impact	No Impact	Minor Negative	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact
Occupational Health & Safety	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact

KEY

(red)	Major Negative
(purple)	Minor Negative
(yellow)	No Impact
(dark green)	Major Positive
(light green)	Minor Positive

TABLE 6-4: IMPACT IDENTIFICATION TABLE FOR MONTEGO BAY PROJECT SITE

	EIA Activities															
	Landing Site Preparation				Cable Installation				Cable Station Construction							
	Site Surveying	Site Clearance	Solid Waste Disposal	Manhole Construction	Cable Laying (marine)	Cable routing (land)	Trenching	Materials Sourcing	Materials Transport	Construction Camp/Materials Storage	Construction Works	Solid Waste Disposal	Sewage Treatment	Increased workforce	Landscaping	**Cable Station Operation**
TOPOGRAPHY																
GEOLOGY																
VIBRATION																
RAINFALL																
GASEOUS EMISSIONS/ ODOUR																
AMBIENT NOISE																
DUST																
DRAINAGE																
TEMPERATURE																
NATURAL HAZARD VULNERABLITY																
Water Quality																
SEDIMENTATION																
CHEMICAL IMPACT																
Ecological Parameters:-																
TERRESTRIAL ECOSYSTEMS																
VEGETATION																
BIRDS																
OTHER FAUNA																
AQUATIC ECOSYSTEMS																
VEGETATION																
FAUNA																
SENSITIVE HABITATS																
Socio-Economic Parameters:-																
AESTHETICS																
LAND USE COMPATIBILITY																
EMPLOYMENT																
FOREIGN EXCHANGE EARNINGS																
STRUCTURES/ROADS																
WASTE MANAGEMENT																
TRAFFIC ON THE ACCESS ROAD																

	EIA Activities															
	Landing Site Preparation				**Cable Installation**				**Cable Station Construction**							
	Site Surveying	Site Clearance	Solid Waste Disposal	Manhole Construction	Cable Laying (marine)	Cable routing (land)	Trenching	Materials Sourcing	Materials Transport	Construction Camp/Materials Storage	Construction Works	Solid Waste Disposal	Sewage Treatment	Increased workforce	Landscaping	**Cable Station Operation**
INCREASED CRIME																
HAZARD VULNERABILITY					Minor Negative	Minor Negative	Minor Negative		Minor Negative						Minor Positive	
SOLID WASTE DISPOSAL							Minor Negative									
SEWAGE DISPOSAL													Major Positive			
FISHING INDUSTRY					Minor Negative											
Occupational Health & Safety																

KEY

Red	Major Negative
Purple	Minor Negative
Yellow	No Impact
Dark green	Major Positive
Light green	Minor Positive

ENVIRONMENTAL MONITORING PLAN

7 Environmental Monitoring Plan

7.1 Outline

Any scale of operation that is being started without any existing infrastructure is generally divided into three phases:

1. Pre-construction phase
2. Construction phase
3. Operational Phase.

All of these phases require independent monitoring regimes in order to ensure that the integrity of the environment is preserved.

The type of development being proposed in this EIA is estimated to have minimal impact on the environment in all three of its phases. In fact, the only phases which really require monitoring are the pre-construction phase and the construction phase. The operational phase is automated and does not involve any extensive operations that require human intervention or the use of chemicals, physical tools, etc. The operation is also a zero discharge operation and does not require any frequent input of raw materials other than electricity for sustained operations.

All data recorded, all observations made, and all analytical techniques employed will be documented, summarized, compiled and submitted to NEPA according to the accepted terms outlined for each phase of this development, and according to any additional terms outlined in the permit license, if granted.

7.2 Pre-construction Phase

This phase involves the preparation of the proposed sites for the facilitation of the development. Site preparation will occur on the on-shore areas.

For the preparation of the onshore sites, the following measures are proposed:

- During site clearing activities, any animals or plants that are in the area designated for the buildings must be evaluated to ensure that no endemic, rare or protected species will be affected. Any such species identified will be documented and the proper authorities notified so that the best relocation practice can be employed or if necessary the location of the building changed to accommodate the species.

- Where identified, endemic and rare species should be preserved in place or collected for transplanting (As Observed)
- Stockpiles of soil and vegetative debris generated during site clearing activities should be monitored and maintained to eliminate generation of fugitive dust. (Daily Monitoring)
- Noise levels along the perimeters of the project area should be monitored and recorded to insure that activities at the site are not exceeding standards. (Daily Monitoring)

7.3 Construction Phase

Construction is slated to occur on both near-shore and onshore areas. Directional drilling may be employed to bring the cable in from the sea to the low tide line where it will be trenched to a manhole that will be constructed onshore. Such an activity will warrant the monitoring of turbidity levels of the near shore areas for the duration of the construction phase. The turbidity levels will provide insight on the magnitude of the occurrence of processes such as siltation and sedimentation, which may be caused by the drilling and the on shore construction activities.

Construction at each landing site is estimated to be daily. During the construction process on the onshore areas the following areas will be monitored:

- Solid Waste Management - Ensure that solid waste management plan is prepared, and that workers are aware that no solid waste material should be scattered around the site. Monitor availability and location of skips/dumpsters. (daily monitoring)

- Exposed soil areas must be monitored to determine potential for erosion, silting and sedimentation particularly during storm events. (daily monitoring)
- If erosion, silting or sedimentation is a potential or occurs, immediate steps must be taken to negate the impact on the coastal waters and other receptors where applicable. (As Needed)
- Equipment staging and parking areas must be monitored for releases and potential impacts. (Weekly Monitoring)
- If any cultural heritage resources are unearthed during construction activities, activities should be stopped and an Archaeological Retrieval Plan implemented. (As Needed).
- Noise levels along the perimeters of the project area should be monitored and recorded to insure that activities at the site are not exceeding standards. (Daily Monitoring)

APPENDICES

APPENDIX I

APPENDIX I: TERMS OF REFERENCE

FibraLink Jamaica Limited proposes to install, commission and operate a fibre optic network linking Jamaica to the USA via the Bahamas. This project will involve the laying of fibre optic cables on the sea floor, terminating in Jamaica for the provision of broadband services to the island. This EIA seeks to identify all environmental, socio-cultural, ecological, physical and natural resources that may be impacted (positively or negatively) by this project.

FibraLink has been awarded a licence to install and operate the fibre optic system by the Office of Utilities Regulation in Jamaica. FibraLink seeks to identify two (2) landings for its fibre optic cable on Jamaican shores with locations in Bull Bay, Kingston and Port Antonio, Portland being the two areas under consideration.

On September 11, 2004, the country experienced a serious disruption of services from damage caused by Hurricane Ivan to the existing single fibre optic cable servicing the island. This project will present the country with another option for linking with the outside world and provide a level of redundancy to the network to safeguard against total disruption of services in the event of significant natural disasters, representing great economic and social potential. It will serve to drive the cost of e-services down, creating a more affordable environment for commercial and personal broadband communication availability in the island.

STUDY AREA

The study area will include to some extent Jamaica's territorial waters and two (2) landing sites, namely in the Bull Bay (Kingston) and Soldiers Cove (Portland) areas. The projected sphere of influence of the study sites is expected to be no more than 2km in radius of identified sites. The Bull Bay site is presently used as a fibre optic landing site by AT&T and will be utilized in its existing configuration for the new fibre optic line proposed in this project.

SCOPE OF WORK

The Scope of Work requires that an Environmental Impact Assessment must be carried out. The Scope of Work is listed under the tasks to be undertaken below.

TASKS TO BE UNDERTAKEN

The tasks to be undertaken are structured to meet the requirement of the National Environment and Planning Agency (NEPA), Ministry of Health (Environmental Health Unit), Office of Disaster Preparedness and Emergency Management (ODPEM) and all other relevant governmental and regulatory agencies.

Task 1: Policy, Legislative and Regulatory Framework

All International and Government of Jamaica policies, legislation and regulations relevant to the project will be identified and analysed. This will be a comprehensive analysis from which FibraLink will be advised as necessary to ensure that all phases of the project maintain compliance.

Task 2: Project Description

CD&A will identify all the critical activities, equipment and procedures that will be implemented throughout the major stages of the project. The project designs, specifications, and schedules will be clearly presented in this section. The completed project description will include at a minimum, details such as:

- Description of the materials of construction and structure of the fibre optic cable. Method of linkages and securing along its alignment as well as linkages from sea to land
- Project implementation schedule, descriptions of preconstruction, construction and occupational activities
- Detailed description of project components, with special emphasis on those that may cause potential environmental impacts during each phase.
- Review of designs with details to show how FibraLink will be able to maintain environmental compliance and not negatively impact the environment. This includes structural, operational and emergency safeguards
- Mode of operation, hours of operation and types of machinery and equipment to be used. Special emphasis will be placed on activities that involve the generation of waste materials
- the number of employees proposed for the operation
- Description of the role of regulatory agencies, NEPA, Parish Council, Marine Police and others in terms of inspections and follow-up visits

The relevance of the project to national development will also be evaluated.

Task 3: Description of Current Environmental Baseline Data

This task seeks to identify the principal parameters of the natural and human environment which may be sensitive to the project, and to compile, analyse, assess and document the present (baseline) status of this environment. This database will provide an invaluable baseline against which future impacts on the environment may be measured. The environmental setting and baseline parameters will address primarily the bio-physical environment and the socio-cultural environment.

The Bio-Physical Environment

- Topography, basic land, and marine conditions.
- geomorphology and earth surface processes
- natural hazard vulnerability and risk
- hydrogeology (surface and ground water)
- marine environment (territorial waters)
- rainfall characteristics
- wind speed and direction
- temperature profiles
- relative humidity
- ambient air quality
- background noise levels
- water quality surveys
- floral and faunal types and their distribution
- the ecology of the area (identification of any rare, endangered and threatened species, and habitats)

These studies will incorporate the two (2) proposed landing sites and the surrounding environment/communities that may be impacted. A potential environmental sphere of influence will be developed based on the information collected and the potential for impact.

The socio-cultural environment

Both primary and secondary data sources will be developed involving: documentation of the existing human environment will include a review and analysis of census data. Populations in the environs of the landing sites will be taken into account in compiling the socio-economic baseline information. A coded, pre-tested socio-economic survey instrument will be developed and administered in the communities located within the anticipated sphere of influence of the project. The findings will be presented in a manner to categorize and identify socio-economic impacts (perceived and real) in terms of positive and negative.

Among the key elements which will be addressed are:

- the spatial distribution of populations
- demographic profile
- use/dependence on natural resources
- knowledge of the proposed project and their disposition towards it
- occupations and skills
- employment levels
- economic activity
- relevant historical heritage in the vicinity of the site

Task 4: Description of Current and Proposed Broadband Systems in Jamaica

CD&A will utilize both graphical and descriptive approaches to describe and compare the existing fibre optic equipment and capabilities on the island against those of the proposed upgrade, to highlight effectively the benefits both environmentally and economically of the proposed project. This will include at a minimum:

- Characteristics of the methods, equipment and processes
- Designs, size, scale and capacity
- Equipment and machinery

Task 5: Analyses of Alternatives

Alternative landing sites and plans (inclusive of the preferred and no action alternatives) will be evaluated in terms of the economic, logistical, and environmental selection criteria, inclusive of their potential for positive and negative impacts, and the degree to which the negative impacts may be mitigated. In the case of each alternative reviewed a rationale will be provided for selection or non-selection.

Task 6: Impact Identification

All potential impacts on the receptors and attributes of the environment, both adverse and beneficial, will be identified and their duration, magnitude, reversibility, and extent described and quantified. In addition, in the case of positive impacts, recommendations will be made on their maximisation. This will cover all phases of the project. This will include qualitative as well as quantitative assessments. Areas to be addressed will include at a minimum:

- Human population of the area
- Flora and fauna
- Soil

- Ground and surface water
- Marine environment
- Weather and climate
- The landscape
- Cultural Heritage Resources

Cumulative impacts will also be addressed by taking into account existing operations in the area, particularly in respect of their contribution to the baseline and the incremental changes which will be caused by the proposed works, if any.

Task 7: Impact Mitigation

An impact mitigation plan will be developed. This will include the measures to be implemented in the environmental action plan for each potentially negative impact identified. These will also include mitigative measures to be applied during all phases of construction and operation to minimise or eliminate any identified negative impacts. Estimated costs to implement the mitigation items in the plan will be presented. Additionally a Disaster Preparedness Plan for the project will be developed based on findings of the Natural Hazard and Vulnerability section of the report.

Task 8: Environmental Management and Training

CD&A will work to develop management and training protocols to govern the actions of employees and contractors within Jamaica's territorial waters and on land during all phases of the project. The protocols developed will address all the steps which will be taken during the site preparation, construction and operating phases of the project to avoid, or mitigate potential impacts, as well to maximise beneficial impacts. Where necessary, required training activities will be defined and in conjunction with FibraLink these will be developed and tested. This is an important step in the project as it speaks to issues of regulatory compliance, liability, and occupational health and safety.

Task 9: Environmental Monitoring Plan

CD&A will develop an environmental monitoring plan in which all the parameters to be monitored and the methods to be used will be identified and described. This plan will include at a minimum:

- An organizational/responsibility chart
- Institutional arrangements for carrying out the work
- Parameters to be monitored
- Methods to be employed
- Standards, guidelines or protocols to be used

- Evaluation of results
- Schedule and duration of monitoring
- Initiation of mitigative actions
- Format and frequency of reporting

Task 10: Risk Assessment/Natural Hazard Vulnerability

All potential physical risks associated with the proposed project, such as hurricanes, earthquakes, fires, explosions, spillages, flood events and landslides will be identified and addressed. Methods to address these will also be documented.

A Disaster Preparedness Plan/Emergency Response Plan for the construction sites will be developed based on the findings of this task and through consultation with the Office of Disaster Preparedness and Emergency Management (ODPEM).

Task 11: Public Participation

CD&A will follow international and national guidelines for public participation that the public, particularly those who may be impacted (negatively or positively) by the project. This will begin as an early stage in planning and project implementation. Public participation will provide early indications of public perception and potential areas where problems may arise and what it may take to handle those situations. While the socio-economic survey will introduce the project to the community through a fact sheet, informal meetings and collaborations will be held with community leaders and members to explain the project.

CD&A recommends the following procedures and schedule for meeting with communities in the estimated radius of influence of the facility:

Procedures:

- Identify and classify the various communities in the radius of influence
- Identify and involve "community leaders" early in the process
- Listen carefully and record the ideas, needs, and wants of the communities (where possible implement their input into the process)

CD&A recommends that this type of interface with the community continue as long as the project is being implemented and beyond if practicable, to foster good community relations.

The EIA Report will take the following form:

- Executive Summary
- Policy, Legislative and Regulatory Framework
- Project Description
- Description of Current Environmental Baseline Data
- Analyses of Alternatives
- Impact Identification
- Impact Mitigation
- Environmental Monitoring Plan

- Environmental Management and Training
- Risk Assessment/Natural Hazard Vulnerability
- Public Participation
- Appendices/List of References

APPENDIX II

APPENDIX II: SIGNATURE PAGES FOR FIBRALINK LICENSE

MINISTRY OF COMMERCE, SCIENCE AND TECHNOLOGY
(with **ENERGY**)
PCJ Building, 36 Trafalgar Road, Kingston 10, Jamaica, W.I.
Tel: (876) 929-8990-9 **Fax**: (876) 960-1623
E-mail: admin@mct.gov.jm Website: http://www.mct.gov.jm

December 20, 2004

The Managing Director
Fibralink Jamaica Ltd.
24-26 Grenada Crescent
Kingston

Dear Sir/Madam,

I am pleased to inform you that you have been granted a license for the construction and operation of a Submarine Fiber Optic Cable Network.

Enclosed is the signed license.

Yours truly,

Phillip Paulwell
MINISTER

Encl.

PORTFOLIO AGENCIES AND DEPARTMENTS: Anti-Dumping and Subsidies Commission, Bureau of Standards, Central Information Technology Office, Consumer Affairs Commission, Electricity Division, Fair Trading Commission, Food Storage and Prevention of Infestation Division, Jamaica Intellectual Property Office, Petrojam Limited, Petrojam Ethanol Limited, Petroleum Company of Jamaica, Petroleum Corporation of Jamaica, Post and Telecommunications Department, Registrar of Cooperatives and Friendly Societies, Office of the Registrar of Companies, Rural Electrification Programme, Scientific Research Council, Spectrum Management Authority, Trade Board Limited such renumbering of those Parts or sections in the Act, as a result of amendment or repeal of that Act.

DATED this 20th day of December 2004

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MINISTER OF COMMERCE, SCIENCE AND TECHNOLOGY

APPENDIX III

APPENDIX III: PROJECT TEAM

Information and data for this EIA was compiled from work done by the following people:

- Dr. Conrad Douglas
- Mr. Paul Thompson
- Mr. Orville Grey
- Mr. Vance Johnson
- Ms. Deonne Caines